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Editorial Message from the Head of Scientific Committee

Welcome to the Proceedings of the 3rd IPB International Conference on Nutrition and Food (ICNF 2024) which is published by the Malaysian Journal of Medicine and Health Sciences. The conference was successfully organized by the Department of Community Nutrition, Faculty of Human Ecology, IPB University, Bogor, Indonesia on 7 – 8 October 2024.

This conference was aimed to be a platform where academias, researchers, private sectors, and general audiences could get updates on the latest issues in nutrition and food. Recognizing the importance of promoting research and innovation in nutrition and food, we have chosen to focus on "Sustainable Food and Nutrition for Human Development" as the theme of the conference this year. The conference speakers, oral presenters, poster presenters, and participants of this conference came from a variety of countries, such as Indonesia, United Kingdom, Cyprus, Philippines, Malaysia, Singapore, Germany, Australia, Japan, South America, Uganda, and Taiwan.

On behalf of the scientific committee of ICNF 2024, I would like to congratulate all participants who submitted their research papers to the conference, and 54 of them are featured in this issue. The articles covered four main areas: clinical nutrition, community nutrition, food innovation, and food and nutrition system. Each of those articles underwent three cycles of a thorough review by two reviewers, to ensure their academic merit and quality. The significant research presented at this conference represents the importance of nutrition and food in improving our quality of life.

I would like to thank the team of reviewers from the Department of Community Nutrition, IPB University, and the Department of Nutrition, Universiti Putra Malaysia for their hard work and commitment to providing valuable input for the authors. Moreover, I would also like to thank the organizing committee of ICNF 2024 and all their supporting partners for ensuring the success of the conference. Finally, I hope that these proceedings serve the need for high-quality research articles in the area of food and nutrition.

Head of the Scientific Committee of ICNF 2024,
Prof. Dr. Ir. Ali Khomsan, MS

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EXTENDED ABSTRACT

Reducing Blood Pressure Through Intervention with a Herbal Drink Containing Moringa Leaf and Date Extract

Triagung Yuliyana, Rimbawan Rimbawan, Evy Damayanthi, Eny Palupi

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author: enypalupi@apps.ipb.ac.id

SUMMARY

This study aimed to determine the effect of moringa leaf and date extract intervention in women of reproductive age with prehypertension. A randomized controlled crossover design was conducted over 42 days with 16 participants. A 150 ml serving of moringa leaf date extract contains 31.26 kcal of energy and was administered twice daily. The results demonstrate a significant reduction in blood pressure in the intervention groups, with systolic pressure decreasing by 9.18 mmHg and diastolic pressure decreasing by 4.06 mmHg. This study highlights the potential of herbal drink containing moringa leaf and date extract as a formulation for reducing blood pressure.

Keywords: Anti-hypertension, Blood pressure, Herbal drink, Moringa date extract, Women of reproductive age.

INTRODUCTION

Hypertension is a non-communicable disease (NCD) affecting significant individuals of the global population. Hypertension affects approximately 25% of the adults worldwide. By 2025, its prevalence is expected to increase by 60% or 1.39 billion people. Prehypertension is characterized by systolic blood pressure ranging from 120 to 139 mmHg and diastolic blood pressure ranging from 80 to 89 mmHg [1]. Moringa oleifera (MO) contains flavonoid such as quercetin and kaempferol, which have anti-inflammatory, antioxidant, and anti-hypertensive properties [2]. Moringa leaves (MO) act effectively as antioxidants and help reduce oxidative stress by relaxing resistant arteries in hypertension [3]. This study aimed to determine the effect of herbal drink containing moringa leaf and date extract on blood pressure in pre-hypertensive women of reproductive age.

MATERIALS AND METHODS

This research employed a randomized pre and post-test crossover design. Approval for the study was obtained from the Health Research Ethics Committee at Universitas Indonesia Maju (UIMA) number 586/Sket/Ka-Dept/RE/UIMA/II/2024. This research involved 16 women of reproductive age with prehypertension, who received an intervention consisting of a 150 ml herbal extract drink adminestered twice daily, once in the morning and once in the evening, for 42 days. Subjects' adherence to the drink regimen was monitored using the adherence card. Blood pressure measurement were taken weekly, twice on weekends and weekdays. A washout period was implemented to clear bioactive substances from the subject's blood before transitioning to the previous period. The study included a minimum of 8 participants in both control and intervention groups. Nutritional evaluation was conducted to determine the content of water, ash, protein, fat, and carbohydrate through proximate analysis. Dietary fiber was assessed using enzymatic gravimetry.

RESULTS AND DISCUSSION

A single 150 ml serving of the herbal drink contains 31.26 kcal of energy, 0.34 g of protein, 7.47 g of carbohydrate, 0.03 g of fat, 0.34 g of ash and 2.61 g of dietary fiber.

There was significant effect on blood pressure changes of subjects comparing before and after with baseline systolic and diastolic blood pressure measurements ($p=0.001$) and ($p=0.007$). This effect is attributed to Moringa oleifera (MO) containing the amino acid L-arginine, which is a precursor to nitric oxide (NO). NO acts as a vasodilator and inhibits the aggregation, (clumping) of blood platelets thereby improving blood circulation [4]. Additionally, Moringa oleifera (MO) contains flavonoids that are believed to have antihypertensive properties by increasing NO levels and decreasing angiotensin II through ACE regulation. This leads to vasodilation, reducing peripheral vessels, preload, and afterload on the heart, ultimately contributing to lower blood pressure [5].

Table I: Total Energy Content and Nutrient Distribution of Modified Herbal Drinks Per Single Serving

Nutrients	Content/serving (150 ml)	Contribution to Nutrition Label References (%)
Water Content (ml)	**141.84**	-
Energy (kcal)	31.26	1.45
Protein Content (g)	0.34	0.57
Carbohydrate (g)	7.47	7.47
Fat content (g)	**0.03**	**0.04**
Ash content (g)	**0.34**	-
Dietary fiber (g)	2.61	8.7

*% Nutrition Label References based on the total energy requirement of 2.150 kcal for the general population;. nutrient content based on wet weight (BW)

Table II: Description of average and different test results for blood pressure

Intervention	Pre Intervention	Post Intervention	Δ	P value**
	Mean±SD	Mean±SD		
Systolic	122.68±7.01	113.5±6.87	-9.18	0.001*
P value*	0.289	0.000*		
Diastolic	76.25±3.35	72.18±4.56	-4.06	0.007*
P value*	0.876	0.000*		

** Paired t-test* (<0.05 Significant)
*** Independent t-test* (<0.05 Significant)

CONCLUSION

There was a significant reduction in blood pressure among the 16 women of reproductive age with prehypertension in the intervention group. They were given a 300 ml herbal extract drink, which reduced systolic pressure by 9.18 mmHg and diastolic pressure by 4.06 mmHg. The drink was consumed twice daily throughout the study.

ACKNOWLEDGEMENTS

We have no conflict of interest to declare. The authors wish to thank BRIN *Pendanaan Riset dan Inovasi untuk Indonesia Maju* (RIIM) for providing funding for the present study

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EXTENDED ABSTRACT

Knowledge, Attitudes, Consumption Patterns of Saturated Fat and Fiber After Nutritional Counseling in Patients with Coronary Heart Disease at Regional Public Hospital Dr. M. Yunus Bengkulu 2024

Ade Dian Pratiwi, Kusdalinah, Anang Wahyudi

Department of Nutrition Health, Polytechnic Ministry of Health Bengkulu, 38225 Bengkulu, Indonesia

Corresponding author's email: anang@poltekkesbengkulu.ac.id

SUMMARY

Coronary heart disease often results from the narrowing of coronary arteries due to abnormalities, with high fat intake leading to increased cholesterol levels. Adequate fiber can help stabilize blood fat levels. Additionally, lack of nutritional knowledge can contribute to coronary heart disease. This study aims to compare the effects of nutrition education on knowledge, attitudes, and intake of saturated fat and fiber between two groups: one using video and the other using flip charts. Utilizing a quasi-experimental design with a control group pretest-posttest, the study found significant differences in knowledge, attitudes, and intake before and after counseling in the video group.

Keywords: Consumption pattern, Coronary heart disease, Fiber intake, Nutrition counseling, Saturated fat

INTRODUCTION

Coronary heart disease (CHD) is a condition that occurs when the heart muscle is deprived of blood due to the blockage of the coronary blood vessels caused by damage to the vessel walls, a process known as atherosclerosis. This blockage reduces or stops blood flow to the heart. Elevated cholesterol levels are a major consequence of high fat intake [1]. Media in counseling can facilitate health promotion by enabling communication and information dissemination. Video media, in particular, is effective due to its audio-visual nature, making information more impactful and accessible [2]. The objective of this study is to explore whether nutrition education on saturated fat and fiber influences respondents' knowledge, attitudes, and consumption patterns.

MATERIALS AND METHODS

This study employed a quasi-experimental design with a control group pre-test post-test approach, focusing on outpatient coronary heart disease patients at the Regional Public Hospital Dr. M. Yunus Bengkulu. The study population consisted of patients under the age of 60 years, residing in Bengkulu City, and capable of providing informed consent. All respondents or their families were required to have access to an Android or iOS-based mobile phone. Using purposive sampling from Patient Data reports, 28 participants were selected, with 14 assigned to the video intervention group and 14 to the flip chart control group. Nutrition counseling was conducted in two sessions, during which respondents' nutritional issues were addressed collaboratively. The intervention group received counseling via video media accessible at home, while the control group was provided with counseling through flip charts.

RESULTS AND DISCUSSION

Following the implementation of nutritional counseling, there was a notable enhancement in the average level of knowledge, attitude and dietary fibre consumption among both the video and flip chart groups. Conversely, there was a reduction in the average intake of saturated fat among the video and flip chart groups. Knowledge is one of the factors that influence the formation of a person's attitude. Knowledge can make someone aware so that they will behave according to their knowledge. Knowledge is one of the variables that influence the development of individual attitudes. Given involvement and exploration, assuming a person has good information, he will have appropriate behavior or activities as well [3].The results of the independent test in Table I show a difference in knowledge variables between the video group and the flip chart group where the p-value <0.05. While the variable of saturated fat and fiber intake between the video group and the flip chart group had

Table I: Differences in knowledge, attitude, saturated fat and fiber intake between video group and flip chart group

Variable	Group		Δ Mean±SD	*P*
	Video	Flip chart		
	Mean±SD	Mean±SD		
Knowledge	8.28±1.63	6.92±2.07	1.36 ± -0.44	0.038
Attitude	32.92±1.26	29.64±1.82	3.28 ± -0.56	0.000
Saturated fat intake	12.78 ±3.53	15.83±4.37	-3.05 ± -0.84	0.053
Fiber intake	7.04±1.77	6.34±1.65	0.7 ± 0.12	0.290

no difference as seen from the p-value>0.05. Research by [3] reported that health education media with video is more effective than flip chart media in improving knowledge and attitudes. The increase in knowledge shows that health education interventions with video media can be repeated and the right way of delivery can provide better research results compared to the flip chart. According to the research of [4], it was found that there was no significant difference in behavior scores between the intervention and control groups, indicated by the results of the statistical test obtained p-value = 0.482.

CONCLUSION

The study found differences in knowledge and attitudes between the video and flip chart groups, but no differences in saturated fat and fiber intake. Both video and flip chart counseling can improve knowledge, attitudes, and dietary patterns in patients with coronary heart disease, providing valuable insights for hospitals and academic institutions.

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EXTENDED ABSTRACT

The Relation Between Feeding Habits and The History of Children Who Have Been Involved in Infectious Diseases as a Result of The Stunting Incident in The West Bontang Health Center, Aged 6-23 Months

Natasya Cicilia Suwuh, Iriyani Kamaruddin, Erri Larene Safika

Department of Public Nutrition, Faculty of Public Health, Mulawarman University, 75119 Samarinda, East Kalimantan, Indonesia

Corresponding author's email: natasyafkmunmul@gmail.com

SUMMARY

Stunting prevalence in Bontang was reaching 21% in 2022 and 14,840 families are at risk of having child with stunting in the West Bontang Health Center. This is cross-sectional research with 74 respondents. Data was collected with questionnaires and analyzed using Fisher's Exact test. The result showed that there were 13 stunted child aged 6 – 23 months in the West Bontang Health Center (17.6%). The conclusion is that there is a relation of feeding habits and no relation of history of infection with the stunting incident among child aged 6 - 23 months in the West Bontang Health Center.

Keywords: Child, Feeding patterns, Health, Infection, Stunting

INTRODUCTION

Stunting is a chronic child malnutrition and defined as height-for-age <-2 standard deviation. Stunting in Bontang in 2022 reached 21%, where 14,840 families are at risk of having child with stunting in the West Bontang Health Center. The main cause of 45% of child's deaths is malnutrition due to inappropriate feeding patterns and infection [4,5]. Based on Riskesdas 2018, the prevalence of infectious diseases in children like Acute Respiratory tract Infection (ARI) and diarrhea in East Kalimantan reached 10.8% and 9.7%. Adequate nutritional intake and good health status during the first 1000 days of life are important because of the rapid development of brain cells and the formation of nerve tissue in toddlers [3]. This research aims to determine the relation between feeding habits and history of children who have been involved in infectious diseases with the stunting incident, aged 6 - 23 months in West Bontang Health Center.

MATERIALS AND METHODS

This research is an analytical observational study with a cross-sectional design. The subjects were mothers who had child aged 6 – 23 months. This research was held on 1 – 20 November 2023 in the West Bontang Health Center. The sample size was 74 with mothers who directly cared for child aged 6 - 23 months, lived in West Bontang Health Center, and had a Mother and Child health book. The dependent variable is the stunting incidence and the independent variables are feeding patterns and history of infectious diseases. Research instruments include a Child Feeding Questionnaire (CFQ), Infection History Questionnaire (IHQ), and infantometer. CFQ include 15 statement to describe feeding patterns based on type, amount, and meal schedule. IHQ include name of infectious diseases and the symptoms in the last 3 months. The infantometer from the Focus brand with an accuracy of 0.1 cm. Bivariate analysis using the Fisher's Exact test.

RESULTS AND DISCUSSION

Table I showed that there were 13 stunted toddlers (17.6%). Most of the child were male (55.4%) and 16 child (22%) had a history of LBW (Low Birth Weight). The majority of mothers of children who were respondents were aged 21 – 35 years as many as 62 mothers (83.8%). The majority of mothers had at least a senior high school/equivalent education (43.2%) and the majority were housewives (74.3%). Family income per month is more than IDR 3,000,000.00 (64.9%). Figure I showed that mothers implemented appropriate feeding patterns (86.5%). However, there were 10 mothers with inappropriate feeding patterns for their

Table I: Characteristics of children and mothers of children

Characteristic	Frequency (n)	Percentage (%)
Child Age (months)		
6 – 8	18	24.3
9 – 11	13	17.6
12 – 23	43	58.1
Gender		
Male	41	55.4
Female	33	44.6
History of LBW		
Yes	16	22.0
No	58	78.0
Nutrional Status (HAZ)		
Normal	61	82.4
Stunting	13	17.6
Mother Age (years)		
< 21	3	4.1
21 – 35	62	83.8
> 35	9	12.2
Level of education		
Elementary School	4	5.4
Junior High School	4	5.4
Senior High School	32	43.2
Diploma	5	6.8
Bachelor	28	37.8
Not completed in primary school	1	1.4
Job		
Housewife	55	74.3
Civil Employees	5	6.8
Private Employees	6	8.1
Enterpreneur	5	6.8
Nurse	1	1.4
Farmer	1	1.4
Cleaning Service	1	1.4
Monthly Family Income		
< Rp 1,000,000	4	5.4
Rp 1,000,000 - Rp 3,000,000	22	29.7
> Rp 3,000,000	48	64.9

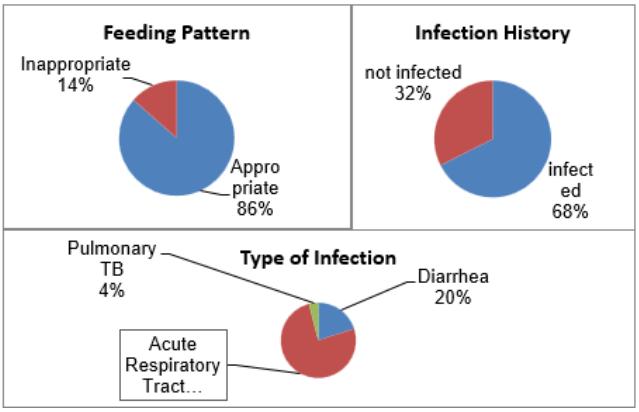

Figure 1: Distribution of feeding patterns and infection history in child aged 6 - 23 months

child (13.5%). The majority of children had a history of infections (67.6%). Among them, 76% children had upper respiratory tract infections.

Fisher's Exact test (Table II) shows that feeding patterns are significantly related to the stunting incident among child aged 6 - 23 months (p-value < 0.05). History of infectious disease is not significantly related to the stunting incident among child aged 6 - 23 months.

Stunted child show that malnutrition has accumulated over a long period of time and is not treated immediately. Inappropriate feeding patterns affect the nutritional needs of children not being met, which has implications for disrupting their growth and development [2]. Based on interviews, 76% of children suffer from Acute

Table II: The relation between feeding patterns and history of infection with the incidence of stunting in child aged 6-23 months in the West Bontang Health Center

Feeding Pattern	Nutritional Status (Length for Age)				p-value
	Normal		Stunting		
	n	%	n	%	
Appropriate	57	89	7	11	0.001*
Inappropriate	4	40	6	60	
History of Infection					
Infected	40	80	10	20	0.528*
Not Infected	21	87	3	13	

*) Fischer's Exact Test

Respiratory tract Infection (ARI) because they are infected from people close to them. This is caused by a lack of personal hygiene and environmental sanitation so that microorganisms can be transmitted between individuals or through equipment. A dirty and damp environment is a place where microorganism can infect the respiratory tract. In the transition season, the level of humidity and circulation of viruses in the air increases because the rotation of air currents so that the child's immune system is vulnerable to infection [1].

CONCLUSION

There is a relation between feeding habits and stunting incident among child aged 6 - 23 months in West Bontang Health Center, and no relation between history of children who have been involved infectious diseases as a result of stunting, aged 6 - 23 months in West Bontang Health Center.

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EXTENDED ABSTRACT

The Relationship of Physical Fitness, Nutritional Status, Quality of Life and Academic Achievement in Students

Muhammad Irwan Setiawan[1], Nana Astriana Hasibuan[2], Azaria Nafisah Pahlavie[3], Fahrini Yulidasari[1], Siti Aisyah Solechah[1]

[1] Departmen of Public Health Nutrition, School of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat University, 70714 Banjarbaru, Indonesia
[2] School of Nursing, Faculty of Medicine and Health Sciences, Lambung Mangkurat University, 70714 Banjarbaru, Indonesia
[3] Master of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat University, 70714 Banjarbaru, Indonesia

Corresponding author's email: irwan.setiawan@ulm.ac.id

SUMMARY

High academic demands during the study period negatively impact students' physical and mental health. Additionally, poor physical fitness exacerbates these mental health issues and contributes to academic achievement. This study to analyze the relationship between physical fitness, nutritional status, quality of life and academic achievement among students at Lambung Mangkurat University. A cross-sectional study was conducted of 263 students. There was a significant relationship (p<0,05) between nutritional status and academic achievement, physical fitness and academic achievement, and physical fitness and quality of life. However, no significant relationship was observed between nutritional status and physical fitness nor quality of life.

Keywords: Academic achievement, Mental Health, Nutritional status, Physical fitness, Quality of life.

INTRODUCTION

During the study period, high academic demands likely affect students' physical and mental health. Key health indicators include physical fitness, quality of life, nutritional status, health behaviour, and stress management. Previous research highlights concerning levels of mental health disorders among students. Lack of physical activity, poor diet, and smoking are significant health issues in student. Regular exercise enhances physical fitness and endurance, reducing cardiovascular disease risks, which are linked to impaired physical performance [1]. Consequently, exercise can mitigate the negative effects of academic stress on students' physical performance [2]. Low physical fitness also correlates with mental health and academic problems [1,3]. Studies from China show that students with higher physical fitness levels often achieve better academic outcomes, as physical fitness enhances working memory and cognitive flexibility [2]. This study examined the relationships between physical fitness, nutritional status, quality of life, and academic achievement among students at Lambung Mangkurat University.

MATERIALS AND METHODS

A cross-sectional analytical design was carried out on 263 active students who were in semesters III and V, who were not post-operative, and had no history of asthma in the last 6 months. Physical Fitness Status is measured using the Indonesian Student Fitness Test (TKPN), consisting of sit and reach, 60 second sit-up, 30 second squat-thrust, and pacer-test. Nutritional status is measured from Body Mass Index (kg/m2), academic achievement is measured from last of GPA, and the Short-Form-36 questionnaire is used to assess quality of life, which consists of physical function, physical role, body pain, general health, vitality, social functioning, emotional roles, and mental health. Univariate analysis was used to describe the frequency distribution and socio-demographic of the subjects. The Pearson Test was used to analyze the relationship between physical fitness status, nutritional status, quality of life and academic achievement. The research has received ethical clearance commission approval.

RESULTS AND DISCUSSION

The socio-demographic characteristics of the subjects are shown in Table I. Results indicate an average GPA classified as very satisfactory (3.0 < GPA < 3.51) and normal BMI, while physical fitness is classified as poor. Respondents generally reported non-limiting physical function (score: 88.9), good social function (score: 71.43), quite good vitality (score: 57.83), and good mental health (score: 62.18). However, most respondents

Table I: Socio-demographic characteristics of respondents

Variables	Result
Age (years)	19.83±0.87
Last of GPA	3.42±0.29
Physical Fitness (VP)	1.79±0.38
• Poor (<2)	175 (66.54%)
• Fair (2-3)	85 (32.32%)
• Good (≥3)	3 (1.14%)
General Health	62.50±16.28
Physical Function	88.90±18.45
Physical limitations	70.92±31.96
Emotional limitations	61.73±39.56
Social Function	71.43±18.78
Body Pain	75.17±18.91
Vitality	57.83±17.47
Mental Health	62.18±17.57
Height (cm)	160.23±8.60
Body Weight (kg)	56.89±14.42
BMI (kg/m2)	22.04±4.84
• Underweight (< 18.5)	48 (18.3%)
• Normal (18.5-22.9)	89 (33.8%)
• Overweight (23.0-24.9)	29 (11%)
• Obesity (≥25)	48 (18.3%)

experienced body pain during activities over the last 4 weeks (score: 75.17), felt emotional limitations (score: 61.73), and had restricted activity levels (score: 70.92).

Our findings reveal significant relationships between nutritional status and academic achievement (p=0.024), physical fitness and academic achievement (p=0.043), and physical fitness and quality of life, specifically in mental health (p=0.046), vitality (p=0.012), and general health (p=0.018). Nutritional status significantly influences academic achievement, as sufficient nutrition is essential for cognitive function, focus, and memory. The link between physical fitness and academic performance may result from increased blood flow and oxygen to the brain, promoting neurogenesis and brain plasticity, which improve focus, learning, and memory [2,3]. Additionally, the connection between physical activity and mental health is fostered by neurogenesis, angiogenesis, and positive brain changes, alongside improvements in the hypothalamic-pituitary-adrenal axis, amygdala, and hippocampus, which regulate motivation and mood [4]. Positive effects on vitality are noted through improved hormone balance, energy levels, reduced fatigue, enhanced immunity, and overall wellness [5]. However, no significant relationship was found between nutritional status and physical fitness, nor between nutritional status and quality of life (p>0.05).

Table II: Bivariate analysis for all variables

Two-variable relationship	*p*-value
Physical Fitness and General health	0.018[Ŧ]
Physical Fitness and Mental Health	0.046 [Ŧ]
Physical Fitness and Vitality	0.012 [Ŧ]
Physical Fitness and Physical Function	0.182
Physical Fitness and Physical Limitation	0.832
Physical Fitness and Emotional Limitation	0.978
Physical Fitness and Sosial Function	0.849
Physical Fitness and Body Pain	0.365
Physical Fitness and Academic Achievement	0.043 [Ŧ]
Physical Fitness and Nutritional Status	0.166
Academic Achievement and Nutritional Status	0.024 [Ŧ]

[Ŧ]Chi-square analysis and significant results at p<0.05

CONCLUSION

In conclusion, there is a significant relationship between physical fitness, nutritional status, and academic achievement. Physical fitness impacts mental health, vitality, and general health. Future research should explore factors linking nutrition and fitness, assess long-term effects on academic performance, and examine other determinants of quality of life through integrated health interventions.

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EXTENDED ABSTRACT

Competence in Balanced Nutrition Messaging Among Parents of Raudhatul Athfal and Kindergarten Students in Semarang City

Laksmi Widajanti

Department of Nutrition, Faculty of Public Health, Diponegoro University, 50275 Semarang, Indonesia

Corresponding author's email: laksmiwidajanti@gmail.com

SUMMARY

The competence of parents and caregivers from Raudhatul Athfal (RA) or Kindergarten in delivering balanced nutrition messages competence was assessed in this study. It aimed to evaluate the competence of Balanced Nutrition Messaging among parents of RA & Kindergarten in Semarang City. A cross-sectional survey was conducted using clustered sampling with criteria including both public and private schools. A total of 82 parents were selected as subjects. Competence variables included knowledge, attitude, and practices regarding balanced nutrition messages in parents among RA & Kindergarten, were rated as very good (95.1%), with a median score of 95.0±6.96.

Keywords: Balanced nutrition, Competence, Kindergarten, Parents, Raudhatul Athfal

INTRODUCTION

Given the considerable number of students in Raudhatul Athfal (RA) or Kindergarten, regular activities are necessary to implement Balanced Nutrition Guidelines for children through their parents or guardians.. These efforts are crucial to preparing human resources that are sufficiently nourished, healthy, and intelligent from early age. Parents or guardians of Raudhatul Athfal or Kindergarten students are responsible in catering to the daily needs of children, including their daily nutritional requirements. Therefore, they need to possess adequate competence in balanced nutrition guidelines. The parent-child format for cooking has been shown to be effective in increasing children's perceived cooking competence [1]. Interventions designed to enhance the eating competent of preschool's parents may improve child nutrition status [2]. The objective of this study is to evaluate the effectiveness of balanced nutrition messages among parents or guardians of RA or Kindergarten students in Semarang City.

MATERIALS AND METHODS

The study employed a cross-sectional survey approach. The research sites included one RA and two Kindergarten. The research spanned six months. The population comprised parents of RA or Kindergarten students. Sample selection was conducted through clustered sampling based on criteria for public and private RA or Kindergarten. The selected parents for study chosen through randomized sampling: 27 parents from RA, 25 parents from public kindergarten, and 30 parents from private kindergarten. Prior to the research the questionnaires were validated through content validation for parents. Competence in Balanced Nutrition Messages was measured using composite scores for three variables: knowledge (10 questions; minimum score 0, maximum score 100), attitudes (8 questions; minimum score 0, maximum score 100), and practices (7 questions; minimum score 0, maximum score 100). Competence in Balanced Nutrition Messages was categorized as follows: 0-55 as poor, 55-80 as good, and 81-100 as very good. Data processing to analyze differences in competence scores were analyzed using the Kruskal-Wallis H test.

RESULTS AND DISCUSSION

The Competence in Balanced Nutrition Messages, which represents a combination of assessments of knowledge, attitudes, and practices among parents or guardians of Raudhatul Athfal or Kindergarten students in Semarang City, demonstrates that the median competence is rated as very good (Fig. 1). Local adaptation and family parenting curriculum are practical approach to enhance competence and self-confidence in promoting early childhood development [3]. The excellent competence scores (knowledge, attitudes, practices) in Balanced Nutrition Messages align with the findings that sources of information and credibility acceptance vary based on maternal health literacy [4].

The knowledge, attitudes, and practices of Balanced Nutrition Messages are rated as very good (Table I). Social media used among parents can promote young

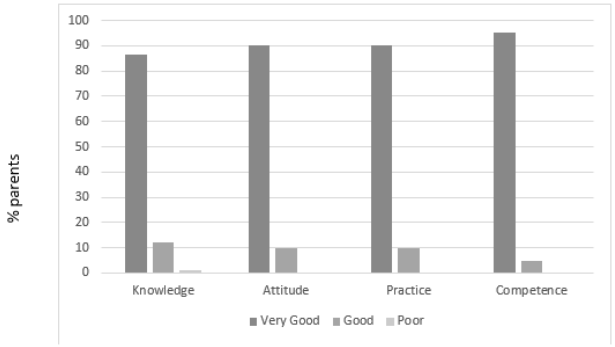

Figure 1: Balanced Nutrition Messages Competence of RA and Kindergarten Parents in Semarang City

Table I: Competence of Balanced Nutrition Messages of Parents of Raudhatul Athfal and Kindergarten Students in Semarang City

Description	Parents of RA and Kindergarten Students Mean ± Standard deviation
Knowledge of Balanced Nutrition Messages	95.0 ± 13.43
Attitudes towards Balanced Nutrition Messages	100.0 ± 7.90
Practices of Balanced Nutrition Messages	90.0 ± 8.48
Competence in Balanced Nutrition Messages	95.0 ± 6.96

Note : No significant difference ($p<0.05$) parents competence between Raudhatul Athfal and Kindergarten students, analyzed using the Kruskal-Wallis H test.

children's health [5].

CONCLUSION

The competence (KAP) in Balanced Nutrition Messages among parents or guardians of Raudhatul Athfal and Kindergarten students in Semarang City is rated as very good (95.1%). Parental competence in Balanced Nutrition Messages is highlighted as promising intervention for RA and Kindergarten children.

ACKNOWLEDGEMENTS

Thank you to the Dean of the Faculty of Public Health, Diponegoro University, who has given permission and financial assistance to conduct this research. I would also like to thank the Principal of RA and Kindergarten School, selected parents gave permission to be researched. Without their generous contributions, this research would not have been possible.

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EXTENDED ABSTRACT

Knowledge to Action: Evaluating the Impact of the Royco Nutrimenu Programme on Mothers' Practice in Complementary Feeding

Dodik Briawan[1], Elma Alfiah[2], Farida Dwi Rokhmah[3], Muhammad Aries[1]

[1] Community Nutrition Department, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia
[2] Nutrition Study Program, Faculty of Science and Technology, Universitas Al-Azhar Indonesia, 12110 Jakarta, Indonesia
[3] Nutrition Study Program, Faculty of Medicine, Universitas Negeri Semarang, 50229 Semarang, Indonesia

Corresponding author's email: elma.alfiah@uai.ac.id

SUMMARY

The 2022 survey highlighted a significant stunting issue in Indonesia, affecting 21.6% of children. Despite national efforts, stunting persists, leading to the implementation of the Royco Nutrimenu programme, which aims to improve mothers' knowledge and practices in providing nutritious complementary feeding for children aged 6-24 months. Conducted in West Bogor between June and August 2023, the study evaluated the programme's impact on 625 mothers, showing significant improvements in maternal knowledge, attitudes, and practices regarding child nutrition, notably in meal timing, consistency, and diversity. This underscores the programme's effectiveness in promoting better nutrition among children.

Keywords: Attitudes, Behaviour, Education, Feeding, Nutrition

INTRODUCTION

The 2022 Indonesian Survey revealed ongoing nutritional challenges among children, with stunting affecting 5,558,899 children [1]. Stunting has severe consequences, potentially leading to cognitive impairments and reduced adult productivity. To address these issues, the National Medium-Term Development Plan induces multi-sectoral strategies to enhance nutrition and exclusive breastfeeding up to 6 months, followed by age-appropriate complementary feeding (CF). To combat stunting, the Royco Nutrimenu programme, launched by Unilever in collaboration with the National Population and Family Planning Board in 2019, focused on improving maternal knowledge, attitudes, and practices in preparing nutritious CF. The programme demonstrated measurable improvements, with the majority of mothers showing enhanced knowledge and better feeding practices [2]. This initiative was part of a broader effort to reduce stunting and promote optimal child growth and development through nutritionally balanced CF recipes, supported by educational interventions like flip charts and community programmes. This programme was integrated with Bogor city government's stunting prevention initiative.

MATERIALS AND METHODS

This pre-post intervention study evaluated the Royco Nutrimenu CF Programme, part of the GO ROSTING initiative in Bogor City. Conducted from June toAugust 2023 across 10 neighborhoods in West Bogor, the study involved 100 cadres who received training of trainers and subsequently educated 1,000 mothers, with 625 completing the programme. The intervention included educating mothers on balanced nutrition and CF preparation using both digital and printed materials over 21 days, through online (whatsapp group) and offline methods. Knowledge, attitudes, and practice related to balanced nutrition and CF were assessed pre and post intervention. Knowledge and attitude categories were evaluated based on percentage scores, with "Good" categorized as >80% correct, "Moderate" as 60-80%, and "Poor" as <60%. CF practices were assessed according to UNICEF's guidelines on Indicators for Assessing Infant and Young Child Feeding Practices. McNemar and Wilcoxon tests were used to analyse the results before and after the programme.

RESULTS AND DISCUSSION

The mothers involved in this study, predominantly high school graduates, showed a better understanding and attitude towards nutrition and complementary feeding (CF) for their children aged 6-24 months. The study also examined socioeconomic influences on CF practices, noting that higher family incomes facilitated better nutritional choices. Mothers' occupation as homemakers was positively linked to more effective CF practices, highlighting the role of socio-economic status

in dietary behaviors. This connection underscores the importance of comprehensive health education across all educational levels to improve CF outcomes [3].

Age and breastfeeding status of children also influenced CF practices. Most children in the study, primarily aged 12-23 months, were transitioning from breastfeeding to family foods, reflecting WHO guidelines on food consistency and introduction stages. Previous Nutrimenu programmes have demonstrated the pivotal role of mothers in meal preparation and nutrition education within families [2].

There was an improvement in mothers' knowledge and attitudes post-intervention ($p<0.001$) (Table I). These findings align with similar educational interventions [2, 4]. Knowledge fundamentally shapes a person's attitudes and behaviors [5]. This programme also effectively increased the minimum dietary diversity (MDD) among participating children ($p<0.001$), showing a rise in the variety of food groups consumed, particularly those rich in Vitamin A and protein (Fig. I). The programme's success in enhancing dietary diversity highlights the effectiveness of targeted nutrition education and support provided by cadres and peer learning among mothers.

These findings reflect broader trends observed in nutritional studies across Indonesia, showing a positive correlation between maternal education, socio-economic status, and children's dietary diversity. The study's comprehensive approach, combining education with practical demonstrations and community engagement, proved crucial in improving CF practices and overall nutritional outcomes.

CONCLUSION

The Royco Nutrimenu initiative has effectively augmented maternal knowledge, attitudes, and practices related to complementary feeding, thereby facilitating improved nutritional outcomes and developmental progress in children. This intervention represents a significant advancement in addressing stunting and promoting optimal child development.

Table I: Changes in mothers' distribution according to complementary feeding knowledge and attitudes before and after the programme

Indicators	Before programme		After programme		Difference
	n	%	n	%	n(%)
Knowledge					
Poor	41	6.6	17	2.7	-24 (3.9%)
Moderate	208	33.3	156	25.0	-52 (8.3%)
Good	376	60.2	452	72.3	+76 (12.1%)
Average±SD	79.0±10.5		82.3±10.5		3.2±12.9
			p<0.001*		
Attitude					
Negative	411	65.8	349	55.8	-62(10)
Neutral	211	33.8	269	43.0	-58(9.2)
Positive	3	0.5	7	1.1	+4(0.6)
Average±SD	55.7±9.3		57.8±9.4		2.0±10.6
			p<0.001*		

Note: *Significant different at p<0.001, analysed using Wilcoxon test.

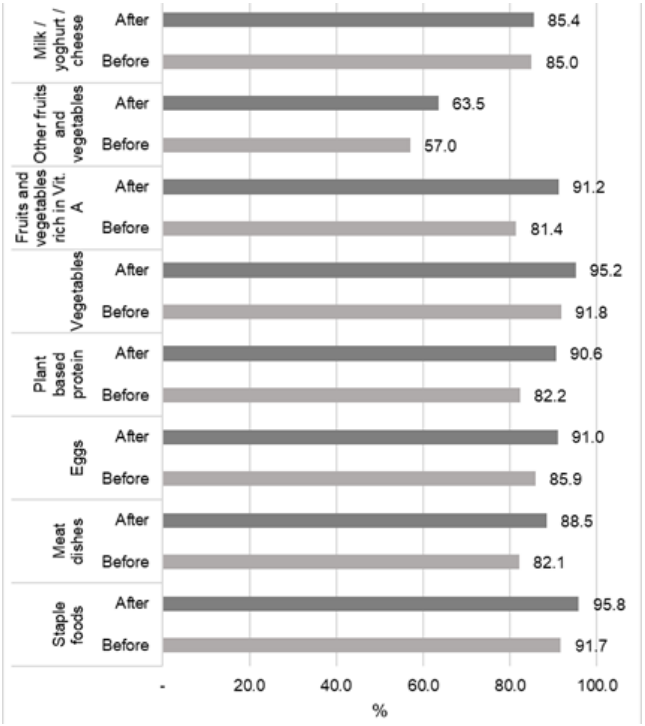

Fig. I: Percentage of mothers providing specific food groups in child's complementary feeding before and after the programme**

Note: **Significant different at p<0.001, analysed using McNemar test.

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EXTENDED ABSTRACT

Diet Quality, Physical Activity and Nutritional Status of School-Going Adolescent in West Aceh Indonesia

Ranita Suri Dewi, Cesilia Meti Dwiriani, Ali khomsan

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, West Java, Indonesia

Corresponding author's email: cmdwiriani@apps.ipb.ac.id

SUMMARY

Nutritional problems that happen in adolescents about undernutrition and overnutrition. This cross-sectional study aimed to determine differences among male and female in diet quality, physical activity and their relationship with nutritional status of school-going adolescents in West Aceh. Data collected from 312 subject were food intake (2x24 hour recall), physical activity (IPAQ), and anthropometric (BIA and microtoice). There were significant differences between male and female adolescent that mothers' education, parent's income, physical activity, BAZ and body fat. Diet quality was significantly related to BAZ on male only while physical activity was not related to BMI-for-Age-Z score (BAZ) and body fat.

Keywords: BAZ, Body fat, Diet quality, Physical activity, School going adolescent

INTRODUCTION

Nutritional problems that occur in adolescents about undernutrition and overnutrition [1]. National Basic Health Research showed the prevalence of undernutrition at 13-15 year was 8.7%, overnutrition has 2.4 times higher than those with poor nutritional status (20%) [2]. National Basic Health Research of Aceh data showed the prevalence of undernutrition in adolescents 13-15 years was 6.5% and overnutrition was 18.5% [3]. West Aceh is the fifth district with the highest prevalence of overweight aged 16-18 years in Aceh (13.7%). Factors that cause the problems are unhealthy eating habits, dominant sedentary activity and low of socio-economic. Physical changes, cognitive development, emotions and social that occur in male adolescents were different with females, this affect their eating habits and practices. The study aimed to determine differences in diet quality, physical activity, among male and female and their relationship with the nutritional status of school-going adolescents in West Aceh.

MATERIALS AND METHODS

This cross-sectional study was held at four middle schools in West Aceh. Data collected were food intake, physical activity, BMI-for-Age-Z score (BAZ) and % body fat. The data of food intake collected by 2x24 hours recall method (weekday and weekend), physical activity data by International Physical Activity Questionnaires (IPAQ). Measured of body height using microtoise, body weight and % total body fat using Omron Bioelectrical Impedance Analysis (BIA). The diet quality analyzed using the Diet Quality Index for Adolescents (DQI-A), consists of three components include dietary quality (DQ), dietary equilibrium (DE) and dietary diversity (DD). The DQ was the weight of intake multiplied by the weighting factor, DD was the amount of intake of food consumed and DE was actual intake minus the recommended maximum divided by the recommended maximum intake. The data were analyzed using Spearman Rank and Mann Whitney test.

RESULTS AND DISCUSSION

More one-fifth of adolescents are aged 13-15 years. Almost all of parents aged ranging from 32-59 years old. The parents' age of male adolescent was higher than female ($p>0.05$). Father's education of male and female subjects was same, almost one-fifth fathers of male and female have educational background until elementary school. Mother's education on female higher than male ($p<0.05$), more than two-thirds mothers of male and female have educational background until senior high school. More one-fifth parent's income of adolescent were below Rp.579,227. Parents' income of male adolescent was significantly higher than female ($p<0.05$). DQI-A score of female adolescents was higher than male ($p>0.05$). Physical activity scores of male adolescents was significantly higher than female ($p<0.05$). BMI-for-Age-Z score and % body fat score of male significantly higher than female ($p<0.05$) (Table I). In term of overnutrition, female adolescent have less physical activity than young men. Diet quality was significantly

Table I. Distribution of subjects according to subject characteristics, family characteristics, nutritional knowledge, diet quality, nutritional status and gender

Variable	Male (n=119)		Female (n=193)		Total (n=312)		*p-value*[1]
	n	(%)	n	(%)	n	(%)	
Subjects' age (years)							
13-15	64	54	96	50	160	51	0.094
16-18	55	46	97	50	152	49	
Mean±SD	14.5±1.9		14.8±2.1		14.7±2.0		
Fathers' age (years)							
32-59	101	85	176	91	277	89	0.358
>59	18	15	17	9	35	11	
Mean±SD	49.0±8.6		45.3±7.6		48.0±8.9		
Mothers' age (years)							
30-59	111	93	187	97	298	96	0.395
>59	8	7	6	3	14	4	
Mean±SD	47.4±9.1		44.5±5		44.8±7.6		
Father Education							
Non-school	26	22	18	9	44	14	0.113
Elementary school/ equivalent	58	49	116	60	174	56	
Junior high school/ equivalent	3	2	2	1	5	2	
Senior high school/ equivalent	18	15	36	19	54	17	
University	14	12	21	11	35	11	
Mother Education							
Non-school	17	14	9	5	26	8	0.026*
Elementary school/ equivalent	12	10	21	11	33	11	
Junior high school/ equivalent	7	6	10	5	17	5	
Senior high school/ equivalent	80	67	145	75	225	72	
University	3	3	8	4	11	4	
Parents' Income (Rp/ percapita/month)							
< Aceh poverty line Rp. 579,227	72	61	130	67	202	65	0.032*
≥ Aceh poverty line Rp. 579,227	47	39	63	33	110	35	
Mean±SD	Rp.643,155± Rp.670,709		Rp.520,910± Rp.658,726		Rp.567,536± Rp.664,911		
Diet Quality							
Poor (<36.7%)	11	9	21	11	32	10	0.114
Less (36.7-51.0%)	53	45	65	34	118	38	
Sufficient (51.1-61.1%)	40	34	73	38	113	36	
Good (>61,2%)	15	13	34	18	49	16	
Mean±SD	49.7±10.8		51.2±11.1		50.6±11.0		
Physical Activity (MET-Minute/week)							
Low	49	41	126	65	175	56	0.000*
Moderate	44	37	46	24	90	29	
High	26	22	21	11	47	15	
Mean±SD	1977.7± 1588.2		1464.0± 2251.6		1659.9± 2037.0		
Nutritional status (BAZ)							
Underweight (<−3.0 s/d <-2.0 SD)	10	8	6	4	16	5	0.013*
Normal (≥-2.0 s/d ≤1.0 SD)	89	75	146	78	235	75	
Overweight (>1.0 s/d >2.0 SD)	20	17	41	18	62	20	
Mean±SD	19.7±3.5		20.7±4.0		20.4±3.8		
Nutritional Status (% Body Fat)							
Normal (<20%)	84	71	120	62	204	65	0.000*
Obesity (≥20%)	35	29	73	38	108	35	
Mean±SD	15.5±6.3		25.0±4.8		21.3±7.1		

Note: [1] Mann-Whitney test, *significant p<0.05

Table II. Relationship between diet quality, physical activity and body perception with nutritional status

Variable	Male (n=119)		Female (n=193)		Total (n=312)	
	r	p-value[1]	r	p-value[1]	r	p-value[1]
Nutritional status (BAZ)						
Diet quality	0.190	0.038*	0.015	0.832	0.008	0.121
Physical activity	-0.055	0.551	-0.131	0.069	-0.128	0.023*
% Body Fat						
Diet quality	-0.090	0.331	0.085	0.242	0.071	0.209
Physical activity	-0.037	0.693	-0.056	0.437	-0.185	0.001*

Note: [1]*Spearman test, *p-value* significant <0.05; r=Coefficient Correlation

positively related to BAZ on male only while physical activity was not related to BAZ and body fat (Table II). In this study, male were more diverse in food consumption which affected their nutritional status especially on BAZ. The less of diet quality related to the high consumption of foods with high density which has an impact to weight gain and nutritional status. Consumption of high quality also associated with a reduction in excessive weight [4]. Gender was an important consideration for nutritional status. Male and female had divergent tastes in consume the different types of food. Physical activity significantly positive related to BAZ and BF on total subject. High physical activity was affect the BAZ % body fat). Physical activity has role in balanced the nutrients that in and out from body.

CONCLUSION

In conclusion, there were significant differences in mothers' education, parent's income, physical activity, and nutritional status. Diet quality was significantly related to BAZ on male and female. This finding suggest the need for nutritional education related to fulfilment of nutrients need and to increase physical activity of school going-adolescent.

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EXTENDED ABSTRACT

Gender Relations in Fisherman's Families

Dyah Retna Puspita[1], Ikeu Tanziha[2], Rofifah Irbah Syahputri[2]

[1] Department of Communication and Development Sciences, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia
[2] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: ikeu_jamilah@apps.ipb.ac.id

SUMMARY

This research aims to analyze differences in gender relations between fisherman families in Cikahuripan village, Sukabumi Regency. This is a quantitative research with a survey method using a questionnaire. The respondents were 100 wifes (55 non-stunting families and 45 stunting families). The research results showed that there were no differences in all aspects studied except for the reproductive role in the form of accompanying children to play (p-value 0.034). From these results, it is recommended that fathers from stunted families increase their role in caring for children by paying more attention to their growth and development.

Keywords: Coasts, Fishermen, Gender, Household, Stunting

INTRODUCTION

Stunting is a global problem where Indonesia is ranked second with the highest prevalence in ASEAN countries. Stunting can cause less than optimal cognitive, motor, and verbal development, increased risk of obesity and other degenerative diseases, increased incidence of illness and death. This condition can hamper economic growth, increase poverty, and widen disparities within a country. One of the contributing factors is the existence of gender inequality in the household. Coastal areas are prone to stunting due to poverty and low food security. Therefore, this research aims to analyze whether there are differences in gender relations among fishing families.

MATERIALS AND METHODS

This research was carried out in Cikahuripan Village, Cisolok District, Sukabumi Regency with quantitative approach using survey methods. The respondents were 100 wives from 45 households with stunted toddlers and 55 households with normal toddlers. Primary data collection was carried out by interviews using a validated questionnaire in January 2024. Gender equality was measured using the Moser Gender Framework [1] which includes three types of roles namely reproductive, productive, and social role. The collected data was then analyzed using the Mann Whitney statistical test to determine differences in gender equality in all aspect (reproductive, productive, and social role) between stunting and non-stunting families/households [2].

RESULTS AND DISCUSSION

Gender relations are social relationships between men and women that are formed socially and culturally, which include reproductive, productive, and social roles. According to Caroline Moser [1], productive work involves income-generating activities typically recognized in the formal economy, such as farming or employment in a factory. Reproductive work encompasses tasks necessary for the maintenance of households, such as cooking, cleaning, and childcare, which are often unpaid and undervalued. Social work refers to community-based activities that support social networks and community cohesion, like organizing local events or participating in neighborhood associations. For example, a woman working as a teacher (productive), caring for her children at home (reproductive), and volunteering at a community center (social). In this research, the reproductive role of fishermen includes the activities of preparing children's meals, taking children to the posyandu and accompanying children to play, their productive role is in the form of selling their catch, while their social role includes social gathering activities and attending RT meetings.

The results of the study found that all activities in the three roles were not significantly different between non-stunting families and stunting families, except for accompanying children to play (p-value=0.034). In this activity, the percentage of fathers and mothers who do it together from non-stunting families is greater than from stunting families. Another finding is the division of labor.

Table I. Reproductive, productive and social roles of respondents from non-stunting families and stunting families

Variabel	Non-stunting (n=55)		Stunting (n=45)		p-value
	n	%	N	%	
Reproductive role					
Preparing children's food					
Male only	0	0	0	0	
Dominant male	0	0	0	0	
Together	1	1.8	2	4.4	0.274
Dominant female	1	1.8	2	4.4	
Female only	53	96.4	41	91.1	
Take the child to the *posyandu*					
Male only	0	0	0	0	
Dominant male	0	0	0	0	
Together	4	7.3	2	4.4	0.250
Dominant female	2	3.6	0	0	
Female only	49	89.1	43	95.6	
Accompanying children to play					
Male only	0	0	0	0	
Dominant male	0	0	0	0	
Together	35	63.6	20	44.4	0.034*
Dominant female	11	20	10	22.2	
Female only	9	16.4	15	33.3	
Productive role					
Selling fish catch					
Male only	55	100	45	100	
Dominant male	0	0	0	0	
Together	0	0	0	0	1
Dominant female	0	0	0	0	
Female only	0	0	0	0	
Do not do	0	0	0	0	
Social role					
Lottery club (*Arisan*)					
Male only	0	0	0	0	
Dominant male	0	0	0	0	
Together	1	1.8	1	2.2	0.957
Dominant female	1	1.8	0	0	
Female only	14	25.5	7	15.6	
Do not do	39	70.9	37	82.2	
Neighborhood meeting (*Rapat RT*)					
Male only	32	58.2	22	31.7	
Dominant male	1	1.8	2	2.4	
Together	3	5.5	1	29.3	0.516
Dominant female	0	0	0	0	
Female only	10	18.2	10	2.4	
Do not do	9	16.4	10	34.1	

Reproductive roles are mostly carried out by women, productive activities (selling fish caught) are carried out by men, and social roles (social gatherings) are mostly attended by women, while meetings related to decision-making for local residents are mostly attended by men (Table I). The findings of this study which show that parents have more play activities with children from non-stunted families compared to families with stunted children support several previous research results [3–5].

CONCLUSION

This research show that there are no significant differences between non-stunting families and stunting families in reproductive, productive, and social roles except for accompanying children to play. It is recommended that parent pay more attention to children's growth and development, including by increasing their time to play with children.

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EXTENDED ABSTRACT

Relationship between Eating Habits, Sleep Duration, Nutritional Status, and Stress Levels with The Incidence of Hypertension among Adults in Central Jakarta

Jasmin Wulansari Hidayat, Avliya Quratul Marjan, Nur Intania Sofianita, Dian Luthfiana Sufyan

Nutrition Study Program, Faculty of Health Sciences, National Development University, Jakarta, Indonesia

Corresponding author's email: avliyaquratul@upnvj.ac.id

SUMMARY

Hypertension is a serious problem in Indonesia, and the prevalence in Jakarta reached 33.43%. This study aimed to determine the relationship between eating habits, sleep duration, nutritional status, and stress levels with the incidence of hypertension in the adult group. This cross-sectional study was carried out in the Gambir Health Center involving 68 subjecs. The sampling technique used a purposive sampling method and data analysis used univariate and bivariate tests. The variables nutritional status and stress level were significantly related to the incidence of hypertension in the adult group in that study.

Keywords: Adulthood, Eating habits, Hypertension, Nutritional status, Stress level

INTRODUCTION

Blood pressure that is higher than usual is known as hypertension. A person is diagnosed with hypertension if their systolic and diastolic blood pressures are greater than 140 and 90 mmHg, respectively [1] . Eating habits are one of the risk factors for high blood pressure (consumption of foods high in fat, calories, and salt). Additionally, eating fatty foods can increase the risk of atherosclerosis, which increases heart rate and dilates your blood vessels [2]. Short sleep duration causes imbalances in the hormones ghrelin and leptin, increased appetite, and disruption of circadian rhythms [3]. Obesity-related hypertension is generally characterized by increased plasma volume and cardiac output [1]. Stress is also a risk factor for hypertension in adults [4]. Based on this background, researchers are interested in exploring research related to the relationship between eating habits, sleep duration, nutritional status, and stress levels with the incidence of hypertension in adult groups in Jakarta.

MATERIALS AND METHODS

The study conducted from February to June 2023 investigated the incidence of hypertension among adults aged 25-45 years at three health centers: Gambir Duri Pulo Village, and Petojo Selatan Village Health Center. Utilizing a cross-sectional quantitative design, the research population consisted of patients aged 25-45 undergoing medical check-ups at Gambir Health Center. Data collection methods included interviews, questionnaires, and secondary data from Gambir Health Center records. Various instruments were utilized, including Informed Consent forms, PSP, Semi Quantitative-Food Frequency Questionnaires, DASS Questionnaires, Pittsburgh Sleep Questionnaires, Microtoise/Stadiometer, digital scales, and digital Sphygmomanometers. Post-collection, data analysis was conducted using univariate and bivariate analyses.

RESULTS AND DISCUSSION

The research result indicated 74.3% had the Overweight status, 61.4% suffered from hypertension and the other 12.9% did not suffer from hypertension. 25.7% of respondents who had the normal status 12.9% suffered from hypertension and the other 12.9% did not suffer from hypertension so it can be concluded that the majority of respondents had an overweight status and suffered from hypertension. Table I is the characteristics of the respondents in this study.

Based on the p-value analysis section, there is a relationship between nutritional status and hypertension. The results are in line with research conducted by [1] (Hasanah et al., 2016) which explained among adults, there is a noteworthy correlation between hypertension and dietary health. The weakening of arterial pressure regulation mechanisms brought on by obesity can raise blood pressure and increase the excretion of water and salt through diuresis and natriuresis. The analysis's findings are displayed in this Table II.

Table I: Respondent Characteristics

Respondent characteristics	Frequency	Persentage (%)
Gender		
Man	27	38.6
Woman	43	61.4
Total	**70**	**100**
Age Group		
Early Adulthood	19	27.1
Late Adulthood	51	72.9
Total	**70**	**100**
Work		
Doesn't work	4	5.7
Government Employee	2	2.9
Private employee	16	22.9
Driver	6	8.6
Other	42	60
Total	**70**	**100**
Eating Habits		
Deficit	13	18.6
Enough	3	4.3
More	54	77.1
Total	**70**	**100**
Sleep Duration		
<6 hour/day	44	62.9
>6 hour/day	26	37.1
Total	**70**	**100**
Nutritional Status		
Normal	18	25.7
Overweight	52	74.3
Total	**70**	**100**
Stress Level		
Normal	20	28.6
Mild Stress	2	2.9
Severe Stress	48	68.6
Total	**70**	**100**

Table II: Result of the study

Variable	Hypertention		Non Hyper-tention		Total		p-value
	n	%	N	%	N	%	
Eating Habit							
Less	10	14.3	3	4.3	13	18.6	0.933
Adequate	2	2.9	1	1.4	3	4.3	
Over	40	57.1	14	20	54	77.1	
Total	**52**	**74.3**	**18**	**25.7**	**70**	**100**	
Sleep Duration							
<6 hours/day	36	51.6	8	11.4	44	62.9	0.061
>6hours/day	16	22.9	10	14.3	26	37.1	
Total	**52**	**74.3**	**18**	**25.7**	**70**	**100**	
Nutritional status							
Normal	9	12.9	9	12.9	18	25.7	**0.011***
Overweight	43	61.4	9	12.9	52	74.3	
Total	**52**	**74.3**	**18**	**25.7**	**70**	**100**	
Stress level							
Normal	10	14.3	10	14.3	20	28.6	**0.007***
Mid	1	1.4	1	1.4	2	2.9	
Severe	41	58.6	7	10	8	68.6	
Total	**52**	**74.3**	**18**	**25.7**	**70**	**100**	

The majority of respondents who had a severe stress level suffered from hypertension. Based on the p-value analysis, there is a relationship between stress level and hypertension in the Gambir Health Center working area. Experienced stress influences psycho-biological processes that stimulate biological systems by activating the central nervous system using autonomic, neuroendocrine, and immune responses. Stress is then received by the brain as a response and transmitted to the hypothalami-pituitary-adrenal axis, which activates the autonomic nervous system axis and innervates tissues of the immune system. When stress is left uncontrolled, the hormones adrenaline and noradrenaline are released in excess, which can narrow blood vessels and increase blood pressure [5].

CONCLUSION

This research showed that there is a significant relationship between nutritional status and stress levels with the incidence of hypertension in the adult group in Central Jakarta. Researchers recommend that participants consider making lifestyle adjustments such as reducing their consumption of salty foods, managing their weight, and scheduling routine health screenings.

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EXTENDED ABSTRACT

Relationship between Diet Quality and Eating Speed with Nutritional Status of Adolescents in Jakarta, Indonesia

Jennifer Natalia Christsanta, Cesilia Meti Dwiriani, Purnawati Hustina Rachman

Department of Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: cmdwiriani@apps.ipb.ac.id

SUMMARY

The nutritional issues in adolescents are influenced by the quality of food consumption and eating behaviors such as eating speed. This study aimed to evaluate diet quality and eating speed and its correlation with nutritional status of adolescents at SMPN 35 Jakarta. The study comprised 79 subjects. Diet quality was measured using a 2 x 24-hours recall of food intake data and analyzed using the diet quality index for adolescents (DQI-A), while eating speed was assessed with the self-reporting questionnaire (SRQ). The results indicated a poor diet quality and moderate eating speed. Furthermore, there is a significant positive correlation existed between eating speed and BMI-for-age.

Keywords: Adolescents, DQI-A, Diet quality, Eating speed, Nutritional status

INTRODUCTION

Triple burden malnutrition, comprising undernutrition (stunting and wasting), overnutrition (obesity), and micronutrient deficiencies, reflects the complex nutritional challenges faced by adolescents. Jakarta had a 25.1% prevalence of overnutrition among adolescents, the highest in obesity prevalence compared to other provinces according to the Indonesian Ministry of Health. Poor dietary quality, characterized by inadequate quantity and quality of food intake, directly contributes to nutritional problems [1]. Nutritional status is affected by the quality of the diet, given that inadequate intake can influence an individuals' nutritional well-being [2]. Moreover, research shows that adolescents with poor diet quality are 10.4 times more likely to be obese. Besides diet quality, nutritional status is influenced by eating behaviors like eating speed, although studies on this link vary in findings [3]. Given these issues, this study aimed to investigate the relationship between eating speed, diet quality, and nutritional status in adolescents from SMPN 35 Jakarta is of interest.

MATERIALS AND METHODS

This cross-sectional study involved 79 7th-grade students using convenience sampling. Data collected were diet quality, eating speed, and anthropometric data. The study employs the DQI-A to evaluate diet quality through dietary quality (DQ) for optimal food selection, dietary diversity (DD) indicating diet variation level, and dietary equilibrium (DE) assessing balance between adequacy and excess consumption. The evaluation followed Indonesian dietary guidelines for food group portions. Eating speed was assessed using the SRQ, adapted from studies on eating speed, diet quality, and metabolic health. Eating speed was measured subjectively (very slow to very fast) and objectively (meal durations for breakfast, lunch, dinner), with only actual meal duration used in correlation tests. Average eating speed was categorized based on quartiles. Statistical analysis included mean and median presentation for normal and non-normal data, normality checks with Kolmogorov-Smirnov, T-test and Mann Whitney test for differences, and Pearson or Spearman correlations based on data distribution.

RESULTS AND DISCUSSION

The nutritional status measurements based on BMI-for-age showed that 19.0% of subjects overweight or obese. Almost a quarter of the subjects had excess body fat percentages. On average, female subjects had higher body fat percentages than males. There was a significant difference between the body fat percentages of males and females (Table I). The DQI-A score of 36.0% on a scale from -33% to 100% reflects the combined assessment of three components, with higher scores indicating better diet quality. Notably, male subjects had higher average DQI-A scores compared to females. This score is categorized as poor diet quality, aligning with other research that associates similar scores with inadequate nutrient intake. Given the lack of ordinal or categorical classifications in the original data, comparisons with existing literature were employed to provide context for these findings [4]. Majority of respondents had a moderate eating speed (Table II). Spearman correlation analyses revealed a significant

Table I: Distribution of subjects based on BMI-for-age and body fat percentage

Characteristics	Male (n=33)		Female (n=46)		Total (n=79)	
	n	%	n	%	n	%
BMI-for-age						
Underweight	3	9	3	7	6	8
Normal	23	70	35	76	58	73
Overweight/Obese	7	21	8	18	15	19
The average z-score (BMI-for-age)±SD	-0.34±1.46		-0.04±1.56		-0.17±1.53	
Body fat percentage						
High	12	36	6	14	18	23
Normal	19	58	32	70	51	65
Low	2	6	8	17	10	13
The average±SD body fat percentage (%)	18.35±6.31		24.62±5.69		22.00±6.68	

Table II: Average subject scores based on DQI-A assessment categories

Variable	Male (n=33)	Female (n=46)	Total (n=79)
DQI-A component (%)			
Dietary Quality (DQ)	41.3±13.3	40.9±15.6	41.1±14.6
Dietary Equilibrium (DE)	23.4±7.7	20.3±7.3	21.6±7.6
Dietary Diversity (DD)	45.3±11.6	45.4±8.9	45.3±10.0
DQI-A Score	36.7±7.9	35.5±7.4	36.0±7.6
Eating speed category (%)			
Slow (≥20 minutes)	15	11	13
Moderate (9-19 minutes)	70	80	76
Fast (<9 minutes)	15	9	11
Median (25-75 Percentile) (minutes)	14.3 (9.0-23.0)	13.7 (9.6-20.0)	14.0 (9.3-20.0)

Table III: Correlation test

Variables	BMI-for-Age		Body fat percentage	
	r	p	r	p
Eating speed	0.242	0.031[a]	0.169	0.137[a]
Diet quality	0.130	0.252[a]	-0.083	0.467[b]

Note: [a] Spearman test, [b] Pearson test

positive correlation between eating speed and BMI-for-age. However, the associations between body fat percentage and diet quality, as well as eating speed, were not significant (Table III). These findings suggest a potential link between prolonged eating durations and elevated BMI-for-age values among the subjects. Fast eating may reduce anorexigenic hormones, essential for regulating energy balance and appetite control. This hormonal decline from rapid eating habits can lead to increased food intake and a higher risk of obesity. Anorexigenic hormones, from the hypothalamus, play a critical role in suppressing appetite and enhancing energy expenditure. However, the contradictory nature of these results compared to previous research can be attributed to several factors, including variations in individual eating habits influenced by food preferences, satiety, or familial eating practices. Additionally, larger-scale studies involving diverse populations ranging from 1,000 to 50,000 participants are needed to establish definitive eating speed thresholds for specific populations [5].

CONCLUSION

In conclusion, the DQI-A reflects poor diet quality with moderate eating speed. Dietary education should emphasize diverse and balanced diets. A significant positive correlation between eating speed and BMI-for-age suggests higher BMI-for-age values with slower eating. Interventions should focus on improving dietary variety, portion control, and promoting moderate eating speeds.

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EXTENDED ABSTRACT

Correlation between Fatsecret Application Use with Weight Changes, Physical Activity, and Eating Behavior of Undergraduate Students

Nadhia Tifallinuha, Cesilia Meti Dwiriani

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: cmdwiriani@apps.ipb.ac.id

SUMMARY

Fatsecret is an application that contains nutrient of food, intake and physical activity records, and time distribution of meal. This study analyzed correlation of weight changes, physical activity, and eating behavior with fatsecret application use in undergraduate students. Food intake were calculated using 2x24 hours recall and physical activity using IPAQ. The result showed that the eating behavior such as adequacy level of energy and macronutrients subject were severe deficit. There were weight changes in the subject. Significant correlation was found between Fatsecret application use with weight changes, physical activity, and eating behavior.

Keywords: Eating behavior, Fatsecret, Physical activity, Student college, Weight changes

INTRODUCTION

Increasing prevalence of overnutrition, such as overweight to obesity goes up 2.4% at the age of ≥18 years, has experienced in the last 5 years in Indonesia [1]. Impact of such nutritional problems may raise the risk of people getting noncommunicable disease or even death [2]. It suggests that having a normal nutritional status becomes important to reduce the risk by monitoring intake and physical activity. Technological developments create applications which easier for users to control intake and activity, such as fatsecret. Fatsecret contains information of food nutrient content, intake and activity records, and distribution of meal times. According to Sensor Tower data in December 2022, this application is the third most popular in Indonesia. The college student is the highest internet user in Indonesia [3]. Based on this background, this research analyzed correlation of weight changes, physical activity, and eating behavior with fatsecret application use in undergraduate students.

MATERIALS AND METHODS

This cross-sectional study with purposively sampling involved 106 undergraduate students. It was conducted February-April 2023 via online by shared posters in social medias to get subject who met the inclusion criteria including active undergraduate students, used Fatsecret minimum 3 months, and willing to be interviewed. The primary data collected were self-administered (individual and socioeconomic characteristic, Fatsecret application used, and weight changed data) and online interviews for food recall 2x24 hours. Eating behavior was included adequacy level of energy and macronutrient, dietary diversity, and frequency food consumption (carbohydrates source, animals protein, vegetables protein, vegetables, fruits, milk-dairy products, snacks, and sweet drinks). Dietary diversity data was obtained using IDDS, frequency food consumption data using FFQ, and physical activity level data using IPAQ. Weight changes data was obtained from difference weight at that time and before using Fatsecret. Data processing using WHO AnthroPlus, Microsoft Excel 2021, and SPSS version 16.0 for windows.

RESULTS AND DISCUSSION

Subjects in this study were 17-25 years old and mostly female (87.7%). A quarter subjects had overweight and obesity nutritional status (Table I). The average of subject meal allowance was Rp30,000 per day. More than half subject had application duration use for 3-6 months with the duration and frequency of access for 6-15 minutes/day and ≤3 times/day respectively. More than two-thirds subjects had moderate and heavy physical activity levels because most of them doing vigorous physical activity in last week such as jogging, workout, aerobic, cardio, running, and weightlifting. Average dietary diversity subject was moderate. Table II shows the average portion of all food consumed were lower than the recommendation [4]. Meanwhile, oil consumption is already appropriate. The average adequacy level of energy and macronutrient were severe deficits. Most of subjects (75-90%) were severe deficit and only 2-7% subjects were adequate. Due to

Table I: Distribution subject based on nutritional status, physical activity, weight change, and eating behavior

Subject Characteristic	n	%
Nutritional status (kg/m^2)		
Underweight	8	7.5
Normal	71	66.9
Overweight and Obesity	27	25.4
Physical activity level		
Light	29	27.4
Moderate	37	34.9
Heavy	40	37.7
Duration Fatsecret application use (months)		
3-6	64	60.4
7-12	20	18.9
>12	22	20.8
Duration of Fatsecret application access (minutes/day)		
≤5	35	33.0
6-15	55	51.9
>15	16	15.1
Frequency of Fatsecret application access (times/day)		
≤3	58	54.7
4-5	40	37.7
>5	8	7.5
Weight loss	71	67.0
Weight gain	12	11.3
No change weight	23	21.7
Average of Adequacy Level	**n**	**%**
Energy (mean ± SD)		51.8±14.5
Protein (mean ± SD)		54.9±17.4
Fat (mean ± SD)		61.8±18.2
Carbohydrate (mean ± SD)		50.0±16.9
Average of Food Consumed	**Portion**	**Recommendation (portion)**
Staple foods (rice)	2.5	5-8
Animal proteins (chicken and eggs)	2.1	3
Vegetable proteins (tofu and tempe)	0.5	3
Vegetables	0.8	3
Fruits (banana)	1	4-5
Oil	4	≤5
Frequency consumption of vegetable protein (mean ± SD times/week)		1.7±0.9

the frequency of eating the majority subjects only 2 times/day and also doing calorie deficits by limiting the daily intake monitored by Fatsecret. Most subjects didn't consider with nutrient balanced for their calorie deficit. The average weight loss and gain among the subjects were 0.6±0.5 kg per month and 0.4±0.4 kg per month, respectively. There were significant positive correlation between application used with eating behavior included adequacy level of energy, dietary diversity, frequency vegetables protein consumption, physical activity, and negative correlation with weight changes (Table II). This may occur because using Fatsecret application can motivated subject to manage intake, increasing dietary diversity, and physical activity. This result in line with research in American adult where dietary self-monitoring using Fatsecret corelated with weight loss [5]. This study also found a positive correlation between weight change with adequacy level of energy, carbohydrate, fat, and negative correlation between frequency consumption of vegetables protein and physical activity (Table III).

Table III: Correlation test between eating behavior and physical activity with weight changes

Variable	Weight changes	
Eating behavior	***p***	**r**
Adequacy of energy	**0.038**[a]	**0.202**
Adequacy of fat	**0.041**[b]	**0.199**
Adequacy of carbohydrate	**0.001**[b]	**0.312**
Frequency consumption of vegetables protein	**0.048**[b]	**-0.193**
Physical activity	**0.014**[b]	**-0.238**

[a]Pearson test, [b]Spearman test

CONCLUSION

Fatsecret application may be used to assist food intake and physical activity in order to monitor the body weight and nutritional status. College students need to increase their amount of food consumed of all food group according to nutrition guideline recommendation except for the oil.

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Table II: Correlation test between Fatsecret application use with eating behavior, physical activity, and weight changes

Variable	Eating behavior						Physical activity		Weight changes	
	Adequacy of protein		Dietary diversity		Frequency consumption of vegetables protein					
	p	**r**	***p***	**r**	***p***	**r**	***p***	**r**	***p***	**r**
Fatsecret application use										
Duration use	**0.046**	**0.194**	**0.027**	**0.215**	-0.015	0.876	**0.003**	**0.289**	**0.021**	**-0.224**
Duration access/day	0.143	0.145	0.042	0.670	**0.038**	**0.202**	0.102	0.297	0.290	-0.104
Frequency access/day	0.035	0.722	0.072	0.464	**0.025**	**0.218**	**0.030**	**0.211**	**0.000**	**-0.340**

Spearman test

EXTENDED ABSTRACT

Socio-economic Inequality Factors Predicting Food Security Index in 514 Districts of Indonesia: A Supervised Machine Learning Regression Analysis

Eflita Meiyetriani[1,2], Apriningsih[3], Budi Utomo[1], Dwi Nastiti Iswarawanti[2,4]

[1] Faculty of Public Health, Universitas Indonesia, 16424 Depok, Indonesia
[2] Southeast Asian Ministers of Education Organization-Regional Centre for Food and Nutrition, 13120 Jakarta, Indonesia
[3] Department of Public Health, Faculty of Health Sciences, Universitas Pembangunan Nasional Veteran Jakarta, 16415 Depok, Indonesia
[4] Faculty of Health Sciences, Bhakti Husada Indonesia University, 45561 Kuningan, Indonesia

Corresponding author's email: eflita@seameo-recfon.org

SUMMARY

This study investigates the relationship between socio-economic inequality and food security across 514 Indonesian districts, using supervised machine learning regression and data from Badan Pangan Nasional from 2018 to 2023. Variables such as normative consumption per capita ratio (NCPR), poverty, food expenditure, lack of electricity, lack of clean water, healthcare worker ratio, female school duration and life expectancy emerge as significant predictors with an R-squared value of 66,42%. However, stunting duration show no significance relationship. Findings provide insights for policymakers to address food insecurity and socio-economic gaps, while further research on confounders is recommended.

Keywords: Food security, Inequality, Regression analysis, Socio-economic factors, Supervised machine learning

INTRODUCTION

Food security is a critical issue globally, with implications for human health, socioeconomic development, and environmental sustainability. Food security directly impacts the health and nutrition of the population [1]. Access to a diverse diet is vital, especially for children's development, while malnutrition poses long-term health risks [2]. Indonesia faces challenges like socio-economic inequality and food security disparities among its districts, impacting vulnerable groups. Trade policies and agricultural practices influence food security outcomes, highlighting the need for targeted interventions. Addressing socio-economic inequalities is crucial for sustainable food security [3]. By understanding the socio-economic determinants of food security disparities, policymakers can design more effective interventions. The National Food Security Index (FSI) or *Indeks Ketahanan Pangan* (IKP) evaluates food security across districts, aiding focused interventions. This study investigates the intricate relationship between socio-economic inequality and food security across 514 Indonesian districts.

MATERIALS AND METHODS

This study addresses food security using supervised machine learning, specifically linear regression, with secondary data compiled by Badan Pangan Nasional. Variables include stunting, normative consumption per capita ratio, and healthcare access indicators. The normative consumption per capita ratio, sourced from BPS and the Ministry of Agriculture [4], measures the availability of rice, cereals, maize, and tubers relative to population needs. The ratio of the population per healthcare worker to population density, sourced from the Health Worker Profile by the Ministry of Health, assesses healthcare distribution. Definitions for commonly known variables like stunting and the percentage of the population living below the poverty line can be found in the IKP report. Data preprocessing included handling missing values, encoding variables, and feature selection. Model performance was evaluated using R-squared and mean absolute error, validated through cross-validation in KNIME (Konstanz Information Miner) with a 70-30 training-test split. The process is depicted in Fig 1.

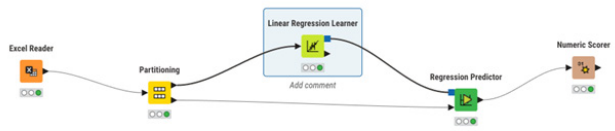

Figure 1: Nodes of KNIME for predicting Food Security Index in 514 Districts in 2018-2023

RESULTS AND DISCUSSION

The detailed regression analysis results for predicting IKP in 2018-2023 are shown in Table I. The regression analysis for predicting IKP from 2018-2023 shows that several socio-economic factors significantly impact food security. The results indicate that a higher normative consumption per capita ratio is associated with lower food security, possibly due to economic pressures affecting food access [4]. Poverty has a strong negative effect, as financial constraints limit access to adequate food. Conversely, higher food expenditure improves food security, suggesting that spending a larger income share on food correlates with better outcomes. The lack of electricity significantly impairs food security, likely due to challenges in food storage and preparation. Similarly, the absence of clean water is strongly associated with reduced food security, underscoring the importance of water access for health and food preparation. Longer female schooling duration improves food security by empowering women with better economic opportunities and enhancing family nutrition. A higher ratio of healthcare workers positively impacts food security, highlighting the role of healthcare in maintaining health and preventing malnutrition. Increased life expectancy is linked with better food security, reflecting improved health and living conditions. Interestingly, stunting does not show a statistically significant relationship with food security. This may be due to the complexity of stunting, which is influenced by multiple factors beyond immediate food access, such as long-term nutrition, healthcare quality, and early childhood conditions that aren't directly addressed by food security interventions. These findings highlight the need for targeted policies that address poverty, improve infrastructure (electricity and clean water access), and enhance healthcare services to boost food security across Indonesian districts [5]. Addressing these factors can lead to significant improvements in food security outcomes, supporting overall public health and economic stability.

Table I: Regression Analysis Results for Predicting IKP in 2018-2023

Variable	B (Coefficient)	SE (Standard Error)	t value	p value
NCPR	-0.2228	0.0189	-11.7846	<0.001
Poverty	-0.5416	0.0372	-14.5477	<0.001
Food expenditure	0.0449	0.0151	2.9648	0.0031
No electricity	-0.2976	0.025	-11.9001	<0.001
No clean water	-0.196	0.0137	-14.2861	<0.001
Female schooling duration	-0.9513	0.1586	-5.9987	<0.001
Healthcare worker ratio	-0.1296	0.0166	-7.8168	<0.001
Life expectancy	1.0265	0.0718	14.2876	<0.001
Stunting	0.0288	0.0179	1.6073	0.1082
Intercept	22.238	5.7597	3.8609	0.0001

R. squared: 0.6642, Adjusted R squared:0.6625

CONCLUSION

NCPR, poverty, food expenditure, lack of electricity, lack of clean water, healthcare worker ratio, female school duration, and life expectancy were predictors for the food security index across 514 Indonesian districts. Targeted interventions based on these findings will guide policymakers in addressing food insecurity and socio-economic disparities.

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EXTENDED ABSTRACT

Care Empowerment for Preventing Child Malnutrition: Lessons from the Psychosocial Recovery of 2009 Tasikmalaya Earthquake Survivors

Euis Sunarti

Department of Family and Consumer Sciences, Faculty of Human Ecology, IPB University, 16601 Bogor, Indonesia

Corresponding author's email: euissunarti@apps.ipb.ac.id

SUMMARY

A breakthrough method to accelerate the elimination of stunting in Indonesia is urgently needed. This study highlights care empowerment resources and practices involving parents, cadres, community leaders, and regional officials in supporting supplementary feeding (PMT) interventions to combat hunger (SDGs-2) and malnutrition in children under five. This study uses secondary data regarding the nutritional status of 500 children under five who were victims of the 2009 Tasikmalaya earthquake. Success is indicated by high stakeholder involvement, compliance with PMT consumption, and significant improvements in children's nutritional status. These findings emphasize the importance of a collaborative, community-based approach in addressing child malnutrition.

Keywords: Care empowerment, Child malnutrition, Combat hunger, Disaster psycho-social recovery, SDGs-2

INTRODUCTION

Freedom from malnutrition is a fundamental human right, and their eradication is crucial for both human and national development [1]. The United Nations Children's Fund (UNICEF) acknowledges care as a critical determinant of children's nutritional status [2]. In Indonesia, limited knowledge and skills regarding care resources and practices necessitate enhancing care practices and analyzing their impact on children's nutritional status [1]. The concept of care has been developed into care resources and behaviors components [3]. Preventing malnutrition is particularly crucial for children under five from disaster-affected families, as disasters disrupt fundamental aspects of life [4]. Integrating disaster risk reduction into regular development plans is necessary [5]. This study highlights effective practices in empowering care to prevent malnutrition among children under five who were victims of the 2009 Tasikmalaya earthquake, providing insights into improving child nutrition through community-based care empowerment initiatives.

MATERIALS AND METHODS

This study uses secondary data from an intervention study conducted in May-July 2010, or the 7th to 11th months after the Tasikmalaya earthquake. Care empowerment initiatives were conducted in the four districts most severely affected by the 2009 Tasikmalaya earthquake: Ciamis, Bandung, Tasikmalaya, and Garut. As part of the intervention, biscuits weighing 50 g (4 pieces) were provided for 60 days to 500 under five children (maximum aged 60 month after intervention) with a Body Weight-for-Age (WAZ) z-score of less than -2.0 SD to both correct and prevent malnutrition. Each serving of biscuits contained 240 kcal, 10 g of protein, 27 g of carbohydrates, and 11 g of fat. The empowerment activities involved all parents, 67 cadres across 18 locations, community leaders, and local government officials (RT/RW and Village). Nutritional status data for the children was obtained through anthropometric measurements conducted twice: before (baseline data) and after the completion of the PMT program (endline data). Nutritional status based on weight for age (WAZ score) is categorized into severe underweight (PCM, protein calorie malnutrition), underweight, and normal.

RESULTS AND DISCUSSION

The PMT program initially included 500 children under five, but 25 children (5%) dropped out, leaving 475 participants (48% boys and 52% girls). Various field obstacles prevented all children from receiving and consuming the PMT. However, the cooperation, support, and motivation of all parties involved (parents, cadres, community leaders, and officials) resulted in a high compliance rate with PMT consumption, averaging

Table I: Mean and standard deviation of PMT compliance

District	Week I-II (days)	Week III-IV (days)	Week V-VI (days)	Week VII-VIII (days)	Total days
Bandung	10.5±4.0	10.7±4.2	12.7±3.9	13.3±3.9	47.2±12.6
Garut	13.5±2.8	11.8±4.8	11.6±4.8	12.1±4.4	48.9±15.1
Tasikmalaya	15.0±0.2	15.0±0.3	14.9±0.5	15.0±0.0	59.9±0.7
Ciamis	12.8±3.3	13.4±3.0	13.7±2.1	14.1±1.6	54.0±7.0
Total	12.9±3.4	12.7±3.9	13.3±3.4	13.6±3.2	52.5±11.5

PMT*: Pemberian Makanan Tambahan* / Providing Supplementary Food

52.5 out of a maximum of 60 days (Table I).

The results (Table II) indicated a decrease in the number of under five children with severe underweight (PCM) and an increase in those with normal (well nourished) nutritional status. The care empowerment aspect of behaviors was implemented by enhancing parenting knowledge, stimulating growth and development, and providing additional food. The resource aspect includes the empowerment of parents (as a micro-system), cadres and community leaders (as a meso-system), as well as village government officials (as a hexo-system). This is a family ecosystem which is the key to ensuring children's nutritional status. The success indicators of the care empowerment program using family ecosystem approach, included: 1) decreased children with PCM (from 5.9% to 4.0%), and increased the mean of WAZ (from -1.36 to -1.24); 2) high participant attendance (70%) compliance with PMT consumption; 3) increased parental concern (especially among mothers) regarding child growth and development; and 5) enhanced awareness among posyandu cadres and village and sub-district officials about the nutritional status of disaster-affected under five children.

CONCLUSION

Care empowerment to improve and prevent child malnutrition requires behavior change (care behavior) and optimizing resources and support (care resources) for families. Lessons from disaster recovery underscore the need for a family ecosystem framework highlighting the importance of comprehensive family, community and environmental support to effectively address child malnutrition.

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Table II: Under five years children (%) according to nutritional status and empowerment area

District	Nutritional status based on WAZ index					
	Baseline			Endline		
	Severe underweight (%)	Underweight (%)	Normal (%)	Severe underweight (%)	Underweight (%)	Normal (%)
Bandung	2.3	5.7	15.8	1.9	5.7	16.2
Garut	2.1	5.9	18.3	0.6	4.8	20.8
Tasikmalaya	1.3	4.0	18.3	1.3	2.9	19.4
Ciamis	0.2	4.6	21.5	0.2	4.4	21.7
Total	5.9	20.2	73.9	4.0	17.9	78.1

WAZ: Weight-for-Age-Z score

EXTENDED ABSTRACT

Consumption Pattern of High-Sugar Processed Foods among Patients with Diabetes

Liya Sutanti, Risda Yulianti, Tetes Wahyu Witradharma, Meriwati Mahyuddin

Department of Nutrition, Poltekkes Kemenkes Bengkulu, 38225 Bengkulu, Indonesia

Corresponding author's email: risda@poltekkesbengkulu.ac.id

SUMMARY

This study examined the quantity of high-sugar processed food and the consumption patterns of high-sugar processed foods among patients with diabetes using a Food Frequency Questionnaire (FFQ). The population studied consisted of diabetes patients registered at the Telaga Dewa primary healthcare center in Bengkulu City. Among the 50 respondents selected purposively, it was found that 20-34% daily consumed high-sugar dairy products, 14% daily consumed confectionery/candy/chocolate, and 44% frequently (3-6 times/week) consumed high-sugar cereal products. These findings highlighted a significant intake of high-sugar processed foods among diabetes patients, underscoring the need for targeted dietary interventions and education to manage blood sugar levels effectively.

Keywords: Consumption pattern, Diabetes, High sugar, Packaged foods, Processed foods

INTRODUCTION

Diabetes is one of the four main non-communicable diseases leading to death [1]. According to the 2018 Basic Health Research (Riskesdas), the prevalence of diabetes in Indonesia was 10.9% [2]. The Indonesian Health Survey (SKI) in 2023 showed a significant increase in the prevalence of diabetes in Indonesia, which was at 11.7%. The prevalence of diabetes in Bengkulu Province was 1.1% [3]. Studies have found that increased consumption of processed foods, especially sweet foods and beverages, correlates with a higher risk of diabetes [4] and can exacerbate the condition in existing diabetic patients. However, the ease of access to processed foods, along with their practicality and the low awareness surrounding nutritional label information, leads to high exposure of diabetic patients to sugar-laden packaged foods. Therefore, this study aims to quantify the proportion of high-sugar processed food and to examine the consumption patterns of high-sugar processed foods among diabetic patients.

MATERIALS AND METHODS

The study recorded sugar content in 500 processed foods sold at a modern retail minimarket, which has readable labels and distribution permits. Fresh food, 100% fruit juice, baby/toddler food, food for specific uses, and intermediate products were excluded. Processed foods were classified based on BPOM Regulation No. 13 of 2023, whereas their sugar content was categorized according to BPOM Regulation No. 1 of 2022. A list of high-sugar processed foods was used to create a food frequency questionnaire (FFQ). Fifty diabetes patients, aged 20-59 years, from the Telaga Dewa primary healthcare area in Bengkulu City, who had previously shopped at modern retail minimarkets, were purposively sampled. The FFQ assessed their consumption of high-sugar processed foods over the past month, with categories: Daily (1x/day or more), Often (3-6x/week), Occasionally (1-2x/week), Rarely (2x/month), and Never. The study was ethically approved by the Health Research Ethics Committee of Poltekkes Kemenkes Bengkulu (No. KEPK.BKL/006/02/2024).

RESULTS AND DISCUSSION

Fig. 1 indicated that the majority of packaged processed food products sold in modern retail minimarkets/ convenience stores in Bengkulu City were classified as high-sugar products. The standard for categorizing products as high or low in sugar in this study referred to Indonesian Food and Drug Authority Regulation regulation No. 1 of 2022, where food is considered low in sugar if it contains less than 5 g per 100 g (in solid form) and 2.5 g per 100 mL (in liquid form). Bakery products, candies/ chocolates, and edible ice were almost entirely (over 90%) classified as high-sugar containing products. Meanwhile, beverages other than milk, dairy products, and processed fruit and vegetable-based products were largely (over 80%) classified as high-sugar food products.

The data presented in Table I only displayed the types of high-sugar products most frequently consumed by

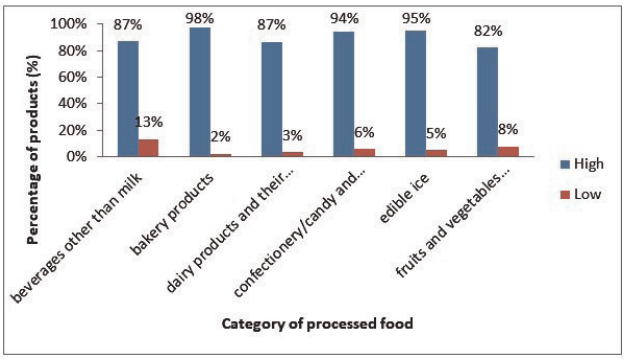

Figure 1: The Number of High-Sugar and Low-Sugar Products in Each Group of Processed Food Products Sold in Modern Retail Minimarkets

diabetic respondents. From Table I, it was evident that nearly a third of the diabetic respondents still consumed high-sugar processed products daily, with about 10-24 percent of the respondents falling into this category. Meanwhile, around 44 percent of the respondents consumed instant noodles frequently. Based on the nutritional labels displayed on the packaging, sweetened condensed milk contained 50 g of sugar per 100 g, powdered cereal drinks containing milk contained 58.6 g of sugar per 100 g, and instant noodles contained 10.6 g of sugar per 100 g.

Sugary foods have been shown to cause a more rapid increase in blood glucose and insulin levels, and they possess a medium to high glycemic index, which contributes to a high glycemic load of foods when consumed in large quantities. The high glycemic index could increase insulin resistance, exacerbate inflammatory biomarkers [5], and potentially worsen the condition of individuals with diabetes.

CONCLUSION

Most processed foods in modern retail contain high sugar levels. Frequent consumption by diabetes patients involved products like powdered cereal drinks, sweetened condensed milk, and instant noodles. Government regulation on high-sugar food labelling is urgent for both public health and diabetic individuals.

Table I: The Consumption Patterns of High-Sugar Containing Processed Foods Among Diabetic Patients (n=50)

Category	Respondent (%)				
	Daily (1 time/ day)	Often (3-6 times/ week	Occasion-ally (1-2 times/ week)	Rarely (2 times/ month)	Never
Dairy products and their analogs					
Sweetened con-densed milk	20	12	3	7	58
Powdered cereal drinks containing milk	34	12	4	2	48
Confectionery/ candy and choc-olate					
Chocolate spread	14	12	0	0	74
Cereals and cere-al products					
Instant noodle	0	44	10	4	42
Beverages other than milk					
Instant coffee powder	10	0	0	0	90

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EXTENDED ABSTRACT

Impact of Macronutrient Intake and Child Eating Behaviour (Picky Eating) on Growth in Toddlers

Cast Torizellia, Yustin Ari Prihandini

Bachelor of Nutrition Study Program, Faculty of Health Sciences, Borneo Lestari University, 70714 Banjarbaru, Indonesia

Corresponding author's email: casttorizellia91@gmail.com

SUMMARY

Picky eater tends to consume less energy, protein, carbohydrates, and vitamin. This research is a quantitative study with a case-control design of a sample of 35 children from control and case group aged 24 months to 59 months and come to visit Posyandu. Instrument used the Food recall adopted from the Nutrition Status Assessment Questionnaire for nutritional status and picky eater variable was measured using the Child Eating Behaviour Questionnaire (CEBQ). Relation between nutritional status, carbohydrate intake, protein intake, fat intake and behaviour with growth toddlers that the nutrition of children with picky eating behaviour is inadequate, carbohydrate intake, protein intake, fat intake and behaviour with toddler's growth that impact of picky eating behaviour is that the growth and development of children is decreased and inhibited.

Keywords: Child eating behaviour, Macronutrient intake, Nutritional status, Picky eating, Toddler

INTRODUCTION

Child eating behaviour is a children's situation are inadequate in consuming various types of food. It is usually followed by a refusal to eat and picky about food [1]. Picky eating is becoming a growing concern in pediatric care as it is associated with an increased risk of being underweight, low vegetable intake, failure to meet age-appropriate dietary guidelines, eating disorders, and conflicts between mothers and their children [2]. The consequences of this problem can potentially be on the child's development [3]. So research needs to be carried out to determine the impact of macronutrient intake and child eating behaviour (picky eating) to growth in toddlers.

MATERIALS AND METHODS

This was a quantitative case-control study conducted in the Cempaka Inpatient Health Center Banjarbaru, with a sample of 35 children from control and case group aged 24 months to 59 months and come to visit Posyandu. Instrument used the Food recall adopted from the Nutrition Status Assessment Questionnaire by being guided by prospective researchers, namely by means of 1x24-hours food recall or asking again what foods have been consumed by children (respondents) one day before. The study was conducted three times over thirty days with an interval of two weeks. The energy and protein adequacy levels were determined using the Nutri Survey Software application. The picky eater variable was assessed through the Child Eating Behaviour Questionnaire (CEBQ), which includes components such as Food Responsiveness (FR), Emotional Over-Eating (EOE), Enjoyment of Food (EOF), Desire for Drinks (DD), Satiety Responsiveness (SR), Slowness in Eating (SE), and Emotional Under-Eating (EUE).

RESULTS AND DISCUSSION

The study was conducted using a list of questions used to collect data related to risk factors for picky eater. Table I showed that 68.6% is the normal nutritional status subject who had no picky eater (normal eating behavior). Cross-tabulation between nutritional status and picky eater cases in toddlers showed there is a relationship with p-value 0,001.

Based on Table II, it showed that insufficient carbohydrate intake indicates a picky eater prevalence of 70.3%, Low protein intake with a picky eater incidence of 64.1% and less fat intake with picky eaters as much as 62.8%. Cross-tabulation results show that macronutrient intake influences toddler growth with p-value 0,001 for carbohydrate intake 0,016 for protein intake and 0,014 for fat intake.

Results of filling out the Nutritional Status Assessment Questionnaire with components of Child Eating Behavior (FR, EOE, EOF, DD, SR, SE, EUE and FF) in Table III all show risks and associations with nutritional problems. Internal factors that affect children not liking

Table I: Cross-tabulation between toddlers eating behavior

Nutritional Status of Toddlers	Eating Behavior				Σ	%	p-value	OR
	Normal		Picky Eater					
	n	%	n	%				
Normal	24	68.6	10	28.6	34	100	0.001	5.455
Wasting	11	31.4	25	71.4	36	100		
Total	35	50	35	50	70	100		

Note: analysed using *Chi-square* significant difference test with p-value 0.001

Table II: Cross-Tabulation between macronutrient intake and toddlers eating behavior

Macronutrient intake	Normal		Picky eater		Σ	%	p-value	OR
	n	%	n	%				
Carbohydrates								
Good	24	72.7	9	27.3	33	100	0.001	6.303
Less	11	29.7	26	70.3	37	100		
Protein								
Good	21	67.7	10	32.3	31	100	0.016	3.750
Less	14	35.9	25	64.1	39	100		
Fat								
Good	19	70.4	8	29.8	27	100	0.014	4.008
Less	16	37.2	27	62.8	43	100		
Total	35	50	35	50	70	100		

Note: analysed using *Chi-square* significant difference test with p-value 0.001

Table III: Cross-tabulation between toddlers' eating behavior and picky eater cases in toddlers

Child eating behaviour	Nutritional status				Σ	%	p-value	OR
	Normal		Picky eater					
	n	%	n	%				
Food responsiveness (FR)								
Risk of wasting	18	36,7	31	63,3	49	100	0,002	0,137
Risk of obesity	17	81	4	19	21	100		
Emotional over-eating (EOE)								
Risk of wasting	18	34	35	66	53	100	0,000	0,340
Risk of obesity	17	100	0	0	17	100		
Enjoyment of food (EOF)								
Risk of wasting	16	34	31	66	47	100	0,000	0,109
Risk of obesity	19	82,6	4	17,4	23	100		
Desire of drink (DD)								
Risk of wasting	19	35,2	35	64,8	54	100	0,000	0,352
Risk of obesity	16	100	0	0	16	100		
Satiety responsiveness (SR)								
Risk of wasting	16	45,7	32	91,4	48	100	0,000	0,079
Risk of obesity	19	54,3	3	8,6	22	100		
Slowness in eating (SE)								
Risk of wasting	18	51,4	31	88,6	49	100	0,001	0,137
Risk of obesity	17	48,6	4	11,4	21	100		
Emotional under-eating (EUE)								
Risk of wasting	19	54,3	35	100	44	100	0,000	0,352
Risk of obesity	16	16	0	0	16	100		
Food fussiness (FF)								
Risk of wasting	18	51,4	35	100	53	100	0,000	0,340
Risk of obesity	17	48,6	0	0	17	100		
Total	35	50	35	50	70	100		

Note: Different superscript letters are significantly different (p<0.05), analysed using *Chi-square* significant difference test.

the food are due to the texture that makes it difficult for children to chew. Children's dislike of colour, taste and sensitivity to food and external factors can be influenced by the environment Preschoolers tend to like to imitate the eating behaviour of the family and the surrounding environment, so they tend to enjoy a variety of foods more if the child sees family members also enjoying a variety of foods [4-5].

CONCLUSION

There is a relationship between several variables, the output and important implications of the research results are additional knowledge in the research environment. The recommendation for future researchers is to use other variables such as fat and fibre intake to determine other factors in children's growth.

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EXTENDED ABSTRACT

Estimated Protein and Iron Intake Quality among Stunted and Non-stunted Children in Malang City

Wardah Willyanti, Hadi Riyadi, Zuraidah Nasution

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: hadiri@apps.ipb.ac.id

SUMMARY

Stunted children can be caused by poor quality of food consumption, especially protein and iron. This research aimed to analyze the protein and iron intake quality of children in Malang City. Children aged 6 to 59 months divided into stunted (n=61) and non-stunted (n=65) groups. The protein quality was estimated by the DIAAS method, while the iron quality was estimated by iron bioavailability percent. The results showed that DIAAS and iron bioavailability tend to be different in both groups, however, stunted children had better protein quality but lower in iron absorption due to higher consumption of iron inhibitor.

Keywords: DIAAS, Iron bioavailability, Malnutrition, Protein quality, Stunted children

INTRODUCTION

Stunted is a chronic malnutrition that occurred in 18% of children in Malang city in 2022. This condition is caused by inadequate food intake that influences the quality of their intake. Protein is a nutrient that has an important role in the growth and development of children. The protein quality is determined by the amino acid content in the food. The method suggested by FAO for estimating protein quality is using the Digestible Indispensable Amino Acid Score (DIAAS) [3]. In India DIAAS has a negative relationship with stunted prevalence [4]. Moreover, the quality of protein will influence the iron quality. Research on pregnant women showed that all of them had low iron bioavailability [2]. This condition is able to increase the risk of having anaemia which leads to stunted children in the future. This study aimed to analyze the children's protein and iron intake quality in Malang City.

MATERIALS AND METHODS

This research is a cross-sectional study design and conducted in Ciptomulyo Community Health Centre, Malang City. The total sample used was 126 children aged 6-59 months. Meanwhile, the children's nutritional status (HAZ) was calculated by anthropometric data and classified into two groups, stunted (Z-score<-2 SD) and non-stunted (Z-score ≥-2 SD). Percentage of DIAAS ranging from 0 – 100 % which is calculated by the formula: [1]

$$DIAAS\,(\%) = \frac{mg\ of\ digestible\ dietary\ indispensable\ amino\ acid\ in\ 1g\ of\ the\ dietary\ protein}{mg\ of\ the\ same\ dietary\ indispensable\ amino\ acid\ in\ 1\ g\ of\ the\ reference\ protein} \times 100$$

Meanwhile, iron bioavailability is calculated using the formula: [3]

$$Iron\ Bioavailability\ (\%) : \frac{total\ of\ absorbed\ iron}{Total\ of\ dietary\ iron}\ x\ 100$$

Then it is classified into 3 categories: (a) low (<10%), (b) medium (10-15%) and high (>15 %). This research has received ethical approval from the Health Research Ethic Committee, Airlangga University under approval number No:2952/KEPK.

RESULTS AND DISCUSSION

Table I showed that stunted children have a slightly higher DIAAS than the non-stunted group, but not significantly different (p=0.787). In contrast, other study showed that increasing the DIAAS percentage will lower the stunted prevalence [4]. In this study, both groups reached almost 100% of DIAAS, which indicates children in Malang City have good protein quality.

The iron bioavailability for almost every child was categorized at a medium level (81.97% and 90.77%). However, the stunted group has a higher percentage with a low bioavailability category when compared to the non-stunted group. The median of iron bioavailability in the stunted group is higher but not significantly different compared with the non-stunted group (p=0.150). (Table II).

Table III is showing the absorbed iron for the non-stunted children aged 6-11 months and 37-59 months have a higher average than the stunted children in the same age groups. Meanwhile, all non-stunted children

Table I: DIAAS percent of children in Malang City

DIAAS (%)	Nutritional status (HAZ)		p-value
	Stunted	Non-Stunted	
Mean±SD	96.25±7.95	95.87±7.85	0.787

Note: Digestible Indispensable Amino Acid Score (DIAAS); analyzed using Independent t-test, significantly different if p<0.05

Table II: Iron bioavailability of children in Malang City

Iron bioavailability	Nutritional status (HAZ)		p-value
	Stunted n (%)	Non-stunted n (%)	
Median (Q1-Q3)	10.48 (6.04-12.61)	10.45 (9.61-11.83)	0.150
Category of Iron bioavailability			
Low (<10%)	11 (18.03%)	6 (9.23%)	
Medium (10-15%)	50 (81.97%)	59 (90.77%)	

Note: analyzed using Mann Whitney, significantly different if p<0.05

had higher average absorbed iron than all stunted children, but this result showed no significant difference (p=0.923). This result was possible due to the non-stunted children consume less food that inhibit iron absorption (for example tea) when compared to stunted children (preliminary study).

Furthermore, the recommendation of iron absorption for children aged 6-11 months is 10% of iron intake, while for children aged 1-8 years is 18% of iron intake [5]. Unfortunately, in this study, only children with ages ranging from 6-11 months met that recommendation while the other age groups have an absorption percentage under 18%. In this study, stunted children in Malang City consume food with good quality protein. On the contrary, the iron absorption in stunted children is still below recommendation (especially in children over 1 years) which is influenced by high consumption of the inhibitor ingredients for iron absorption.

CONCLUSION

In conclusion, stunted children have good protein quality but low in iron absorption. This condition is possibly caused by the consumption of tea as an iron inhibitor

Table III: Average of absorbed iron of children in Malang City

Age groups		Nutritional status (HAZ)		p-value
		Stunted (Mean±SD)	Non-Stunted (Mean±SD)	
6-11 months	Iron Intake (mg)	6.58±6.63	9.97±4.54	
	Absorbed Iron (mg)	0.76±0.78	1.04±0.51	
12-36 months	Iron Intake (mg)	6.16±4.25	6.96±3.27	
	Absorbed Iron (mg)	0.84±1.11	0.73±0.38	
37-59 months	Iron Intake (mg)	7.37±4.41	8.17±5.93	
	Absorbed Iron (mg)	0.76±0.47	0.85±0.58	
Total	Iron Intake (mg)	6.66±4.38	7.80±4.89	
	Absorbed Iron (mg)	0.80±0.89	0.82±0.54	0.923

Note: analyzed using Independent t-test, significantly different if p<0.05

based on preliminary data. In consequence, education about the example of inhibitors for iron absorption is needed to improve the children's nutritional status.

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EXTENDED ABSTRACT

Risk Analysis of Overweight among Adolescent Girls in the Wetland Region of Banjar Regency, South Kalimantan, Indonesia

Atikah Rahayu[1], Fahrini Yulidasari[2], Muhammad Irwan Setiawan[2], Siti Aisyah Solechah[2], Minna Salsabilla[2], Naima Nabila[2]

[1] Department of Sports Science, Faculty of Sports Science and Health, 55621 Yogyakarta State University, Indonesia
[2] Department of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat University, 70714 Indonesia

Corresponding author's email: atikahrahayu@ulm.ac.id

SUMMARY

One of the impacts of protein deficiency, calcium deficiency, and obesity is low bone density. Adolescents before the age of 20 years experience rapid bone formation. This study aims to analyze the risk of protein and calcium intake with obesity in female adolescents. This study used a cross-sectional design. The subjects were female adolescents who were natives of Banjar Regency studying at the Department of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat. Of the 90 subjects, 37.8% and 42.2% had inadequate protein and calcium intakes, respectively. Inadequate calcium intake was associated with obesity nutritional status (p= 0.000).

Keywords: Adolescent girls, Bone density, Calcium intake, Protein intake, Risk of overweight

INTRODUCTION

Peak bone mass growth when approaching the age of 20 years. Calcium is needed for growth, bone strength of adolescent girls, because the body stores it until old age [1]. Calcium needs of adolescent girls aged 10-18 years (1000mg/day), >19 years (800mg/day) [2]. Bone mass of adolescent girls decreases not only because of menstruation, but also because of increasing age, calcium intake, protein, Basal Metabolic Index (BMI) [3]. BMI <20 kg/m2 is at greater risk of osteoporosis than BMI 25 kg/m2 [4]. Banjar Regency, 23.2% of overweight adolescent girls have low bone density, 29.3% 15-49 years old protein intake <80%, calcium intake <300-400mg/day. In fact, Banjar Regency is a center for fish production (as a source of protein and calcium to prevent the risk of osteoporosis) [5]. It is necessary to conduct a risk analysis of protein and calcium intake in obese adolescent girls and their correlation.

MATERIALS AND METHODS

Adolescent girls studying in the Department of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat University were selected using purposive sampling. Inclusion criteria: 1) native residents of Banjar Regency, 2) not boarding students, 3) not on a diet, 4) physically and mentally healthy, 6) willing to be respondents, 7) not fasting during the study. Research instruments: 1) height measuring instrument with an accuracy of 0.1 cm, weight scale with an accuracy of 0.1 kg, 2) informed consent, 3) 3x24 hour food recall questionnaire. This design was chosen because female adolescents who menstruate are at greater risk of calcium deficiency. Protein intake was categorized into two categories: insufficient (<60-65 grams/day), sufficient (≥60-65 grams/day). Calcium intake into two groups: insufficient (<1000 grams/day), sufficient (<1000 grams/day). Statistical analysis used chi-square. Ethical approval was issued by the Ethics Committee of the Faculty of Medicine and Health Sciences, Lambung Mangkurat University, No.220/KEPK-FK ULM/EC/VI/2022.

RESULTS AND DISCUSSION

Univariate and bivariate analysis results are presented in Tables I and II. Table I showed 37.8% have poor protein intake, and 42.2% have poor calcium intake. Besides, 27.8% have overweight based on the BMI/U index. Table II showed Inadequate calcium intake was found to be associated with overweight adolescents (p=0.000).

The results of the study found that the calcium intake of female adolescents was <1000mg/day (42.2%) and protein <60-65g/day (37.8%). Inadequate calcium and protein intake is because the average type of fish consumed by female adolescents is catfish and carp, it is known that the protein and calcium content in these two types of fish are 17.0 mg and 31.0 mg (catfish), 16.0 mg and 20.0 mg (carp). The average calcium and protein intake in overweight adolescents is relatively low. Low calcium intake affects the accumulation of body fat, this is because inadequate calcium intake will increase

Table I: Distribution of risk factor frequencies

Risk Factors	n	%
Protein intake		
Inadequate (<60-65 g/day)	34	37,8
Adequate (≥60-65 g/day)	56	62,2
Calcium intake		
Inadequate (<1000 mg/day)	38	42,2
Adequate (≥1000 mg/day)	52	57,8
Nutritional status		
Overweight (Z score >+1SD)	25	27,8
Normal (Z score between -2SD and +1SD)	65	72,2

Table II: Relationship between risk factors (protein and calcium intakes) and nutritional status in adolescent girls

Risk Factors	Nutritional status				OR (95% CI)	*p*
	Overweight		Normal			
	n	%	n	%		
Protein Intake						
Inadequate	12	35,3	22	64,7	1,804	0,318
Adequate	13	26,7	43	73,3	(0,706-4,609)	
Calcium Intake						
Inadequate	18	47,4	20	52,6	5,786	0,000*
Adequate	7	13,5	45	86,5	(2,087-16,039)	

*p<0.05

intracellular calcium concentration and stimulate calciotropic hormone which has the potential to increase intraadiposity potassium, resulting in increased lipogenesis rates and inhibition of lipolysis, potentially triggering metabolic disorders in overweight adolescents such as hypertension, insulin disorders and diabetes [4,5]. In fact, Banjar Regency as a production center (as a research area), gourami and tilapia are the highest production with higher protein and calcium content compared to patin and carp which are predominantly consumed by female teenagers. The protein and calcium content of gourami and tilapia are 18.0 mg and 41.0 mg (gourami) and 26.0 mg, and 10.0 mg (tilapia). From the nutritional content that has benefits for improving bone growth and development and preventing osteoporosis, both fish production should be an alternative food consumed by adolescents, in order to achieve the recommended calcium and protein intake for female teenagers [2]. Further research is needed on the analysis of calcium and protein intake as well as nutrients and other related variables in various types of more complex foods and their effects on the bodies of female teenagers who are overweight considering that this study only reviews calcium and protein intake in relation to overweight based on fish food sources.

CONCLUSION

Protein and calcium intake of adolescent girls from fish is still low, namely 37.8% and 42.2%. Adolescent girls as prospective mothers need comprehensive and integrated interventions combining health and nutrition promotion by involving health workers and school teachers in improving the habit of consuming fish-based foods and their processed products.

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EXTENDED ABSTRACT

Consumption of Legumes and Their Products among Indonesian Population Aged 19 to 55 Years

Yuseph Saeful Hidayah, Dodik Briawan

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: dbriawan@gmail.com

SUMMARY

Legumes have the potential to serve as a significant source of high-quality protein. The research aims to analyze legume consumption patterns among individuals aged 19 to 55 in the Indonesian population, using data from the Individual Food Consumption Survey (SKMI) 2014. There are significant differences in legume consumption based on sex, age, and regional classification with p-value<0.05. The most consumed legume and its product group was soybeans, averaging 42.96 g per capita daily, representing 81.8% of the population. Peanuts were the next most consumed legumes (1.99 g per capita per day), followed by other nuts (0.89 g per capita per day).

Keywords: Adult, Food consumption, Legumes, Tempe, Tofu

INTRODUCTION

Annually, NCDs claim the lives of 41 million people, or 71% of all fatalities globally. In Indonesia, the prevalence of hypertension was 34.1 in 2018 and 29.2 in 2023, while diabetes mellitus was 6.9% in 2018 and 11.7% in 2023 [1]. The prevalence of various NCDs in Indonesia is high, with nearly one-third of the adult population afflicted by high blood pressure. Meta-analysis research indicates that increased legume consumption is correlated with a decreased risk of cardiovascular disease [2].

The consumption of high-quality protein is essential for maintaining optimal body health. Legumes serve as a source vegetable protein source. Compared to animal protein, vegetable protein offers the benefit of having a higher concentration of unsaturated fats. Additionally, vegetable protein contains a range of phytochemicals that act as antioxidants and includes dietary fibre, which aids digestion [3]. The research aims to analyze legume consumption patterns among the Indonesian population.

MATERIALS AND METHODS

The design of this research is descriptive quantitative. Data analysis was conducted using the Indonesian Individual Diet Survey (SKMI) from 2014. The unit analysis was adults aged 19 to 55 in Indonesia, totalling 78,376 subjects. This research was approved by the National Institute of Health Research and Development Indonesia (Balitbangkes RI). With the large number of samples, it is assumed that the data on diet were normally distributed. Descriptive analysis was performed on percentage, frequency, number (n), mean, standard deviation (SD), and percentage (%). Data were categorized according to individual characteristics (sex, age, and regional classification) and presented using mean and standard deviation statistics. Differences in legume consumption were tested with an independent sample t-test.

RESULTS AND DISCUSSION

There is a significant difference in legume consumption between the two age groups ($p<0.05$), with subjects aged 40-55 consuming more than those aged 19-39. Additionally, the average consumption of legumes is higher in men (48.01±44.83 g per capita per day) compared to women (44.93±40.24 g per capita per day) with a significant difference observed ($p<0.05$). Based on area, there is a significant difference in legumes consumption between urban and rural areas ($p<0.05$). The average intake of subjects is higher in urban (55.88±47.21 g per capita per day) compared to rural areas (38.41±38.18 g per capita per day) (Tabel I).

The average consumption of legumes and their products among Indonesian adults was 46.36±42.57 g per capita per day across all subjects. This consumption was higher than the global average (8.9 g per day) [4]. The most consumed legumes were the soybean and their products (42.96±39.29 g per capita per day). These products were consumed by 37.5% of the adult population (Table II).

The majority of soybean consumption comes from tempe

Table I: Total legumes consumption of the adult Indonesian population

Characteristic	Legumes consumption (g/capita/day)				Total (g/cap/day)
	Peanut	Soybeans	Seeds	Other nuts	
Sex					
Men	2.02± 7.20	44.64± 41.53	0.51± 4.72	0.85± 5.46	48.01± 44.83
Woman	1.96± 6.49	41.50± 37.07	0.54± 3.84	0.94± 5.01	44.93± 40.24
p-value	0.000*	0.000*	0.050*	0.007*	0.000*
Age (y)					
19-39	2.06± 6.88	41.14± 39.39	0.43± 3.55	0.84± 5.12	44.47± 42.57
40-55	1.90± 6.62	45.17± 39.16	0.63± 5.01	0.96± 5.35	48.66± 42.47
p-value	0.374	0.000*	0.030*	0.724	0.000*
Region					
Urban	2.52± 7.56	52.00± 43.79	0.52± 3.82	0.84± 5.22	55.88± 47.21
Rural	1.54± 6.03	35.41± 35.11	0.52± 4.59	0.94± 5.23	38.41± 38.18
p-value	0.511	0.010*	0.781	0.310	0.028*

Description: *Independent sample t-test*

*significantly different (p<0.05)

Table II: Average consumption of legume and its products in Indonesian adults

Legume group	Consumption (g/capita/day)		Proportion (%)
	Subjects (n= 78376)		
	Mean	SD	
Peanuts:	**1.99**	**6.77**	**8.9**
Peanuts	1.56	5.41	7.8
Peanut roasted "dua kelinci"	0.19	2.28	0.5
Peanut sauce	0.08	1.08	0.3
Soybeans:	**42.96**	**39.29**	**37.5**
Tofu	21.50	29.88	19.7
Tempe	21.07	22.24	27.0
Dry soybeans	0.22	3.06	1.1
Seeds:	**0.52**	**4.27**	**2.0**
Melinjo (*gnetum gnemon*)	0.14	1.66	0.7
Melinjo crisp	0.13	2.60	0.4
Pigeon peas	0.10	1.78	0.2
Other nuts:	**0.89**	**5.23**	**3.2**
Mung beans	0.44	3.83	1.8
Kidney beans	0.21	2.34	0.6
Red beans	0.08	1.84	0.3
Total legume	**46.36**	**42.5**	**43.5**

SD: Standard deviation

(27.0%) and tofu (19.7%). The average consumption of tofu and tempe was relatively high, at 21.50±29.88 and 21.07±22.24 g per cap per day respectively (Tabel II). Tempe and tofu dominate soybean use for food, accounting for 50% and 40% of consumption respectively, while 10% is used for soy milk, soy sauce, bean sprouts, bean curd, flour, and other processed products [5]. The elevated consumption of soybeans is further supported by the increased intake of processed soybean products like tofu and tempe, which are used as substitutes for animal products. According to Susenas data, the consumption trends of tofu, tempe, and soy sauce at the household level in Indonesia between 2002 and 2019 exhibited fluctuations. The average tofu consumption during this period was 20.38 g per capita per day. Meanwhile, the average consumption of tempe was slightly higher than tofu, at 20.49 g per capita per day [5].

CONCLUSION

Subjects aged 40-55, men, and those from urban area consumed more legumes. Most Indonesian adults consumed legumes from soybeans group (37.5%) primarily consisting of tempeh (27.0%) and tofu (19.7%). The amount of legumes consumed still does not meet the recommendations for balanced nutrition guidelines, so an optimal strategy is needed to increase legumes consumption.

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EXTENDED ABSTRACT

Effect of Changes in Dietary Fiber on Lipid Profile of Obese Adults in Bogor City

Farida Dwi Rokhmah[1], Dodik Briawan[2], Ikeu Ekayanti[2], Sudikno[3]

[1] Nutrition Sciences, Faculty of Sport Sciences, Semarang State University, 50229 Semarang, Indonesia
[2] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia
[3] National Research and Innovation Agency

Corresponding author's email: faridadwirokhmah@mail.unnes.ac.id

SUMMARY

Obesity is a multifaceted health issue influenced by individual behaviors and genetics. This research focused on examining the impact of dietary fiber changes on lipid profiles in obese adults in Indonesia. The study included 138 adults newly diagnosed with obesity in 2014 and 2016, using a cohort study in Bogor City. Data were analyzed using a generalized estimation equation (GEE). Initially, the average dietary fiber intake was 9.6 grams, which increased to 10.8 grams by the end of the study. Although changes in fiber intake had potential effects on lipid profile, these effects were not statistically significant.

Keywords: Dietary fiber, Dyslipidemia, GEE, Lipid profile, Obese adults

INTRODUCTION

According to the Basic Health Research Survey in 2018, Indonesia's obesity rates accelerated until they doubled over the past two decades to 21,8% [1]. Dyslipidemia often occurs in people who are obese due to increased triglycerides and free fatty acids, lowered HDL cholesterol levels and higher or normal LDL cholesterol levels with an increase in small-dense LDL [2]. It is suggested that in a day, people should eat around 25-30 grams of dietary fiber daily or roughly 250 grams of vegetables and 150 grams of fruits to lower the risk of diseases [3]. Despite the recommendation, dietary fiber intake in Indonesia is still very low; according to the Total Diet Study 2014, Indonesians consumed only 70 g/day of vegetables and 38,8 g/day of fruits [4]. Based on that consideration, this research aims to analyze the effect of changes in dietary fiber on the lipid profile of obese adults in Bogor City.

MATERIALS AND METHODS

This study used secondary data from Indonesia's Health Research and Development Agency which located in Bogor City from 2011 until 2018. A prospective cohort design was used for the study. This study was conducted from April until September 2022. The subjects used in this study from the secondary data were adults (25-60 years old) with a BMI of more than 25.0 kg/m^2 suffering from obesity (2014). It was followed for 2 years (2016), but still have obesity at the time of the follow-up, in which 138 people had already been measured.

Data that were collected are demographic data (age, gender, education, occupation, and income), anthropometric (weight, height, and waist circumference), behavior data (Smoking status, physical activity, and mental and emotional disorder), comorbid data (lipid profile), and dietary intake using a 24-hour recall. Analysis Data for bivariate using Wilcoxon and McNemmar. GEE was used to analyze the factors influencing dietary fiber intake.

RESULTS AND DISCUSSION

The majority of the subjects were female (77.5%), with the largest age group being 35-44 years old (39.9%). Most were employed as domestic workers (49.3%), largely due to low education levels (59.4%). Over half of the respondents engaged in heavy physical activity, 52.2% did not smoke, and only 18.1% experienced mental or emotional disorders. Anthropometric measurements showed that almost all the subjects had a first degree of obesity (25-29.9 kg/m^2), and 98.6% and 84.1% had central obesity. There was an increase in weight at 0.9 kg; waist circumference increased by 2.3 cm, and BMI was about 0.4 kg/m^2.

The percentage of people with dyslipidemia increased from 52,2 to 58%, with the total cholesterol increasing from 36,2 to 45,6, triglyceride 10,9 to 27, LDL 81,2 to 81,9, and HDL normal were the same in those two years. In this study, the average intake of dietary fiber was just 9,6 grams during the initial observation and rose

Table I: Subject frequency of anthropometric measurements

Indicators	First Observation Mean±SD (Min-Max)	Last Observation Mean±SD (Min-Max)	Alteration (Mean)
Weight (kg)	61±6.4 (45.5-76)	61.9±6.6 (46.3-77.9)	+0.9
Waist Circumference (cm)	85.9±5.7(65-98.5)	88.3±6.07 (76-104.5)	+2.3
BMI (kg/m^2)	26.4±1.2 (25-32.4)	26.8±1.3 (25-31.6)	+0.4

to 10.8 grams in the second observation. Most subjects (96.4%) were still under recommendation (25 g/day) in the first and second observations. The results showed no statistically significant effect between dietary fiber intake and lipid profile (total cholesterol: p=0.601; triglyceride: p=0.279; LDL: p=0.674; and HDL: p=0.219 levels), even though there was a slight change in triglyceride levels.

This corresponds with the findings from the Centers for Disease Control and Prevention (2016) based on data from the National Health and Nutrition Examination Survey (NHANES) 2007-2010 that the average increase in body weight in people from early adulthood to middle age is about 1-2 pounds or about 0.4-0.8 kg every year. This study and Sari's research showed the same trend; the average intake of vegetables and fruits remain below the WHO's recommended 400 grams, or five servings per day. Apart from that, there is a meta-analysis conducted by Yanai and Tada (2018) using an Asian population which states that from the results of the meta-analysis, it cannot be explained whether fiber intake is related to HDL levels, even though there are several clinical trials which state that fiber intake related to metabolism which can increase HDL [5].

CONCLUSION

Although dietary fiber intake was not significantly influenced by lipid profile, many factors can influence dietary fiber intake. Obesity status is related to the lipid profile, so the subject should increase fiber consumption to lose weight and improve their health status, especially in this research conducted on obese adults.

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Table II. Effect of changes dietary fiber intake on lipid profile

Variables	Coef β				p-value			
	Cholesterol	TG	LDL	HDL	Cholesterol	TG	LDL	HDL
Dietary fiber as recommendation under recommendation	37.44	23.53	23.02	7.57	0.012	0.208	0.213	0.229
Interaction of dietary fiber with time	-8.02	21.01	-7.73	-7.57	0.601	0.279	0.674	0.219

Note: The p-value that can be read was the one with the time interaction since it is considered to use time (two times of assessment/changes).

EXTENDED ABSTRACT

Relationship Between Body Image, Parental and Peer Influence with Nutritional Status of Adolescents in Rural Areas of Sigi Regency

I Made Arisadana[1], Nikmah Utami Dewi[1], Siti Aisyah Solechah[2], Sendhy Krisnasari[3], Kiki Sanjaya[3]

[1] Department of Nutrition, Faculty of Public Health, University of Tadulako, 94148 Palu, Indonesia
[2] Department of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat University, 70714 Banjarbaru, Indonesia
[3] Department of Public Health, Faculty of Public Health, University of Tadulako, 94148 Palu, Indonesia

Corresponding author's email: nikmah@untad.ac.id

SUMMARY

Adolescents' nutritional status is influenced by various factors, including body image, parental influence, and peer influence. This study aimed to analyze these relationships among 51 students aged 14-16 at Sigi Junior High School using a cross-sectional design. The results revealed a significant association between body image and adolescents' nutritional status ($p<0.05$). In contrast, the study found no significant links between parental or peer influences and nutritional status ($p>0.05$), suggesting that body image plays a more critical role in shaping dietary habits during adolescence.

Keywords: Adolescence, Body image, Nutritional status, Parental influence, Peer influence

INTRODUCTION

Human growth and development in adulthood are primarily determined by the nutritional and health conditions during adolescence [1]. Nutrition-related problems during adolescence are caused by poor dietary patterns, including an imbalance between food intake and recommended dietary allowance [1]. The parents' influence at home and peer influence outside the house can influence adolescents' food intake [4]. Body image perception can also affect food intake, affecting nutritional status due to the desire to change one's perceived appearance [3]. Information regarding the relation of body image, parents' influence, and peer influence to Adolescent nutritional status is still lacking in rural areas. This research aimed to identify the relation of body image, parents' influence, and peer influence to the nutritional status of adolescence in rural areas of Sigi Regency.

MATERIALS AND METHODS

This study used a descriptive correlation approach. The subjects were all adolescents (51 people) aged 14-16 years who attended Safety Center Junior High School in Balamoa Village, Sigi Regency and in accordance with the existing inclusion criteria and exclusion criteria. SMP Safety Center Baloma itself had high cases of overnutrition at the time of the preliminary study. Subjects selected using total sampling method. The data was collected using the body image questionnaire by Thompson and Gray [6] and parents' influence and peer influence questionnaires, which had been validated with a Chronbach Alpha value of >0.8. Nutritional status was determined using the BMI-for-age Z score (BAZ). The correlation between variables was analysed using the Spearman rank correlation test because the type of data used is ratio data, namely the respondent's Z-score value.

RESULTS AND DISCUSSION

Most subject were boys (52.9%), 16 years old (37.3%), and having parents working as farmers (64.7%). Most respondents wanted to be fat (64.7%) and had a low positive parents' influence on eating habits (78.4%). All adolescents had low positive peer influence on eating habits. Most respondents had normal nutritional status (78.4%) (Table I).

Body image had a significant positive correlation with adolescents' nutritional status ($p=0.001$). However, parents' positive influence ($p=0.19$) and negative influence ($p=0.26$), as well as peers' positive influence ($p=0.63$) and negative influence ($p=0.90$), had no significant correlations with nutritional status. The higher

Table I: Respondents' body image, parents' influence, peer influence, and nutritional status

Variables	Frequency (n = 51)	Percentage (%)
Body Image		
Wanted to be thin (1-8)	6	11.8
Constant weight (0)	12	23.5
Wanted to be fat (-1- -8)	33	64.7
Parents' positive influence		
Low (1-2)	40	78.4
High (3-5)	11	21.6
Parents' negative influence		
Low (1-2)	46	90.2
High (3-5)	5	9.8
Peers' positive influence		
Low (1-2)	51	100
High (3-5)	0	0
Peers' negative influence		
Low (1-2)	49	96.1
High (3-5)	2	5.9
Nutritional status		
Thin (3 SD to <-2 SD)	0	0
Normal (-2 SD to 2 SD)	40	78.4
Overweight (>1 SD to 2 SD)	0	0
Obese (>2 SD)	11	21.6

the body image value, the higher the Z-score, meaning that the more the respondents wanted to be thin, the higher their Z-scores, This can be because teenagers feel insecure about their body shape. The desire to gain weight in adolescents can be caused by perceptions about their own bodies that do not match their desires, which they think look thin [2]. The influence of parents and peers was low on eating habits; therefore, the adolescents' nutritional status could be influenced by other factors (Table II).

CONCLUSION

There was a correlation between body image and adolescent nutritional status but not for the influence of parents and peers on adolescent nutritional status. It is recommended that schools provide information media about nutritional status and the importance of maintaining nutritional status and work with local health centres to measure students' nutritional status regularly.

Table II: Correlation between independent variables and dependent variables

Independent variables	Dependent variable: Nutritional status p	R
Body image	0.01	0.47
Parents' positive influence	0.19	-0.18
Parents' negative influence	0.26	-0.161
Peers' positive influence	0.63	0.05
Peers' negative influence	0.90	-0.02

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EXTENDED ABSTRACT

Physical Activity and Milk Consumption were Associated with Nutritional Status of School-Age Children at Primary School in Kaliorang, East Kutai

Denaira Zahwa[1], Siti Aisyah Solechah[2], Ainun Nisa[4], Sigit Yudistira[1], Atikah Rahayu[3], Fahrini Yulidasari[2], Muhammad Irwan Setiawan[2]

[1] Department of Nutrition, Husada Borneo Health Institute, 70712 Banjarbaru, Indonesia
[2] Department of Public Health, Faculty of Medicine and Health Sciences, Lambung Mangkurat University, 70714 Banjarbaru, Indonesia
[3] Department of Sports Science, Faculty of Sports Science and Health, 55621 Yogyakarta State University, Indonesia
[4] South Banjarbaru Community Health Centre, 70713 Banjarbaru, Indonesia

Corresponding author's email: siti.solechah@ulm.ac.id

SUMMARY

Physical activity and the consumption of milk are determinants that may influence the nutritional status. The objective of this investigation was to examine the correlation between physical activity and milk consumption with the nutritional status of school-age children at Primary School in Kaliorang. This cross-sectional study involved 49 children as research participants through the purposive sampling technique. The Spearman Rank correlation test was performed to analysed the data. The results indicated that physical activity (p=0.000), frequency of milk consumption (p=0.018), and the volume of milk consumption (p=0.004) exhibited significant correlations with the nutritional status of school-age children.

Keywords: Milk consumption, Nutritional status, Physical activity, Primary school, School-age children

INTRODUCTION

The incidence rates of severe underweight, underweight, and obesity among children aged 5-12 years in East Kutai in 2018 was 0.97%, 5.87%, 13.18%, and 8.77%, lower than the prevalence of those cases in East Kalimantan. Only the prevalence of overweight in East Kutai (13.18%) was higher than the prevalence in East Kalimantan [1]. Nutritional status can be influenced by physical activity and milk consumption. Regular engagement in physical exercise enhances energy expenditure, which can affect nutrient balance and overall nutritional status [2]. Milk is beneficial for healthy growth and development because it contains calcium, protein, and vitamins, which are essential for healthy growth and development. A lack of these nutrients can result in lower BMI-for-age [3]. This research endeavour sought to examine the correlation between physical activity and milk consumption as they pertain to the nutritional status of school-age children at one of the primary schools in Kaliorang.

MATERIALS AND METHODS

This cross-sectional research was carried out at State Primary School 4 Kaliorang in May 2022. Forty-nine children were chosen as research subjects using the purposive sampling method, with the following inclusion criteria: willing to be a subject, 9-11 years old, and the 3rd, 4th, and 5th grade students. The exclusion criteria were students who refused to be a subject and allergic to milk. Nutritional status was assessed by calculating the subjects' BMI after measuring the height and weight of the subjects. The BMI was juxtaposed with the anthropometric standard table to ascertain the BMI-for-age Z-score (BAZ). Physical activity was evaluated utilizing the 1x24-hour physical activity recall instrument, while milk consumption was examined through a semi-quantitative food frequency questionnaire. Milk consumption was assessed from the frequency and amount of milk consumption. The relationship between physical activity and milk consumption with nutritional status was analysed using Spearman Rank Correlation Coefficient.

RESULTS AND DISCUSSION

Most subjects had standard nutritional status (55.10%) and a moderate level of physical activity (48.98%). The predominant frequency of milk consumption among subjects was categorized as moderate (38.78%) and very low (38.78%). Most subjects consumed very less amount of milk (55.10%) (Table I).

Table I: Nutritional status, physical activity, and milk consumption in school-age children

Variables	Mean±SD	n	%
Nutritional status	0.21±2.19		
Severely thin (<-3 SD)		1	2.04
Thin (-3 SD - <-2 SD)		5	10.20
Normal (-2 SD - +1 SD)		27	55.10
Overweight (+1 SD - +2 SD)		13	26.54
Obese (>+2 SD)		3	6.12
Physical activity	1.77±0.2		
Light (score of 1.40-1.69)		17	34.69
Moderate (score of 1.70-1.99)		24	48.98
Vigorous (score of 2.00-2.40)		8	16.33
Milk consumption frequency	6.08±5.00		
Good (≥14 times/week)		9	18.36
Moderate (7-12 times/week)		19	38.78
Low (4-6 times/week)		2	4.08
Very low (<4 times/week)		19	38.78
Amount of milk consumed	1,116.84±896.64		
Good (≥3,500 ml/week)		1	2.04
Moderate (1,750 ml – 3,250 ml/ week)		19	38.78
Low (1,000 ml – 1,500 ml/week)		2	4.08
Very low (<1,000 ml/week)		27	55.10

Table II showed that physical activity had a significant negative association with nutritional status. The lower the physical activity level, the greater the probability of overweight or obese (higher BAZ). Physical activity increases total energy expenditure, thereby affecting the energy balance and resulting in lower body weight [4]. High physical activity level also reduces the duration of sedentary activities, which correlates with an enhanced nutritional status and lower BAZ [5]. The frequency of dairy intake exhibited a notable and positive correlation with the individuals' nutritional status. A decrease in the frequency of milk intake corresponded with a deterioration in the nutritional status of children. Milk contains essential nutrients, such as protein, calcium, and vitamins. A decrease in milk intake may lower overall caloric and nutrient intake, contributing to a lower BAZ. Reduced intake of milk may adversely impact metabolic health, diminishing the efficacy of nutrient utilization and growth, leading to a decrease in BMI-for-age [3].

Table II: Relationship between physical activity and milk consumption with nutritional status of school-age children

Independent variable	Dependent variable: Nutritional status p*	r
Physical activity	0.000	-0.541
Milk consumption frequency	0.018	0.338
Amount of milk consumed	0.004	0.407

*Spearman Rank (significant if p<0.05)

CONCLUSION

Physical activity and milk consumption have been proven to have association with nutritional status among school-age children at Kaliorang State Elementary School 4. Children should engage in the enhancement and augmentation of their physical activity levels (e.g., participating in exercise) and increase the frequency and quantity of dairy milk intake.

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EXTENDED ABSTRACT

Mindful Eating Practices, Diet Quality and Nutritional Status of Institut Pertanian Bogor (IPB) University Students

Muhammad Aries, Keni Tyradh Megahandayani

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: ariesulaeman@apps.ipb.ac.id

SUMMARY

Mindful eating helps overcome unhealthy eating. This study examines how mindful eating affects IPB University students' diets and nutrition. Diet quality, nutritional status, and mindful eating behaviors were examined using the Indonesian Healthy Eating Index (I-HEI), percent body fat, and Mindful Eating Questionnaire. This cross-sectional study included 88 IPB University students. The data was collected using structured questionnaire interviews. The average I-HEI score of the individuals was 60.5±9.0, indicating need for improvement. The majority of participants had normal nutritional status. This study found no correlation between mindful eating and IPB University students' diet quality and nutritional status ($p>0.05$).

Keywords: Diet quality, Eating behaviour, I-HEI, Mindful eating, Nutritional status.

INTRODUCTION

Due to their transition into early adulthood, students are particularly susceptible to stress disorders from volatile emotions. Individuals experiencing tension often see a rise in cortisol levels and select highly palatable foods as a coping mechanism, creating a negative emotional environment during meals. This can lead to emotional eating, insufficient chewing, distracted eating, eating while doing other activities, or binge eating, resulting in significant weight gain and increasing the likelihood of being overweight. Practicing mindful eating, which involves engaging all sensory, cognitive, emotional, and physical processes during eating, can promote intentional and adequate consumption, improved focus, slower eating speed, and healthier food choices [1]. Currently, there is limited scientific evidence on the impact of mindful eating on diet quality and nutritional status among Indonesian students. This study aims to analyze the relationship between mindful eating practices and the diet quality and nutritional status of students at IPB.

MATERIALS AND METHODS

This cross-sectional study was conducted at IPB University, involving 88 undergraduate students who met specific criteria: second or third-year status, aged 19-24, not majoring in nutrition, not on a special diet, and willing to participate. Data were collected through face-to-face interviews, self-administered questionnaires, and direct measurements. Diet quality was examined using the Indonesian Healthy Eating Index (I-HEI) and their mindful eating behaviours were assessed using the Mindful Eating Questionnaire developed by Framson [2]. Nutritional status and percent body fat were determined using the Omron body composition monitor and scale. Ethical approval for the study was granted (document number 1173/IT3.KEPMSM-IPB/SK/2024). The data utilized in this study consists of primary data, specifically student characteristics, mindful eating practices, diet quality, and nutritional status (body weight, body mass index, and percentage of body fat). The normality test was conducted utilizing the Kolmogorov-Smirnov test, while the correlation test used the Spearman correlation test.

RESULTS AND DISCUSSION

In the study, 67% of subjects had normal nutritional status, with an average body fat percentage of 27.6% for females and 16.4% for males. It was found that 59% of subjects showed low mindful eating practices, while 41% displayed good practices. Mindful eating was assessed in five areas: awareness, distraction, disinhibition, emotional eating, and external stimuli [2]. Subjects scored highest in awareness and lowest in emotional eating (Fig. 1). Understanding all food components can enhance eating enjoyment and positive feelings. This underscores the significance of the emotional experience in mindful eating. Such experiences may serve as the first sensory encounter with food, stimulating appetite through visual or additional sensory cues [3].

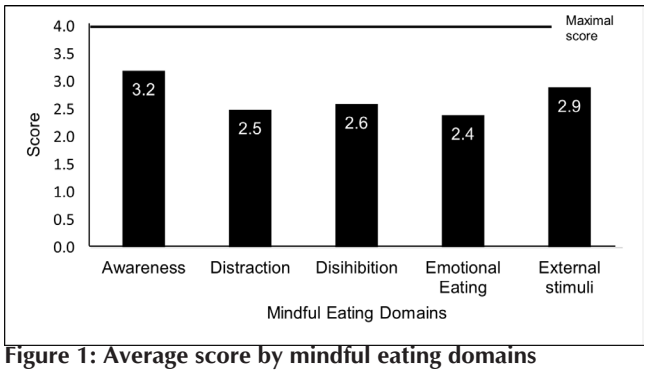

Figure 1: Average score by mindful eating domains

Based on the quality of their diet (Table I), 90% of the subjects fell into the "need improvement" group with the an average I-HEI score was 60.5±9.0. Six of the components met the guidelines recommendation (carbohydrate sources, animal protein, fat percentage, salt, sugar, and oil). On the other hand, the four components that don't meet the guidelines (veggies, fruit, plant protein, and variety of food).

The Spearman test results showed that mindful eating and diet quality were not significantly correlated (p=0.822; r=-0.024). There is no correlation because diet quality can be influenced by various factors such as age, gender, income, and environment. Moreover, health status, price, taste, food access, knowledge level, and support from others also affect the diet quality [3, 4]. Table 1 presents a cross-tabulation of mindful eating practices, diet quality, and subjects' nutritional status. Statistical analysis reveals no significant correlation between mindful eating and nutritional status (p=0.109; r=-0.172). People who have a lot of body fat don't always eat mindfully, and vice versa. Age, gender, diet, exercise, heredity, and physiological state can affect body fat ratio [5].

CONCLUSION

Mindful eating did not significantly correlate with diet quality or nutritional status (p>0.05), indicating low mindful eating practice among students, which may impact their diet quality. The low practice is attributed to insufficient information about its benefits, emphasizing the need for education on mindful eating to promote a healthier lifestyle.

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Table I: Cross tabulation between mindful eating practices and diet quality and nutritional status of subjects

Variable		Mindful eating practices [n (%)]			p-value	r
		Low	High	Total		
Diet Quality	Poor (<50)	5 (9.6)	4 (11.1)	9 (10.2)		
	Need improvement (51-80)	47 (90.4)	32 (88.9)	79 (89.8)	0.822	-0.024
	Good (>80)	0 (0)	0 (0)	0 (0)		
Total		52 (100.0)	36 (100.0)	88 (100.0)		
Nutritional status (percent body fat)	Underweight	4 (7.7)	3 (8.3)	7 (8.0)		
	Normal	31 (59.6)	28 (77.8)	59 (67.0)	0.109	-0.172
	Overweight	14 (26.9)	3 (8.3)	17 (19.3)		
	Obese	3 (5.8)	2 (5.6)	5 (5.7)		
Total		52	36	88		

EXTENDED ABSTRACT

Mother's Knowledge and Parenting Practices for Stunted and Non-Stunted Children Under Three in Bogor City

Dwi Hastuti, Melly Latifah, Raihan 'Ainun Hasanah

Department of Family and Consumer Sciences, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: dwihastuti@apps.ipb.ac.id

SUMMARY

This study analyzed mothers' knowledge about nutrition, health, and care, as well as parenting practices among families with children under three, classified as stunted or not, in West Bogor District with a total sample of 200 children. Results showed no significant differences in child and family characteristics. However, the non-stunted group had relatively fewer siblings, a more complete immunization status, and better maternal knowledge about nutrition. The study found that mother's knowledge was significantly correlated with the education level of mother and father, implying that nutritional improvement might be supported by parental education.

Keywords: Health and nutrition, Knowledge, Parenting practice, Stunting, Toddler

INTRODUCTION

Indonesia's governance aims to decrease stunting; however the prevalence of stunting in Indonesia in 2022 was still 21.6%, while in West Java Province, itreached 20.2% [1]. Several programs and activities within the community have been established to address stunting. In Bogor City, West Java Province, the prevalence of stunting increased by 1.8% in 2022. The UNICEF Logical Framework [2] outlines the importance of maternal nutrition, health, and caregiving factors in child nutrition. Previous research has also documented the influence of maternal knowledge and access to health and nutrition services [3]. Therefore, this study was conducted to ascertain whether there are differences in knowledge of nutrition, health, care, and maternal parenting practices between stunted and non-stunted toddlers. It is hoped that these findings will contribute to program considerations of family and maternal roles in decreasing or preventing cases of stunting among children under three years old.

MATERIALS AND METHODS

This study was exploratory research conducted in 2023 in the district with the highest prevalence of stunting, namely Bogor Barat District, covering the areas of Sindangbarang, Situ Gede, and Bubulak. In each location, 33-34 stunted and non-stunted toddler were selected, resulting in a total of 200 toddler and their mothers as respondents to this study. The collected data included family characteristics (parental age and education, income per capita, family size), child characteristics (age, gender, completeness of basic immunization), maternal knowledge of nutrition-health-care, and parenting practices. Maternal knowledge of nutrition, health-care, and parenting practices, was collected through interviews. The data were analyzed using JASP 0.18.1.0 for descriptive statistical analysis, inferential analysis using a t-test to determine the difference between the two groups, and Pearson correlation analysis to determine the association among variables. This study obtained ethical approval from the Research Ethics Committee Involving Human Subjects of IPB University No.1076/IT3.KEPMSM-IPB/SK/2023.

RESULTS AND DISCUSSION

Children and families in this study had similar characteristics in terms of age, mother's and father's age, mother's and father's education, and family income per capita (Table I). Only the number of siblings was larger in the stunted group, with a significant statistical difference compared to the non-stunted group ($p<0.05$). The results showed that knowledge between the two groups was significantly different, with mothers' of non-stunted toddlers having significantly higher knowledge than mothers of stunted toddlers. When compared between the two dimensions, knowledge of caregiving and stimulation was relatively lower (69.850±12.175) compared to knowledge of nutrition,health, and sanitation (75.250±11.339) (Table I). Maternal caregiving practices were measured in two dimensions: child-feeding practices and health-sanitation caregiving

Table I: Child and family characteristic of stunting and non stunting group (n=200)

Variable	Mean ± Standard Deviation		P-value
	Non-Stunting	Stunting	
Child Characteristic			
Sibling (person)	1.212±0.836	1.564±1.135	0.046*
Family Characteristic			
Paternal Age (years)	36.384±7.032	36.317±6.847	0.784
Maternal Age (years)	31.657±5.037	31.881±5.964	0.832
Paternal education (years)	10.354±2.734	10.455±2.614	0.721
Maternal education (years)	10.475±2.616	9.960±2.731	0.139
Family size (person)	5.293±1.592	5.158±1.541	0.504
Income per capita (rupiah/ month)	602,369.689± 420,351.132	602,425.712 ±427,954.774	0.950
Knowledge dan Practice			
Mother's knowledge (Total) (index)	73.838±8.536	71.287±8.621	0.043*
Knowledge of nutrition& health(index)	76.667±10.595	73.861±11.914	0.075
Knowledge of parenting & stimulation (index)	71.010±12.247	68.713± 12.055	0.268
Parenting practice (index)	79.343±11.218	79.554±10.842	0.495
Feeding practice (index)	77.677±16.649	77.129±14.376	0.403
Health practice (index)	81.010±12.330	81.980±13.713	0.961

Note: * is significantly different (p<0.05), analysed using Mann Whitney

practices. Table I shows that child-feeding practices in both non-stunted and stunted groups did not differ significantly, with an average of 77.400±15.506. Similarly, health-sanitation caregiving practices did not differ significantly, with an average of 81.500±13.023.

The results of this study indicate that maternal knowledge of nutrition, health, and care is generally inadequate, with mothers in the stunted group having lower knowledge compared to those in the non-stunted group. This result aligns with research conducted by [4], which has shown that mothers with better child nutrition status also have better knowledge. Maternal parenting practices in the non-stunted group are higher than those in the stunted group, indicating that caregiving practices reflect better maternal ability to provide food and stimulation to the child. This result is consistent with findings from previous research that mothers with better child nutrition status have better access to nutrition-health services, as well as better knowledge. Parental education, both father and mother, is positively related to knowledge of nutrition,health, and care. Previous research in Bogor City also found that children with better nutritional status are associated with better maternal education [5]. Furthermore, non-stunted toddlers also have significantly more complete basic immunization status (Table II).

CONCLUSION

Stunted toddlers tend to have more siblings and fewer

Table II: Correlation of family characteristic with knowledge and practice of nutrition, health and care (n=200; only correlated variables are displayed)

Variable	Stunting Status	Immunization Status	Father's Education (years)	Mother's Education (years)
Care and stimulation knowledge (index)	-0.095	0.045	0.141*	0.300***
Mother's Knowledge (index)	-0.148*	0.104	0.144*	0.274***
Health and sanitation knowldedge (index)	0.037	0.409***	-0.007	-0.044
Caring Practice (index)	0.010	0.254***	0.069	0.060

Note: *p<0.05, **p<0.01, ***p<0.001; Stunting Status (0=non stunting; 1=stunting); Immunization Status (0=incomplete; 1=complete)

immunizations compared to those of non-stunted toddlers. Maternal knowledge is better in the non-stunted group and is associated with parental education. This implies the role of parents in achieving better knowledge as an alternative approach to decreasing stunting among toddlers in Bogor City.

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EXTENDED ABSTRACT

Maternal Parenting Efficacy, Mother-Child Attachment, Home Parenting Environment, and Child Development: An Analysis of Stunted and Non-Stunted Children in Bogor City

Melly Latifah, Neti Hernawati, Yulina Eva Riany, Raihan 'Ainun Hasanah

Department of Family and Consumer Sciences, Faculty of Human Ecology, IPB University, 16630, Bogor, Indonesia

Corresponding author's email: mlatifah@apps.ipb.ac.id

SUMMARY

This study examined the characteristics of children and families in relation to stunting among children in Bogor city. Descriptive statistics, Mann-Whitney U tests, and Pearson correlation analyses were utilized to analyze the data. Comparative analyses revealed significant differences between stunted and non-stunted children in terms of the mean number of siblings (non-stunted: 1.2, stunted: 1.6, $p<0.05$), parental responsiveness (non-stunted: 77.5, stunted: 71.6, $p<0.05$), Bina Keluarga Balita (BKB) scores (non-stunted: 82.6, stunted: 77.1, $p<0.05$), and gross motor skills (non-stunted: 88.2, stunted: 80.9, $p<0.05$). The discussion highlights the importance of family dynamics and parental engagement in child development. The implications suggest targeted interventions in parenting practices may be effective in mitigating the effects of stunting.

Keywords: Child wellbeing, Developmental milestones, Home parenting environment, Nutritional status, Parenting practices

INTRODUCTION

In the critical early years of a child's life, factors such as parenting efficacy, mother-child attachment, and the home parenting environment significantly influence their development. However, research often neglects to comprehensively investigate these factors within the context of stunting, particularly in regions like Bogor City, where the prevalence of stunting is notably high at 18.7%, according to the SSGI 2022 report [1]. This study explores the relationships between maternal parenting efficacy, mother-child attachment, the home parenting environment, and child development outcomes among stunted and non-stunted children in Bogor City. It aims to uncover the challenges faced by stunted children and to identify protective factors that can improve child development, thereby informing targeted interventions and policies.

MATERIALS AND METHODS

This cross-sectional study examined the relationships between maternal parenting efficacy, mother-child attachment, the home parenting environment, and child development outcomes among stunted and non-stunted children in Bogor City. The study included 200 children aged 12 to 36 months and their mothers, selected through purposive sampling. Data were collected through structured interviews and questionnaires, which assessed parenting efficacy, attachment, home environment, and child development. Child development was evaluated using the Toddler Family Development (Bina Keluarga Balita; BKB) instrument [2] and the Pre-Developmental Screening (Pra Skrining Perkembangan; PSP) instrument [3]. Ethical approval for the study was granted by IPB University (No. 1076/IT3.KEPMSM-IPB/SK/2023). Mann-Whitney U tests and Pearson correlation analyses were conducted, with significance set at $p<0.05$, using JASP 0.18.1.0. The study aimed to address challenges faced by stunted children and to identify protective factors for achieving better developmental outcomes.

RESULTS AND DISCUSSION

The result revealed significant differences between stunted and non-stunted children (Table I). Specifically, stunted children had more siblings ($p<0.05$), lower parental responsiveness ($p<0.05$), and lower gross motor skills scores ($p<0.05$).

Correlational analyses (Table II) identified negative associations between family size and parenting efficacy ($p<0.01$), the quality of the home parenting environment ($p<0.01$), and gross motor skills ($p<0.05$). Conversely, parental education positively correlated with the quality of the home parenting environment ($p<0.001$) and positive child development outcomes ($p<0.05$). These findings underscore the critical role of parental education in achieving positive child outcomes. Specifically, parental education is predicted to be an

Table I: Comparison of child and family characteristics, and core variables between stunted and non-stunted children in Bogor City

Variables	Mean±Standard Deviation		p–value
	Non–Stunted	Stunted	
Child Characteristics			
Age (months)	24.6±6.7	27.5±6.5	-
Number of siblings (people)	1.2±0.8	1.6±1.1	0.046*
Family Characteristics			
Father's age (years)	36.4±7.0	36.3±6.8	0.784
Mother's age (years)	31.7±5.0	31.9±6.0	0.832
Father's education (years)	10.4±2.7	10.5±2.6	0.721
Mother's education (years)	10.5±2.6	10.0±2.7	0.139
Family size (people)	5.3±1.6	5.2±1.5	0.504
Per capita income (rupiah/ month)	602,369.7± 420,351.1	602,425.7± 427,954.8	0.950
Core Variables (index)			
Mother's Parenting Efficacy	76.6±13.2	74.5±11.5	0.212
Mother–Child Attachment	65.1±9.2	63.8±9.7	0.217
Home parenting environment	73.6±9.3	72.7±9.0	0.371
Parental Responsiveness	77.5±17.9	71.6±19.7	0.015*
Child Acceptance	82.8±11.0	81.3±13.8	0.530
Organization of Environment	81.1±14.4	81.0±16.5	0.731
Organization of Environment	68.4±20.5	73.4±18.3	0.086
Parental Involvement	71.5±16.7	70.0±17.6	0.602
Variety of Stimulation	58.4±21.9	58.3±19.8	0.882
Child Development (BKB)	82.6±12.8	77.1±15.8	0.022*
Gross Motor (BKB)	88.2±18.6	80.9±23.7	0.017*
Fine Motor (BKB)	74.5±17.6	69.7±17.4	0.090
Cognitive Development (BKB)	84.2±18.2	79.7±20.0	0.081
Child Development (PSP)	83.1±16.6	82.0±17.3	0.538

Note: Mann-Whitney U tests; *p<0.05

Table II: Correlation between parenting variables, child development, and family characteristics (n=200)

Variable	Pearson's r				
	Number of siblings	Father's education (years)	Mother's education (years)	Family size (people)	Per capita income (rupiah/ month)
Mother's Parenting Efficacy	-0.076	0.051	0.016	(-0.211**)	-0.126
Mother-Child Attachment	-0.052	-0.053	-0.101	-0.061	-0.106
Home parenting environment	(-0.205**)	0.305***	0.327***	(-0.236***)	0.246***
Gross Motor (BKB)	(-0.154*)	0.084	0.149*	(-0.285***)	0.094
Fine Motor (BKB)	-0.014	0.080	0.082	-0.086	0.049
Cognitive Development (BKB)	-0.105	0.139*	0.163*	-0.098	0.106
Child Development (BKB)	-0.125	0.151*	0.182*	(-0.190**)	0.112
Child Development (PSP)	0.044	0.013	0.059	0.022	0.111

Note: Pearson correlation test; *p<0.050, **p<0.010, ***p<0.001

effective strategy for promoting positive outcomes among children. This research supports previous studies that highlight the importance of parental education in managing and preventing stunting [4,5].

CONCLUSION

In conclusion, the observed variables significantly impact child development outcomes, underscoring the need for targeted interventions to mitigate stunting. Strategies aimed at improving parenting practices and enhancing parental education are essential for promoting optimal child development inareas with high rates of stunting.

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EXTENDED ABSTRACT

Early Marriage: Early Motherhood and Its Linkage on Family Food Security

Wardina Humayrah[1], Atikah Shalihah Nurusalamah[1], Titien Yusnita[2]

[1] Nutrition Study Programme, Faculty of Food Technology and Health, Sahid University, 12870 South Jakarta, Jakarta, Indonesia
[2] Islam Communication and Broadcasting, Faculty of Da'wah and Communication, Sahid Institute of Islamic Studies, 16810 Bogor, West Java, Indonesia

Corresponding author's email: wardina_humayrah@usahid.ac.id

SUMMARY

Early marriage is common in Bogor Regency, West Java, Indonesia, due to factors such as low parental education and poor family economic status, which increases the risk of food insecurity. This study analysed the relationship between early marriage and family food security among children under five in Leuwiliang. Using a cross-sectional design with 106 families, it found no association between age at marriage and food security, but younger maternal age at first birth was associated with higher family food insecurity. All subjects with an earlier marriage also had their first child before the age of 19.

Keywords: Children under five, Early marriage, Food security, Malnutrition, Stunting

INTRODUCTION

Early marriage is a global concern that is addressed in the 2030 SDGs, particularly Goal 5 on gender equality. Defined as marriage before the age of 19, preventing early marriage can address poverty, nutrition, food security, health, education, economic growth and gender inequality [5]. In 2018, Indonesia ranked second in ASEAN for early marriage rates, with West Java at 20.93% [1]. Leuwiliang had the second highest rate in Bogor regency in 2020 at 49.48% [2]. Factors such as dropping out of school, premarital pregnancy, religious beliefs, economy, customs and parental pressure drive early marriage in Pamijahan, Bogor Regency [3]. Early married couples often face economic pressure, reduced food expenditure and food insecurity [1]. This study aims to determine the relationship between early marriage and food security among families with children under five in Leuwiliang, Bogor Regency, West Java, Indonesia.

MATERIALS AND METHODS

This study used a cross-sectional design with a total of 106 subjects from families with under five children. Data collection was conducted through face-to-face interview in Leuwiliang, Bogor Regency, West Java, Indonesia in July-August 2023. This research has approved through the ethical clearance process with the number 008/KEPK/UNPRI/VII/2023. The research instruments consisted of: a questionnaire on socio-demographic characteristics (education level, mother's occupation, household income, and family expenditure), and Household Food Insecurity Access Scale (HFIAS) questionnaire. The Chi-squared proportional difference test was used to compare the socio-demographic characteristics of families with under-five children who married early (<19 years) and those who married ideally (≥19 years). And the analysis of the relationship between age when getting married and age of mother when she had her first child with the level of family food security was statistically tested using the Spearman Correlation.

RESULTS AND DISCUSSION

There is a significant difference between the age at which mothers had their first child and their educational attainment in early and ideal married families with under five children (Table I). Most mothers in early marriages had their first child under the age of 19, while those in ideal marriages were over 19. Mothers who married early had a lower level of education (primary or lower secondary). Although there was no significant difference in household income (p=0.083), ideally married families tended to have higher incomes.

Table II shows that there is no significant relationship between early marriage and food security (p=0.428). Early married families tends to be associated with and severely food insecure than ideal married families. Although not significant, younger age at marriage tends to worsen food insecurity. The p<0.05 may be because age at marriage is not considered to be a direct factor in

Table I: Socio-demographic characteristics of the subjects

Socio-demographic characteristics	Early marriage <19 yo (n=28)		Ideal marriage ≥19 yo (n=78)		Total (n=106)		*p*
	n	%	n	%	n	%	
Age when mother had first child							<0.001*
15-18 years	15	100.0	0	0.0	15	100.0	
19-33 years	13	14.3	78	85.7	91	100.0	
Mother's education							0.002*
Low (elementary school, junior high school)	23	39.9	36	60.1	59	100.0	
High (high school)	5	10.6	42	89.4	47	100.0	
Mother's occupation							1.000
Housewife	27	26.2	76	73.8	103	100.0	
Employee-entrepreneur	1	33.3	2	66.7	3	100.0	
Household income							0.083
Rp. <1.500.000	14	38.9	22	61.1	36	100.0	
Rp. 1.500.000-2.500.000	11	24.4	34	75.6	45	100.0	
Rp. 2.500.000-3.500.000	1	5.9	16	94.1	17	100.0	
Rp. >3.500.000	2	25.0	6	75.0	8	100.0	

*Significantly different at p<0.05 using Chi-Square two proportions test.

Table II: Relationship between age at marriage and family food security

Food security status	Early marriage <19 yo (n=28)		Ideal marriage ≥19 yo (n=78)		Total (n=106)		*p**	*r**
	n	%	n	%	n	%		
Food security (score 0-1)	19	24.4	59	75.6	78	100.0	0.428	-0.078
Mild food insecurity (score 2-7)	7	30.4	16	69.6	23	100.0		
Moderate food insecurity (score 8-14)	1	33.3	2	66.7	3	100.0		
Severe food insecurity (score 15-27)	1	50.0	1	50.0	2	100.0		

*Correlation test using Rank-Spearman, significant at p<0.05

family food security.

Table III shows a significant association between mother's age at first birth and food insecurity (p=0.045, r=-0.195). Younger age at marriage correlates with higher levels of food insecurity. Mothers who marry young often have their first child before the age of 19, while those who marry at 19 or older have better food security. Teenage pregnancy (<20 years) is often the result of low education and poor economic conditions.

Mothers who marry early tend to become housewives and rely on low household incomes, making it difficult to find employment [4]. Families with low levels of education and income increase the risk of food insecurity, limit access to food and cause nutritional problems, especially among children under five. Young children, as a vulnerable group, are particularly affected

Table III: Relationship between mother's age at first birth and family food security

Food security status	Age when mother had first child						*p**	*r**
	<19 yo (n=15)		≥19 yo (n=91)		Total (n=106)			
	n	%	n	%	n	%		
Food security (score 0-1)	10	12,8	68	87,2	78	100	0,045*	-0,195
Mild food insecurity (score 2-7)	3	13,0	20	87,0	23	100		
Moderate food insecurity (score 8-14)	1	33,3	2	66,7	3	100		
Severe food insecurity (score 15-27)	1	50,0	1	50,0	2	100		

*Correlation test using Rank-Spearman, significant at p<0.05

by low access to food, which increases the risk of nutritional and health problems [5].

CONCLUSION

This research found no significant association between early marriage and food security among the subjects. However, early marriage leads to young mothers taking on childcare responsibilities, which contributes to food insecurity due to lower education and income levels. Addressing these issues requires improved education, economic support, policies and reproductive health services.

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EXTENDED ABSTRACT

Vegetable Consumption in Seven Major Cities in Indonesia

Karina Rahmadia Ekawidyani[1], Rimbawan[1], Anna Vipta Resti Mauludyani[1], Yustiyani[2], Yasu Toride[3]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia
[2] Department of Public Health, Faculty of Health Sciences, UIN Syarif Hidayatullah Jakarta, 15412 South Tangerang, Indonesia
[3] International Life Science Institute (ILSI) Japan, 135-0004 Tokyo, Japan

Corresponding author's email: rimbawan@apps.ipb.ac.id

SUMMARY

Consuming vegetables is essential for maintaining optimal health and reducing the risk of non-communicable diseases. The objective of this study was to describe vegetable consumption among residents of seven major Indonesian cities; DKI Jakarta, Depok, Bogor, Tangerang, and Bekasi (Greater Jakarta), as well as Semarang and Surabaya. Data from the National Socio-Economic Survey (SUSENAS) 2021 were used and analyzed descriptively. Greater Jakarta, Semarang, and Surabaya exhibit higher vegetable consumption compared to the national average, although the patterns of vegetable variety consumed are similar. To enhance the diversity and quantity of vegetables consumed, nutrition education should be provided. Additionally, efforts should be made to ensure the availability and accessibility of a variety of vegetables.

Keywords: Food access, Food pattern, Sustainable diet, Urban, Vegetable intake

INTRODUCTION

Vegetable consumption is crucial for promoting good health and reducing the incidence non-communicable diseases. As urbanization accelerates, understanding the dietary patterns of urban residents becomes increasingly important. Examining vegetable consumption patterns in major cities in Indonesia, which are experiencing significant urbanization, can provide valuable insights for public health interventions. To date, research on vegetable consumption has often been conducted alongside studies on fruit consumption [1] and has tipically focused on specific cities or metropolitan areas [2]. This study aimed to describe vegetable consumption among residents of seven major Indonesian cities: DKI Jakarta, Depok, Bogor, Tangerang, and Bekasi (Greater Jakarta), as well as Semarang and Surabaya. By analyzing data from a nationwide survey, our objective is to reveal disparities in vegetable preferences and consumption quantities. Identifying discrepancies in vegetable consumption patterns may provide valuable insights for targeted to improve public health outcomes and promote sustainable dietary behaviors.

MATERIALS AND METHODS

The study utilized data from the National Socio-Economic Survey (SUSENAS) conducted in 2021. SUSENAS is a comprehensive set of extensive socioeconomic surveys that includes food consumption data and covers a representative sample of households across Indonesia. The survey is conducted biannually, in March and September. To obtain detailed information on vegetable intake, we reviewed the literature and gathered secondary data, focusing specifically on age groups, types of vegetables, and cities. The data were then tabulated to show vegetable consumption by commodity and age group across the seven cities [3]. The data were analyzed descriptively to observe discrepancies and trends in consumption. The quantities of vegetable consumption were presented in grams per capita per day.

RESULTS AND DISCUSSION

The seven major cities exhibit a higher mean vegetable intake compared to other regions of Indonesia (Table I). One possible explanation is that urban areas benefit from a greater availability of vegetables. These cities have widespread access to vegetables through both traditional marketplaces and e-commerce platforms, including Sayurbox, Tanihub, HappyFresh, Papa Pangan, Tokopedia, My Fruit, and BliBli Fresh Box. Online vegetable purchases offer convenience as the products are delivered directly to the customer's home, allowing them to receive their vegetables without leaving the house. Smartphone apps facilitate this process by offering a variety of vegetables options, including mixed vegetable packs and blended juice. Vegetables supply is based on the harvest of the day. This convenience allows consumers to access a variety of vegetables at an affordable price. The SUSENAS 2021

Table I: Average vegetable consumption based on age group (g/cap/day)

Cities	0 - 59 months	5 - 12 years	13 - 18 years	19 - 55 years	> 55 years
Jakarta	40.45	52.64	61.38	105.95	165.25
Bogor	41.29	53.99	63.35	101.92	157.59
Depok	44.69	54.51	64.19	109.24	155.65
Tangerang	44.93	55.90	59.51	104.16	147.10
Bekasi	43.12	57.37	70.38	110.90	152.08
Semarang	35.91	49.22	57.39	100.91	162.38
Surabaya	40.44	56.31	67.48	110.96	161.49
Indonesia	27.98	40.43	49.84	72.48	90.09
Recommended consumption	200	200	250	250	250

survey was conducted during the peak of the COVID-19 pandemic in Indonesia, which likely increased urban residents' inclination to purchase vegetables through e-commerce platforms. Online shopping became a preferred alternative to visiting traditional markets or supermarkets, primarily due to concerns about virus transmission [4].

All seven cities exhibited a similar pattern in the ten most popular vegetables as seen in the national data (Table II). The three most popular vegetables in these cities were kale/swamp cabbage, spinach, and onion. Indonesia is renowned for its rich biodiversity and abundant indigenous edible plants. However, per capita production of certain vegetables, such as spinach, water spinach, string beans, cucumbers, and garlic, is lower than their per capita consumption. Indonesia continues to rely on vegetable imports, leading to elevated prices. To improve the availability and affordability of vegetables, measures such as strengthening farmer organizations and promoting of sustainable land practices should be implemented [5]. In addition to providing nutrition education, these measures are expected to increase vegetables consumption in the future.

CONCLUSION

Residents of Greater Jakarta, Semarang, and Surabaya consume more vegetables than the national average, although their intake remains below the recommended portion. Similar patterns of vegetable consumption are observed in these regions. To improve both the variety and quantity of vegetable consumption, nutrition education is necessary, along with efforts to maintain the supply and accessibility of various types of vegetables.

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Table II: Average vegetable consumption based on commodities (g/cap/day)

Commodities	Jakarta	Bogor	Depok	Tangerang	Bekasi	Semarang	Surabaya	Indonesia
Kale/swamp cabbage	8.0	7.7	8.0	15.6	9.1	8.3	16.0	11.0
Spinach	7.1	8.4	8.1	18.3	8.9	12.6	9.4	9.1
Onion	5.7	6.0	7.3	8.3	6.6	6.4	7.4	8.0
Cassava leaves	1.6	0.7	2.4	2.1	1.4	3.0	1.6	8.0
Eggplant	2.3	1.3	2.3	3.0	2.4	4.7	5.7	7.1
Tomato, cherry tomato	4.7	4.0	4.7	4.9	5.1	3.0	7.0	6.9
Cucumber	3.1	4.4	4.0	5.9	5.3	1.6	2.6	6.3
Long beans	2.9	2.1	2.9	4.3	2.9	5.6	3.6	6.1
Cayenne pepper	3.6	5.1	2.1	3.9	3.1	2.1	5.3	5.3
Garlic	4.1	4.3	4.7	4.1	5.0	6.3	5.3	5.1

EXTENDED ABSTRACT

Office Worker has Better Dietary Habits and Physical Activity when Work-From-Home (WFH) than Work-From-Office (WFO) during Covid-19 Pandemic

Naufal Muharam Nurdin[1,2], Annisa Rachmah[1]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, West Java, Indonesia
[2] Faculty of Medicine, IPB University, 16880 Bogor, West Java, Indonesia

Corresponding author's email: naufal@apps.ipb.ac.id

SUMMARY

The Covid-19 pandemic has led to lifestyle changes. This is cross-sectional study analyses the differences in office workers' dietary habits and physical activity during work-from-home (WFH) and work-from-office (WFO). Data was conducted through an online questionnaire. Breakfast consumption, fruit and vegetable intake, milk consumption, and physical activity were higher during WFH than WFO ($p<0.05$). Conversely, unhealthy behaviour's such as consuming sweet drinks and fast food increased during WFO. This result indicates that office workers have a healthier lifestyle when working from home than working from the office.

Keywords: Covid-19, Dietary habits, Lifestyle, Office workers, Physical activity

INTRODUCTION

Pandemic of Covid-19 led to the implementation of Emergency Community Activity Restriction Enforcement (PPKM) in Indonesia. This policy led to strict activity restrictions in various sectors. These restrictions have caused office workers to work online from home (WFH) when Covid-19 cases are increasing, and when Covid-19 cases subside, they continue to work in the office (WFO). This condition led to lifestyle changes, and previous studies have shown increased vegetable and fruit consumption [1] and decreased physical activity [2]. This study aimed to investigate the effect of WFH and WFO on dietary habits and physical activity of office workers in Jakarta, Indonesia.

MATERIALS AND METHODS

This cross-sectional study utilized an online questionnaire distributed via social media to office workers in Jakarta, Indonesia, from September to October 2022. The sample was selected using the accidental sampling method, with inclusion criteria requiring participants to be at least 18 years old, have experience working both remotely and in the office during the COVID-19 pandemic, and not be on a specific diet. A total of 281 respondents participated. Dietary habits were assessed using a 14-item online questionnaire adapted from Ismail et al. (2020) [3] and Kubo et al. (2021) [4]. Physical activity levels were measured with the Global Physical Activity Questionnaire (GPAQ) [5]. Informed consent was obtained from all respondents prior to participation.

RESULTS AND DISCUSSION

Respondents consumed fruits, vegetables, milk, and breakfast more frequently while WFH than WFO. It is likely due to limited time for meal preparation and long commutes, which lead to skipped breakfasts. Although fruit and vegetable consumption increased during WFH, it remained below recommendations from Indonesia Balanced Nutrition Guidelines (PGS). During WFH, only 12.8% of respondents consumed fruits daily, and 28.8% consumed vegetables daily, compared to 7.1% and 18.9%, respectively, during WFO. Milk consumption increased during WFH, likely due to the belief that milk enhances the immune system and prevents COVID-19. Fast food and sweet drink consumption were higher during WFO, possibly because these items are more accessible at the office and during breaks.

Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ) and converted to Metabolic Equivalent Unit (MET)-minutes per week [5]. Unlike previous studies, the meta-analysis conducted by Runacres et al. (2021) across nine countries found an increase in sedentary time when pandemic time. However, in this study, we found that activity levels were higher during working from home (WFH) compared to working from the office (WFO) ($p<0.001$). In WFH subject have higher chores intensity ($p<0.001$) and higher recreational intensity ($p=0.033$) than WFO.

Table I: Subject characteristics

Characteristics	Category	n	Percentage (%)
Age	Under 30	127	45.2
Mean±SD (32.16+-8.00)	30-40	109	38.8
	Above 40	45	16.0
Sex	Male	171	60.9
	Female	110	39.1
Education	High school (SMA/SMK)	28	10.0
	D3	30	10.7
	D4/S1	207	73.7
	S2	16	5.7
Nutritional status (BMI)	Severely underweight (<17.0)	9	3.2
	Underweight (17.0-18.5)	11	3.9
	Normal (18.5-25.0)	131	46.6
	Overweight (25.0-27.0)	41	14.6
	Obesity (>27.0)	89	31.7
	Mean±SD (Kg/m^2)	25 ± 4.8	

Table II: Diet habits when WFH and WFO

Dietary Habits		Frequency (day per week)					p-value*
		<1	1-2	3-4	4-6	every day	
		%	%	%	%	%	
Breakfast Habits	WFH	24.2	5	9.6	4.6	56.6	0.025
	WFO	24.6	6.4	13.2	7.8	48	
Fruit consumption	WFH	26.3	21.4	31	8.5	12.8	<0.0001
	WFO	40.2	29.5	19.2	3.9	7.1	
Vegetables consumption	WFH	20.3	13.9	25.6	11.4	28.8	<0.0001
	WFO	26.7	17.8	29.2	7.5	18.9	
Milk consumption	WFH	48.8	14.6	17.4	6.8	12.5	<0.0001
	WFO	58.7	14.9	14.2	4.6	7.5	
Meat/egg consumption	WFH	24.2	23.1	28.8	8.9	14.9	0.389
	WFO	27.4	22.8	27.8	8.9	13.2	
Sweet Beverages Consumption	WFH	39.9	23.1	18.1	4.6	14.2	0.003
	WFO	29.2	26.3	19.9	7.1	17.4	
Tea or coffee consumption	WFH	40.6	19.2	15.7	6	18.5	0.001
	WFO	34.2	14.2	21.7	7.8	22.1	
Fast Food Consumption	WFH	48.8	32.4	13.5	1.1	4.3	0.012
	WFO	46.3	24.9	21.4	4.6	2.8	

*McNemar test

Table III: Distribution of Subjects by WHO-Recommended Physical Activity Levels

MET·min/week	WFH		WFO		p-value
	N	%	n	%	
Less than 600	95	33,8	126	44,8	0,000*
600 or more	186	66,2	155	55,2	
Average MET min/week	2403±3967		2062±4610		0,000**

*McNemar test **Wilcoxon test

In contrast, physical activity tended to be lower during WFO due to increased workload and longer commutes, which made it more difficult to find time for recreational physical activity outside of work hours.

CONCLUSION

In this study, a healthier lifestyle was observed during WFH compared to WFO. During WFH, there was higher physical activity, better breakfast habits, higher consumption of vegetables, fruits, and milk, and less consumption of sweet drinks and fast food. Various strategic approaches are needed to maintain a healthy lifestyle when WFO.

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EXTENDED ABSTRACT

Analysis of Risk Factors for Oxidative Stress in the Kulon Progo Batik Industrial Area

Juwita Nur Aisyah[1,2], Ikeu Tanziha[2], Mira Dewi[2], Dwi AA Nugrahaningsih[2]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia
[2] Department of Public Health and Nursing, Faculty of Medicine, Gajah Mada University, 55281 Yogyakarta, Indonesia

Corresponding author's email: ikeu_jamilah@apps.ipb.ac.id

SUMMARY

Lack of diverse food intake and exposure in the work environment can cause oxidative stress, as seen in high 8-OHdG values. This study aims to analyze the risk factors for oxidative stress in the Kulon Progo industrial area. The study utilized a cross-sectional research design. There is a difference in oxidative stress between subjects working in the batik industry and those working outside the batik industry. It can be seen that there is a significant negative relationship between fiber and oxidative stress. Food intake such as fiber intake can help prevent further damage.

Keywords: 8-OHdG, Batik industry, BMI, Fiber intake, Oxidative stress

INTRODUCTION

The development of the batik industry sector has various impacts, one of which is caused by exposure to batik workers. Many studies have shown that carcinogenic chemicals in the batik industry work environment can cause oxidative stress. Research showed that air exposure can cause excess reactive oxygen species, resulting in the production of 8-OHdG. The high value of 8-OHdG in batik workers is caused by air exposure during the batik making process. Research showed that fiber intake can reduce oxidative stress. Excess weight is one factor that helps increase oxidative stress. This study was conducted to determine what factors influence oxidative stress in batik workers so that it can be prevented and minimize health decline. The impact that occurs if oxidative stress is ignored is that it will result in poor health and increased susceptibility to degenerative diseases.

MATERIALS AND METHODS

The research was conducted in April 2021 in Kulon Progo, Special Region of Yogyakarta. Primary data includes nutritional status, age and food intake, secondary data includes biological markers of oxidative stress (8-OHdG) obtained from urine by examination by experts or trained laboratory personnel. 8-hydroxy-20-deoxyguanosine (8-OHdG) is one of the dominant forms of reactive oxygen species (ROS) lesions, which is commonly used as a biological marker for oxidative stress. The chemical compounds from the batik process that produce 8-OHdG are lead and cadmium. This study employed a cross-sectional research design and included a total of 38 participants, consisting of 19 batik makers and 19 non-batik makers. Data variables in this study include respondent characteristics, nutritional status, food consumption, and markers of oxidative stress. The inclusion criteria for this research were batik makers who had worked for at least five years, and non-batik batik makers who did not work in the batik industry but whose homes were still close to the batik industry location. Bivariate analysis to test the relationship used the Pearson and Spearman tests, while the difference test used the independent T-test. Multivariate analysis using logistic regression.

RESULTS AND DISCUSSION

Table I showed that there is a significant negative relationship with fiber intake, meaning that the greater the fiber intake, the smaller the oxidative stress marker (8-OHdG). The statistical tests used were Pearson and Spearman tests. Research showed that low fiber intake can increase oxidative stress.

Table II showed that there is a significant difference between the oxidative stress markers of batik makers and non-batik makers. The statistical test used is the independent T-test. Other research also showed that batik makers have higher damage than non-batik makers, which means that batik makers have a higher level of oxidative stress than non-batik makers. In line with research by Sari et al. (2014) with the title "The Impact of Exposure to Substances in the Batik Making Dyeing Process on Clinical Disorders of Batik Industry Workers", the results of this study showed that VEP1 in the exposed group was 3026.55 ± 551.35 while in the

Table I: Relationship between fiber intake, BMI with oxidative stress

Indicator	Exposed *p- value*	Not Exposed *p- value*	*p- value* (n=30)
Fiber intake	-0.87	-0.04*	-0.04*
BMI	0.17	-0.94	0.35

Table II: Table of differences in oxidative stress, fiber intake, and BMI between batik makers and non-batik makers

Indicator	batik makers Mean±SD (Min-Max)[a]	non-batik makers Mean±SD (Min-Max)[b]	*p- value*
8-OHdG	38.84± 7.31 (29.32-53.39)	33.13±8.46 (18.67-47.34)	0.03*
Fiber intake	7.68±3.92 (3.46-14.74)	9.55±5.39 (3.24-23.28)	0.23
BMI	24.77±4.92 (18.35-33.14)	26.24±6.32 (16,28-43.65)	0.6

Table III: OR values and 95% CI for oxidative stress risk factors

Indicator	*p- value*	OR (95% CI)
Age	0.84	1.11 (0.41-2.99)
Gender	0.62	1.66 (0.23-11.79)
Occupation	0.13	3.73 (0.69-20.17)
BMI	0.65	0.79 (0.28-2.2)
Fiber intake	0.091	8.37 (0.71-98.21)

unexposed group it was 3385.86 ± 640.63.

From the test results, it can be seen that the variables age, gender, occupation, BMI, and fiber intake together are not risk factors for oxidative stress. The statistical test used is the logistic regression.

CONCLUSION

There is a significant negative relationship in batik subjects for fiber intake, meaning that the more fiber intake, the smaller the oxidative stress (8-OHdG). There is a significant difference between oxidative stress markers (8-OHdG) in batik makers and non-batik makers. The average oxidative stress marker (8-OHdG) in batik makers is greater than non-batik makers.

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EXTENDED ABSTRACT

Association between Mid-Upper Arm Circumference and Low Birth Weight among Pregnant Women in Rural Bogor

Kitaka Ashraf[1], Mira Dewi[1,2], Rimbawan Rimbawan[1]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia
[2] Faculty of Medicine, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: mirade@apps.ipb.ac.id

SUMMARY

Maternal nutritional status can have a profound impact on neonatal birth weight and length. This study focused on estimating the relationship between maternal nutritional status and birth size. Results demonstrated that pre-pregnancy body mass index (PP-BMI) and mid-upper arm circumference (MUAC) were significantly associated with birth weight. Binary logistic regression revealed that mothers with normal MUAC measurements were 0.024 times less likely to deliver low birth weight babies compared to mothers with chronic energy deficiency. Low MUAC is a reflection of underlying inadequate energy and protein availability resulting into poor nutrient delivery to the foetus.

Keywords: Birth length, Birth weight, MUAC, Nutritional status, Pregnancy

INTRODUCTION

Optimal maternal nutritional status before conception and during pregnancy plays a crucial role in promoting foetal growth and development [1]. Pre-pregnancy body mass index (PP-BMI), gestational weight gain (GWG) and mid-upper arm circumference (MUAC), as prominent indicators of maternal nutritional status are all associated with birth size among pregnant women in Indonesia [2,3]. Mothers who reside in rural areas are more likely to deliver smaller size infants due to low socioeconomic status. Studies that investigate both birth weight and length among under privileged rural mothers in Indonesia are still limited and far in between, especially in farming communities. Farming families in Indonesia face unique diets, physical demands, limited healthcare, traditional practices, pesticide exposures, and seasonal food insecurity, impacting maternal and child health significantly. This study therefore aimed to estimate the relationship between maternal nutrition and infant birth size in rural Bogor, providing a baseline for targeted interventions.

MATERIALS AND METHODS

This prospective cohort study was conducted at local health centers in Karyamekar and Bojong, and the regional hospital of Cileungsi, Bogor district, from October 2023 to March 2024. The 49 study participants, third-trimester pregnant women with singleton pregnancies, were selected by consecutive sampling based on a sample size calculation using the relative rate and incidence rate formula. Women who had chronic diseases were excluded. Pre-pregnancy body weight, along with birth weight and length recorded immediately after birth, were extracted from the maternal and child health book. In case the mother's weight was unavailable in the book, self-reported weight was considered. Maternal body mass index was computed using measured height. Assessment of weight gain sufficiency followed Institute of Medicine (IOM) recommendations. Mid-upper arm circumference was measured with a MUAC tape for pregnant and lactating mothers. Binary Logistic regression estimated the relationship between nutritional status and birth size using PP-BMI and MUAC.

RESULTS AND DISCUSSION

Results revealed that low birth weight (LBW) and short length at birth were more prevalent among mothers who had gained insufficient weight during pregnancy and had normal PP-BMI. Unlike LBW, short birth length was more frequent among mothers with normal MUAC (Table I). Regardless of PP-BMI, insufficient weight gain may suggest maternal malnutrition, which can delay foetal growth. Slow growth and low birth weight result from metabolic changes, blood flow redistribution, and changes in foetal and placental hormone production [4]. Maternal MUAC and PP-BMI were significantly associated with birth weight. Similarly, birth length showed a significant association with MUAC. Variables that showed significant association with birth weight and length were fed into a logistic regression model to estimate the risk of LBW and short length at birth (Table II).

Table I: Association between nutritional status and birth size

Variable	Birth Weight				p	Birth Length				p
	n=49					n=49				
	NBW	%	LBW	%		NBL	%	SBL	%	
PP-BMI										
Normal	15	37.5	8	88.9		13	39.4	10	62.5	
Overweight	10	25	0	0	0.019*	9	27.3	1	6.3	0.168
Obese	15	37.5	1	11.1		11	33.3	5	31.3	
MUAC										
Normal	38	92.7	3	7.3	<0.001*	30	73.2	11	26.8	0.049*
CED	2	25	6	75		3	37.5	5	62.5	
GWG										
Sufficient	16	40	4	44.4	0.806	15	45.5	5	31.3	0.343
Insufficient	24	60	5	55.6		18	54.5	11	68.8	

Note: *Significant (p≤ 0.05), analysed using Pearson chi-square test
Abbreviations: NBW; normal birth weight, LBW; low birth weight, NBL; normal birth length, SBL; short birth length, PP-BMI; pre-pregnancy body mass index; MUAC; mid-upper arm circumference CED; chronic energy deficiency; GWG; gestational weight gain

Results in Table II demonstrate that pregnant mothers with normal MUAC were 0.024 times less likely to deliver low-birth weight babies compared to mothers who suffered CED (OR 0.024, CI 0.02-0.315) (p=0.05). Although the association between MUAC and birth length is not statistically significant (p>0.05), results suggest that normal MUAC could potentially have a protective effect on short birth length. The present study used an Indonesian cut-off of MUAC ≤23.5 cm to indicate CED. Chronic energy deficiency can occur due to prolonged energy deprivation, thereby exacerbating the risk of LBW by limiting the availability of essential nutrients for foetal growth [5].Findings of the current study demonstrate that majority of the mothers did not attain the recommended weight gain. Additionally, sixteen percent of the mothers suffered CED, three-quarters of whom delivered LBW babies. These findings may suggest an underlying problem related to maternal nutrition inadequacy during pregnancy that could be aggravated by low socio-economic status of the mothers in the study area, portrayed by maternal unemployment and low education.

Table II. Nutritional status as a risk factor of low birth size

Birth Size	Variable	p	OR	95% CI
Birth weight	**PP-BMI**			
	Normal			
	Overweight	0.552	2.143	0.174-26.329
	Obese			
	MUAC			
	Normal	0.05*	0.024	0.02-0.315
	CED			
Birth length	**MUAC**			
	Normal	0.062	0.220	0.045-1.078
	CED			

Note: *significant (p≤ 0.05), analysed using binary logistic regression, R^2=0.577, Accuracy= 91.8

CONCLUSION

The study linked maternal nutritional status with neonatal birth weight and length, showing that mothers with normal MUAC were less likely to have LBW babies. However, cautious interpretation is needed as the odds ratios were unadjusted for confounders. Ensuring optimal maternal nutrition is essential for favourable birth outcomes.

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EXTENDED ABSTRACT

Antioxidant and Nutrient Profile of Instant Powdered Drink Made from Bajakah (*Spatholobus littoralis* Hassk) and Tiwai Onion (*Eleutherine americana* Merr) Extracts

Bernatal Saragih, Angela Christina Nababan, Darma Pawwang, Miftakhur Rohmah, Maghfirotin Marta Banin

Agricultural Product Technology Study Program, Faculty of Agriculture, Mulawarman University, 75119 Samarinda, Indonesia

Corresponding author's email: bernatalsaragih@faperta.unmul.ac.id

SUMMARY

Innovation in making drinks in powder form to make it easier to brew, from local food sources is very important in the development of new functional foods, such as tiwai and bajakah plants. This study aimed to determine the physicochemical characteristics and antioxidants of instant drinks produced. The ratio of tiwai and bajakah extracts did not significantly affect ash content, solubility, brightness level, and sensory properties. It had significant effect on water content, antioxidants, and total flavonoids. The brightness level, measured by L* value ranged from 49.55-53.39, antioxidant capacity ranged from 67.15-114.54 ppm, total flavonoid content ranged from 16.30-20.86 mgCE/100g.

Keywords: Antioxidant, Bajakah, Nutrient, Instant drink, Tiwai onion

INTRODUCTION

Tiwai (Eleutherine americana Merr) or usually known as dayak onion is one of the plants used by local people as traditional medicine and processed ingredients [1]. Tiwai onion contains bioactive compounds such as alkaloids, glycosides, flavonoids, phenolics, steroids, and tannins which can be used as functional food as cholesterol lowering [2]. Drinking tiwai coffee twice a day could decrease inflammation that indicated by lowering lymphocytes, morever, erythrocyte sedimentation rate (ESR) and monocytes decreased from high to normal categories [3]. Bajakah (Spatholobus littoralis Hassk) contains phenolic compounds, flavonoids, tannins and saponins. Bajakah extract contains phenolic compounds, quinones, steroids, and can be used to inhibit thyroonase and anti-inflammatory [4]. Combining these two plants is expected to be able to produce instant drink products that have health benefits and can be an innovation of functional food products.

MATERIALS AND METHODS

The process of making instant drinks starts from making tiwai onion extract, which is sliced to a thickness of ±3 mm then mashed and filtered. Meanwhile, Bajakah extract is obtained from Bajakah which is baked in an oven at 50°C for 24 hours, then boiled in the water for 20 minutes until Bajakah extract comes out and then filtered. Then the extract is mixed with the ratio of tiwai onion: bajakah (ml) respectively P1=20:0, P2=15:5, P3=10:10, P4=5:15, P5=0:20 and K (control)= 20 ml of water. Next, 200g of palm sugar is thinly sliced, then mixed with 20ml of mixed tiwai and bajakah extract, then heated in a pan and stirred until crystals form, then cooled while still stirring until fine grains form. The analyzes carried out included antioxidant activity (spectrophotometric method with DPPH/2-diphenyl-1-picrylhydrazy, total flavonoids (colorimetric assay), water content, ash content, solubility (Powder that remains on the filter paper, after brewing, filtering, vacuuming and drying) , color and sensory properties (25 panelist).

RESULTS AND DISCUSSION

The results of the parameter analysis according to the treatment ratio of tiwai onion extract and bajakah extract are shown in Table I.

The comparison of tiwai and bajakah extracts did not significantly affect ash content, solubility, brightness level, and sensory properties. However, there was a significant effect on water content, antioxidants, and total flavonoids. The L* value is at 49.55 to 53.54, which means the instant drink has a fairly light color. The

Table I. Parameter analysis results of instant drink bajakah extract and tiwai onion extract

Parameter	Treatment					
	P0 (control)	P1	P2	P3	P4	P5
Chemical characteristics						
Water content (%wb)	3.85± 0.064[a]	4.73±0.239[b]	3.89±0.406[a]	3.99±0.501[a]	4.80±0.300[b]	4.49±0.013[ab]
Ash content (%db)	2.45±0.003[a]	2.48±0.001[a]	2.51±0.013[a]	2.53±0.009[a]	2.66±0.016[a]	2.90±0.149[b]
Antioxidants activity (ppm)	114.54±16.3[a]	67.40±3.45[b]	67.15±4.0[b]	90.30±1.28[b]	79.66±11.05[b]	70.03±10.55[b]
Flavonoid(mgCE/100g)	11.17±0.03[a]	16.30±0.02[b]	15.85±0.01[b]	17.20±0.02b[c]	20.39±0.11[c]	20.86±0.03[c]
Physical characteristics						
Solubility (%)	55.39±0.94	55.42±0.87	55.16±0.71	55.49±1.33	54.11±1.35	56.05±0.87
Color Test						
L*	53.39±1.21	49.75±1.07	50.48±3.68	53.48±1.08	49.55±1.39	50.08±1.90
a*	8.62±0.24	8.56±0.4	8.63±0.63	8.82±0.16	9.15±0.06	9.27±0.46
b*	17.36±0.22	19.70±1.69	17.84±3.41	20.82±0.61	18.81±1.14	19.25±1.88
Sensory characteristics						
Acceptance rate						
Color	3.36±0.14[a]	3.93±0.23[b]	3.96±0.13[b]	4.06±0.15[b]	4.01±0.14[b]	3.97±0.24[b]
Aroma	3.65±0.15	3.96±0.24	3.82±0.19	3.91±0.31	3.89±0.06	4.01±0.36
Taste	3.90±0.27	4.07±0.14	3.63±0.37	4.02±0.17	4.12±0.17	2.94±00
Sensory attribute rate						
Browniness	2.75±0.16[a]	3.12±017[ab]	4.29±0.41[b]	4.42±063[b]	4.42±0.35[b]	4.17±0.23[b]
Aroma of tiwai	3.12±0.17	3.17±0.08	3.03±0.17	2.99±0.20	3.17±0.08	3.01±0.18
Sweetness	3.32±0.27	2.94±0.18	3.14±0.19	3.12±0.08	2.86±0.08	3.21±0.01

Note: P0 (without tiwai and bajakah extracts); P1 (100% tiwai extract: 0 % bajakah extract); P2 (75% tiwai extract: 25% bajakah extract); P3 (50% tiwai extract: 50% bajakah extract); P4 (25% tiwai extract: 75% bajakah extract); P5 (0% tiwai extract: 100% bajakah extract).
Hedonic scale (1 = dislike very much, 2 = dislike slightly, 3 = neither like nor dislike, 4 = like slightly, 5 = like very much)
Sensory attribute rate; Browniness; 1= very blackish brown, 2= blackish brown, 3= slightly blackish brown, 4= brown and 5=reddish brown. Aroma of tiwai; 1= very unscented tiwai 2= no tiwai scented, 3= slightly tiwai-scented, 4= tiwai-scented and 5= very tiwai-scented. Sweetness 1= not sweet, 2= slightly sweet, 3= sweet, 4= more sweet and 5= very sweet.
L* = lightness, a* = redness, dan b* = yellowness
Data (mean ± standard deviation) obtained from 3 replications. Data in the same row followed by the same letter showed no significant difference with LSD test at the level of $\alpha<0.05$

antioxidant activity of tiwai and bajakah instant drinks is between 67.15-114.54ppm. The highest flavonoids were obtained when 20ml of bajakah extract was added, namely 20.86 mgCE/100g. The total flavonoid test results showed that the addition of bajakah extract could be increase the flavonoid content in instant drinks. Flavonoids, tannins and alkaloids are some of the dominant components in bajakah extract [5]. The results of the sensory test (color, aroma and taste) were neither like nor dislike [3] and like slightly [4] by the panelists.

CONCLUSION

The instant drink obtained had an antioxidant activity between 67.15-114.54 ppm. The highest flavonoid value was 20.86 mgCE/100g with the addition of 20ml of bajakah extract. The instant drink has a brownish red color and the sensory parameters were accepted by the panelists.

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EXTENDED ABSTRACT

Increasing the Dietary Fibre Content of Chicken Sausage Using Pigeon Pea (*Cajanus cajan*) Flour

Jeallyza Muthia Azra[1,2], Hendra Wijaya[1,3], Zuraidah Nasution[4]

[1] Department of Nutrition, Faculty of Health Sciences, Universitas Esa Unggul, 11510 West Jakarta, Indonesia
[2] Department of Nutrition, Faculty of Public Health, Universitas Andalas, 25128 Padang, Indonesia
[3] Research Centre for Biotechnology, Indonesian Institute of Sciences, Jalan Raya Bogor Km. 46, 16911 Cibinong, Indonesia
[4] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: jeallyzamuthia@ph.unand.ac.id

SUMMARY

Pigeon pea is a good source of fiber. This study explored the use of pigeon pea (*Cajanus cajan*) flour (PPF) in chicken sausages with five formulas (100:0 (control), 75:25, 50:50, 25:75, and 0:100 w/w). Laboratory analysis revealed increased ash (2.37-2.91%), carbohydrate (6.64-33.11%), and dietary fibre (16.95-20.13%), while moisture (46.68-74.28%), and protein (12.36-13.8%) decreased following increasing PPF. PPF did not affect pH but decreased brightness and increased redness. Sensory evaluation showed no significant difference in color, taste, texture, aftertaste, and overall acceptability between control and the 75:25 PPF-chicken formulation, suggesting that PPF is a good source of fiber in sausage production without affecting consumer acceptance.

Keywords: Chicken sausage, Dietary fibre, Physicochemial characteristics, Pigeon pea flour, Sensory acceptance

INTRODUCTION

Recently, plant-based products have gained more attention for their protein, dietary fiber, and bioactive substances. Specifically, pigeon pea shows potentials as a meat replacement due to its nutritional and health benefits, as well as its low production cost [1] . Pigeon pea is a good source of protein (23.96-24.20%), crude fiber (3.58-5.50%), carbohydrate (69.48-69.82%), and fat (1.51-1.61%) [2], and it has been shown to exhibit hypocholesterolemic and hypoglycaemic effects [1]. Pigeon pea protein has been successfully iused to enhance the physical properties of sausages, owing to its effective fat- and water-binding capacities and its ability to form stable emulsions [3]. Therefore, substituting chicken with pigeon pea in sausage production may offer benefits for the food industry, consumers, and sustainability of future food supply. This study aimed to optimize the substitution of chicken breast with various amounts of pigeon pea flour and evaluate the physicochemical properties and sensory acceptance of the sausage products.

MATERIALS AND METHODS

Five formulas of chicken sausages with pigeon pea flour (PPF) were prepared (Table I) using ingredients purchased from a local market. The chicken meat, PPF, and other ingredients were blended for 5 minutes, then stuffed into collagen sausage casings and steamed for 15 minutes. Afterwards, the sausages were cooled and stored at 4 °C±1 °C until further analysis. The samples were evaluated for their physical properties (pH and colour), chemical composition (proximate analysis and dietary fibre), and sensory acceptance (rating test with hedonic scale). A total of 35 semi-trained panelists, all students of IPB University in Indonesia, were invited to participate. Data were presented as the mean of two independent replicates and expressed as the average ± SD. Statistical significance was assessed using one-way ANOVA, and differences among formulations were analyzed using Tukey's test ($P< 0.05$).

Table I. Chicken breast sausage formulas substituted with PPF

Ingredients (g, %)	Formulas (chicken breast:PPF)				
	100:0	75:25	50:50	25:75	0:100
Chicken breast	100 (56.79)	75 (37.29)	50 (24.86)	25 (11.06)	0 (0.00)
PPF	0 (0.00)	25 (12.43)	50 (24.86)	75 (33.17)	100 (44.23)
Water	25 (14.20	50 (24.86)	50 (24.86)	75 (33.17)	75 (33.17)
Tapioca flour	10 (5.68)	10 (4.97)	10 (4.97)	10 (4.42)	10 (4.42)
Ice	25 (14.20)	25 (12.43)	25 (12.43)	25 (11.06)	25 (11.06)
Spices	16.1 (9.14)	16.1 (8.01)	16.1 (8.01)	16.1 (7.12)	16.1 (7.12)
Collagen casing					
Total	176.1 (100.00)	201.1 (100.00)	201.1 (100)	226.1 (100)	226.1 (100)

Note: PPF=Pigeon pea flour

RESULTS AND DISCUSSION

The effects of varying levels of PPF as a substitute for chicken breast on the physicochemical characteristics of sausages are presented in Table II. The ash, carbohydrate, and dietary fibre content increased significantly ($P<0.05$) with the increasing use of PPF. This can be attributed to higher ash (4.36-4.92%), carbohydrate (62.78-69.48%), and dietary fiber content (3.58-5.50%) in pigeon pea as compared to chicken breast [1,2]. However, the moisture and protein content of sausage samples significantly decreased as the concentration of PPF increased ($P<0.05$). These decline is attributed to the higher content of moisture (73.9%) and protein (22.5%) content in chicken breast compared to pigeon peas (10.08-11.92% and (21.70-23.96%), respectively) [1,2,4] . This result aligns with a previous study, which found that protein content in PPF is lower in flour than in isolate [3] . Despite the decrease in protein concentration, formulas with up to 50% PPF still met the required protein content for meat sausages (>13%) [5] .

The pH of the samples was not significantly affected by the use of PPF ($P>0.05$), while the color showed the opposite trend (Table II). The L* values (brightness) decreased significantly with increasing PPF concentration, likely due to the darker colour of PPF [2], leading to a darker appearance of the samples, as shown in Table III.

Sensory analysis indicated that the sample with 25% PPF was not significantly different from the control in terms of color, taste, texture, aftertaste, and overall acceptability (Table III). This suggests that 25% PPF can be used to substitute chicken meat in sausage production without affecting panelist's acceptance, except for aroma, influenced by the beany characteristics of PPF.

Table II. Physicochemical characteristics of cooked chicken breast sausage substituted with PPF

Parameters	Formulas (chicken breast:PPF)				
	100:0	75:25	50:50	25:75	0:100
Moisture (%)	74.28±0.04^{a}	64.77±0.04^{b}	56.13±0.04^{c}	52.22±0.00^{d}	46.68±0.28^{e}
Ash (%wb)	2.37±0.01^{c}	2.36±0.01^{c}	2.78±0.49^{b}	2.68±0.04^{b}	2.91±0.04^{a}
Fat (%wb)	3.20±0.13^{e}	3.97±0.03^{d}	5.69±0.06^{a}	5.43±0.04^{b}	4.34±0.06^{c}
Protein (%wb)	13.80±0.07^{a}	13.52±0.02^{b}	13.32±0.03^{c}	12.96±0.01^{d}	12.36±0.02^{e}
Carbohydrate (%wb)	6.64±0.20^{e}	15.08±0.02^{d}	22.07±0.04^{c}	27.31±0.01^{b}	33.11±0.27^{a}
Dietary fibre (%wb)	16.95±0.02^{a}	17.32±0.02^{b}	17.53±0.02^{c}	20.06±0.00^{d}	20.13±0.02^{e}
pH	6.31±0.01^{a}	5.96±0.39^{a}	5.60±0.16^{a}	6.36±0.01^{a}	6.20±0.26^{a}
L*	78.88±0.40^{a}	56.82±0.73^{b}	49.33±0.24^{c}	43.01±1.43^{d}	37.90±0.44^{e}
a*	4.19±0.04^{d}	6.85±0.13^{c}	9.84±0.13^{b}	10.44±0.21^{a}	9.94±0.13^{b}
b*	11.33±0.09^{b}	10.13±0.32^{c}	12.72±0.13^{a}	11.14±0.46^{b}	10.82±0.32^{b}
Colur intensity					

Note: Values with different superscript letters within a column are significantly different ($P<0.05$). PPF=Pigeon pea flour

Table III: Sensory acceptance scores of cooked chicken breast sausage substituted with PPF

Attributes	Formulas (chicken breast:PPF)				
	100:0	75:25	50:50	25:75	0:100
Colour	6.63±1.88^{a}	6.23±1.37^{a}	4.54±1.44^{b}	3.14±1.57^{c}	3.14±1.47^{c}
Aroma	7.28±1.49^{a}	6.43±1.01^{b}	5.26±1.37^{c}	3.97±1.31^{d}	3.31±1.25^{d}
Taste	7.43±1.38^{a}	7.05±1.08^{a}	5.11±1.51^{b}	3.57±1.53^{c}	2.54±1.35^{d}
Texture	6.88±1.47^{a}	6.91±0.91^{a}	4.77±1.57^{b}	4.08±1.80^{b}	3.06±1.45^{c}
After taste	7.11±1.67^{a}	6.80±1.05^{a}	4.80±1.56^{b}	3.54±1.55^{c}	2.45±1.31^{d}
Overall acceptability	7.40±1.03^{a}	7.00±1.00^{a}	4.97±1.40^{b}	3.65±1.41^{c}	2.88±1.20^{d}

Notes: Values with different superscript letters within a column are significantly different ($P<0.05$). PPF=Pigeon pea flour . 9-point hedonic scale (9 = like extremely, 8 = like very much , 7 = like moderately, 6 like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, 1 = dislike extremely).

CONCLUSION

Substituting chicken meat with pigeon pea flour (PPF) in sausages production increased the ash, carbohydrate, and dietary fiber content, while decreasing moisture and protein content. Higher amount of PPF did not affect the samples' sensory acceptance (up to 25% PPF) and pH, but it altered their colour. Chicken sausages with 25% PPF could be a healthier product without altering sensory acceptance.

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EXTENDED ABSTRACT

Development of Cookies from Moringa and Soybean Flour as an Alternative Snack for Adolescent Girls

Desika Winasti Imran, Aldiza Intan Randani, Nurdin Rahman, Jamaluddin Sakung

Department of Nutrition, Faculty of Public Health, University of Tadulako, 94148 Palu, Indonesia

Corresponding author's email: randanidiza49@gmail.com

SUMMARY

Snacks which contain iron and protein can become an alternative solution for improving adolescent girls' intake. Moringa and soybeans, local food in Palu containing iron and protein, have the potential to improve the health of adolescent girls. This study aims to formulate cookies using varying ratios of moringa and soybean flour (F1=50%:25%; F2=40%:35%; F3=30%:45%; F4=20%:55%). The results showed that F3 produced the highest iron (11.008mg/100g) and protein content (23.56g/100g). Hedonic test showed that F4 was the most preferred cookies. Thus, F3 can be recommended as an alternative snack for adolescent girls to help fulfill their need of iron and protein.

Keywords: Adolescent girls, Anemia, Cookies, Moringa, Soybean

INTRODUCTION

In Palu, the iron and protein intake of adolescent girls meet 64.3% and 30.5% of RDA. This is under the standard for improving health outcomes and may lead to anemia [1]. In 2018, 32% of adolescent girls in Indonesia were anemic [2]. The annual consumption of cookies in Indonesia is 21.185 kg, which are commonly favored by them. The use of moringa and soybean flour as key ingredients offers an innovative way to address this issue. Moringa contain protein levels twice as high as other vegetables, while soybeans' protein and iron aids in red blood cell production. Each one of moringa and soybean flour has 25.30% and 40.4% protein also 97.9 µg/g and 8.4g/100g iron [3]. Combining these ingredients is expected to increase nutritional content of a product. This research focuses on analyzing iron and protein content of product and evaluating sensory preferences to create an alternative snack for adolescent girls.

MATERIALS AND METHODS

This study employed a randomized design, using moringa flour, soybean flour, and wheat flour in four formulations: F1(50% moringa, 25% soybean), F2(40% moringa, 35% soybean), F3(30% moringa, 45% soybean), and F4(20% moringa, 55% soybean). The assessment of protein and iron content was conducted in January 2024 at the Research Laboratory of the Faculty of Mathematics and Natural Sciences, Tadulako University. The research involved laboratory analysis with two replicates. Iron content was analyzed using the colorimetric method, and protein content was assessed using the Kjeldahl method. Data analysis for iron and protein content was conducted in Microsoft Excel, employing descriptive statistics such as mean and standard deviation. A sensory organoleptic test was performed using a hedonic test with 30 semi-trained panelists. Results were analyzed using the Kruskal-Wallis Test and continued with Mann-Whitney as the post hoc test with SPSS 16 to detect differences between formulations.

RESULTS AND DISCUSSION

The results revealed variations in iron and protein content across formulations (Table I). F3 exhibited the highest iron and protein levels, while F1 had the lowest. The content of moringa and soybean influenced protein levels in each sample, with 30% moringa flour and 45% soybean flour blend yielding the highest iron and protein content. A prior study showed that differences of iron and protein between formulation due to protein denaturation caused by heating and variations in baking temperatures during the cookie-making process. Those differences also caused by the proportion of soybean flour in each formulas [4].

While the cookies formulation may not fully meet 10% daily adequacy requirement for iron and protein of adolescent girls. All formulations adhere to SNI standard for protein content (SNI 2973-2022) [5]. This compliance ensures the nutritional quality of cookies,

Table I: Iron and Protein content of cookies that were made from moringa flour and soybean flour (Mean ± Standard Deviation)

Formulation of Cookies	Iron Content (mg/100 g)	Protein Content (g/100 g)
F1	4.8480 ± 0.10	10.7695 ± 0.49
F2	6.9445 ± 0.51	12.5305 ± 0.37
F3	11.0080 ± 0.24	23.5605 ± 0.28
F4	7.6995 ± 0.41	17.5530 ± 0.83

Notes: g–gram, mg–milligram, F1–moringa flour: soybean flour 50%:25%, F2–moringa flour: soybean flour 40%:35%, F3–moringa flour: soybean flour 30%:45%, F4- moringa flour: soybean flour 20%:55%.

making them a dependable snack option for adolescent girls. Despite falling short of the 10% daily adequacy, this development cookie can be recommended as a supplementary food due to its sufficient iron and protein content. By applying the research practically, we highlight its relevance to nutrition.

Panelists showed different preferences for color, aroma, texture, and taste across cookie formulations (Table II). The hedonic test identified F4 as the favored formulation. The inclusion of moringa flour impacted cookies' characteristics, with F4 containing less moringa flour compared to other formulations. Increasing the amount of moringa flour resulted in darker color, a more distinct moringa aroma, and a harder texture. The taste of product was also influenced by proportion of moringa flour, attributed to the unique taste of moringa. Previous research revealed that the higher of moringa flour proportion, color and aroma of cookies would be stronger which could be unpleasant. Additionally, the more moringa and soybean flour were substituted into product, the texture would be harder [4].

CONCLUSION

Cookies F3 from moringa and soybean flour had the highest iron and protein content although it did not meet 10% daily adequacy requirement. The panelists also favored F3. This F3 development can be used as a supplementary food to prevent anemia in adolescent girls, contributing significantly to their nutritional requirements.

Table II: Sensorial test of cookies that were made from moringa flour and soybean flour

Formulation	Parameter			
	Color	Aroma	Texture	Taste
	Median			
F1	2^{a}	3^{a}	3^{a}	2^{a}
F2	3^{a}	$3,5^{ab}$	4^{b}	4^{b}
F3	$3,5^{b}$	4^{bc}	4^{c}	4^{c}
F4	4^{c}	4^{c}	4^{bc}	4^{c}
P-Value	0.000	0.001	0.000	0.000

Notes: a significant difference (α≤0.05) with Kruskall Wallis test, Letter notations (a,b,c) that are different indicate a significant difference (α≤0.05) using Mann-Whitney as the post hoc test.

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EXTENDED ABSTRACT

Effectiveness of Catfish Nuggets to Improve Nutritional Status and Prevent Stunting in Toddler

Sus Widayani[1], Muhammad Ansori[1], Bambang Triatma[2], Romiyatun Mijiling Astuti[1], Tri Hanan Soleh[1], Hasna Candra Ningsih[1], Ahmad Fadilah[1], Diel Piero Junior[1]

[1] Culinary Education Study Program, Universitas Negeri Semarang, Semarang, Indonesia
[2] Family Welfare Education Study Program, Universitas Negeri Semarang, Semarang, Indonesia

Corresponding author's email: widayani_dr@mail.unnes.ac.id

SUMMARY

The research aims to study the effectiveness of providing catfish nuggets and their nutritional status. The results of interviews with village heads and toddler mothers showed that 90% of mothers worked outside the home as factory employees, working full time all day, often overtime until late at night, taking care of toddler by grandmothers who can no longer take care of their grandchildren. Children's food consumption isn't managed, don't eat enough. Children are quiet and not fussy, a benchmark for healthy children. Providing nuggets is efficacious in improving the nutritional status and preventing stunting.

Keywords: Adolescent girls, Anemia, Cookies, Moringa, Soybean

INTRODUCTION

The stunting rate in Semarang City is high. The leading cause is malnutrition due to hardship and lack of food. Catfish nuggets, a superior research product in 2019, are rich and high in 14.9% protein [1], which can improve nutritional status and prevent stunting. There will be a reduction and free of stunting. Nuggets are liked as a snack or side dish to increase toddlers' protein needs. According to village cadres and midwives, the local government handles several stunted toddlers. The presence of village midwife is very active in running the neatly scheduled posyandu and is always actively present to encourage cadres and mothers of toddlers. However, mothers' nutritional knowledge is relatively low, resulting in feeding toddlers often not focusing on nutritional content but rather as long as they are allowed to eat, eat as they please, and eat as long as they are full. The Dashat Program was created to overcome stunting in Branjang Village. Village communities independently supply ingredients from local villages and prepare nutritious food for pregnant women and toddlers.

MATERIALS AND METHODS

Experimental method with a randomized control trial design. The nugget consumption control card is used as a measuring tool for nugget consumption. The effectiveness of giving catfish nuggets in improving nutritional status and the incidence of stunting in children under three years old (toddlers) was carried out in 2 stages: laboratory scale production of catfish nuggets and field investigations in giving nuggets. Catfish nuggets formula in previous research [2,3]. Before catfish nuggets were given to respondents, the research team invited partners, the community and the media to campaign and socialise eating nuggets to introduce high protein nuggets, which are helpful for increasing protein adequacy and growth of toddlers. Before and after distribution were collected for anthropometric measurements. The distribution is accompanied by the provision of control cards for the consumption of catfish nuggets. Nuggets are distributed by enumerators at the beginning of every month on the first Saturday for the next 1 week while interviewing the toddler's mother and placing a control card on catfish nugget consumption for the next week.

RESULTS AND DISCUSSION

Campaign and socialisation of eating catfish nuggets to toddlers. held on Tuesday, June 20, 2023, at the Dahlia Posyandu, Branjang Village, West Ungaran District, Semarang. Presented material on nutrition, stunting, and the benefits of catfish nuggets. The catfish nugget distribution activity was carried out after the catfish nugget eating campaign. Distribution (per week) is 700 grams of catfish nuggets per person. The effectiveness of providing catfish nugget consumption is determined by the nutritional status and consumption of catfish nuggets. Nutritional status reflects the child's health due to energy and nutrient consumption in the previous few days. [4]. Based on control card records, the average daily

Table I: Distribution of 'Batita' children by nutritional status based on W/A index

Nutritional status	SD	n(P)	%	n(K)	%
Before intervention (May)					
Very underweight	<-3 SD	2	6.7	3	10
Underweight	-3 SD to <-2 SD	5	16.6	3	10
Normal weight	-2 SD to +1 SD	23	76.7	23	76.7
Risk of overweight	>+1 SD	0	0	1	3.3
Total		30	100.0	30	100.0
After intervention (July)					
Very underweight	<-3 SD	0	0	3	10
Underweight	-3 SD to <-2 SD	3	10	6	20
Normal weight	-2 SD to +1 SD	25	83.3	21	70
Risk of overweight	> +1 SD	2	6.7	0	0
Total		30	100.0	30	100.0

Notes: n(P): Treatment sample; n(K): Control sample

Table II: Distribution of 'Batita' children according to daily energy and protein consumption

Energy and protein consumption	n(P)%		n(K)%	
	> Mean	< Mean	> Mean	< Mean
Before intervention				
Energy	19 (63)	11 (37)	24 (80)	6 (20)
Protein	25 (83)	5 (17)	24 (80)	6 (20)
Total	44 (73)	16 (27)	48 (80)	12 (20)
After intervention				
Energy	24 (80)	6 (20)	23 (77)	7 (23)
Protein	30 (100)	0 (0)	22 (73)	8 (27)
Total	54 (90)	6 (10)	45 (75)	15 (25)

Notes: n(P): Treatment sample; n(K): Control sample

consumption of toddlers is sufficient, mainly according to the recommended nutritional values [5]. The average energy consumption of toddlers aged 1 - 3 years per day is 1350 kcal, and protein is 20 g. The effectiveness of providing consumption of nutritious catfish nuggets is measured through indicators, number of nuggets (JN), frequency of eating nuggets (FN), and number of grams of nuggets (GN). Continuous evaluation is essential to ensure continued effectiveness. Based on the statistical results of the multiple regression test, it was obtained that R^2 = 0.893, meaning that around 89.3% of the variation in the dependent variable of nutritional status or stunting could be explained by this regression model from the variables of status and consumption of catfish nuggets. For about 10.7% can be explained by several external factors, such as hygiene, sanitation, household food security, and so on.

CONCLUSION

There is a strong relationship between giving nuggets

Table III: Distribution of 'Batita' children by dit Status Based on H/A Index

Stunting Status	SD	n(P)	%	n(K)	%
Before Intervention					
Very short height	<-3 SD	9	30	11	37
Short height	-3 SD to <-2 SD	4	14	2	7
Normal height	-2 SD to +3 SD	16	53	16	53
High height	>+3 SD	1	3	1	3
Total		30	100	30	100
After Intervention					
Very short height	<-3 SD	4	13	11	36
Short height	-3 SD to <-2 SD	2	7	2	7
Normal height	-2 SD to +3 SD	20	67	17	57
High height	>+3 SD	4	13	0	0
Total		30	100	30	100

Notes: n(P): Treatment sample; n(K): Control sample

to improve nutritional status and preventing stunting which the effectiveness can explain, as well as energy and protein consumption with R2 = 0.66 with p=0.02 ($p<0.05$). There was statistically significant evidence of the t-test between stunting conditions before and after nugget administration ($p<0.05$/p=0.000). Even though effective, it doesn't mean that providing nuggets will directly improve nutritional status or prevent stunting. Other factors still influence the improvement of nutritional status and the prevention of stunting.

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EXTENDED ABSTRACT

Evaluation of Calcium (Ca) and Magnesium (Mg) Content of Sprinkles Produced from Chicken Feet and Mung Bean (*Vigna radiata*)

Kurnia Dwi Juliani[1], Hardinsyah[2], Eny Palupi[2], Isniati Dwijayanti[1]

[1] Department of Nutrition, Faculty of Health Sciences, Universitas Esa Unggul, 11510 Jakarta, Indonesia
[2] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: kurnia.dwi@esaunggul.ac.id

SUMMARY

The utilization of chicken feet and mung beans is limited. Processing them into sprinkles is expected to become a way of utilizing their use. This study aimed to evaluate the calcium and magnesium content of the sprinkles. The content of calcium and magnesium of the formula with variable amounts of chicken feet and mung beans were analyzed by Flame-AAS. The average concentrations of calcium and magnesium varied between 962.10-1227.80 mg/100g and 204.35–283.02 mg/100g, respectively, with no significant differences observed among the four formulas. In addition, the calcium content of F2 meets the "high" nutrient claim as per BPOM regulations.

Keywords: Calcium, Chicken feet, Magnesium, Mung beans, Sprinkles

INTRODUCTION

Adequate calcium and magnesium intake is essential for human body health. These minerals play an important role for physiology of human body such as in DNA repairing, bone metabolism, and especially for magnesium, it has role as enzymatic cofactor [1]. Chicken feet have been recommended as a food source that can contribute to sufficient calcium intake [2]. Until now, chicken feet have been underutilized due to their numerous bones. Therefore, the development of sprinkles made from chicken feet is aimed at optimizing their use. Besides, mung beans are considered as a good source of magnesium [3]. Their utilization represents an innovative approach to enhance calcium and magnesium intake levels. Since there is no existing research on the nutrient content of this type of sprinkle, this study aimed to evaluate the calcium and magnesium content of sprinkles with different formulation of chicken feet and mung beans flours.

MATERIALS AND METHODS

The primary ingredients included broiler chicken feet and mung beans. Broiler chicken feet were chosen over country (kampong) chicken due to their easier-to-crush bones and higher collagen content. These materials were procured from traditional markets. The pre-experimental method with completely randomized design (CRD) was applied. The sprinkles were produced by mixing chicken feet flour and mung beans flour. Chicken flour was produced by pressure cooking the chicken feet for 3 h, followed by drying process for 20 h at 60°C, and grounding into fine powder. The mung bean flour was made by many steps, such as boiling the clean bean, drying, crushing, and then sieving through an 80-mesh sieve. The four formulas were determined by ratio of chicken feet and mung beans flour. The minerals Ca and Mg were examined using Flame Atomic Absorption Spectrometry (Flame-AAS), analyzed statistically using one-way ANOVA, and if the p-value was <0.05, it was considered statistically significant.

RESULTS AND DISCUSSION

Laboratory analysis showed that F2 had a calcium content ranging from 962.10 to 1227.80 mg/100g, with statistical analysis indicating no significant differences between the formulas. This result may have occurred due to the determination of the formulations. Although the F1 contained the most chicken feet flour, the combination of chicken feet flour and mung bean flour in the F2 formulation contributed the most to the calcium content. The previous study showed that chicken feet flour contained 1.194% of the calcium in 100 g chicken feet flour which was categorized as "high" nutrient claim according to Badan Pengawas Obat dan Makanan (BPOM) Regulation [4]. Regardless, there were no significant differences among the four formulas. Although the magnesium content of sprinkles was higher in F1, the magnesium content of the four formulas was also considered not statistically significant (Table I).

Table I: Calcium and magnesium contents of the sprinkles

Contents	Minerals contents (mg/100 g)			
	F1 (3:1)	F2 (2:1)	F3 (7:5)	F4 (1:1)
Calcium	1119.70±57.14[a]	1227.80±134.10[a]	1166.57±0.69[a]	962.10±94.80[a]
Magnesium	283.02±67.83[a]	204.35±18.82[a]	210.68±24.81[a]	258.70±96.77[a]

Note: Different superscript letters showed that there were significantly different results ($p<0.05$), analysed using one-way ANOVA. The formulations was determined by using chicken feet flour: mung beans flour ratio.

Considering the calcium and magnesium levels from this product, we expect that this product can be an alternative additional food especially for groups who vulnerable to malnutrition or need more calcium and magnesium. For the example, in pregnant women, they have high requirement for calcium and magnesium. During pregnancy, women need high calcium and magnesium for various biological process, such as growth, development and formation of cell or tissue.

As a simulation, if applied to pregnant women, this product is suggested to be consumed in an amount of 15 g and twice a day or 30 g/day. In example, the consumption of 30 g/day of F2 will contribute to 31% daily calcium adequacy and 19% daily magnesium adequacy in second trimester pregnant women aged 19-29 years. Based on The Indonesian Food and Drug Authority (BPOM) regulations, the calcium and magnesium content of F2 met the claim "high" nutrient.

CONCLUSION

In conclusion, there were statistically no significant differences of the average calcium and magnesium concentrations between four formulas. The F2 sprinkle had "high" claim terms especially in calcium content. The further study about mineral bioaccessibility and bioavailability are important to do for investigating its potential for absorption and utilization.

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EXTENDED ABSTRACT

Effect of Cowpea (*Vigna unguiculata* (L.) Walp) Substitution on Tannin, Protein, and *in vitro* protein digestibility of Sorghum (*Sorghum bicolor* (L.) Moench) Sprouted Rice

Endah Wulandari[1], Desi Harneti Putri Huspa[2], Afra Hafny Noer[3], Fitry Filianty[1]

[1] Department of Food Industry Technology, Faculty of Agricultural Industrial Technology, Universitas Padjadjaran, 45363 Sumedang, Indonesia
[2] Department of Chemistry, Faculty of Maths and Science, Universitas Padjadjaran, 45363 Sumedang, Indonesia
[3] Department of Psychology, Faculty of Psychology, Universitas Padjadjaran, 45363 Sumedang, Indonesia

Corresponding author's email: endah.wulandari@unpad.ac.id

SUMMARY

The addition of cowpea is intended to increase the protein content and digestibility of sorghum rice, while the decrease in tannin content is done by the germination process. The purpose of this study was to determine the amount of cowpea substitution that can increase protein content and protein digestibility. The methodology used was experimental. The results showed that cowpea substitution up to 50% could increase tannin content, protein and protein digestibility by 0.45%, 7.52%, and 35.29%, respectively. The germination process can reduce the tannin content by 0.27% and increase the protein content and protein digestibility by 11.79% and 49.55%, respectively.

Keywords: Cowpea, Digestibility, Germination, Sorghum rice, Tannin

INTRODUCTION

Sorghum is a cereal that has the potential to be developed with a protein content of 8-12% while the protein content of rice is only 6-10%, so sorghum has the potential to be a suitable material to be used in a high-protein food diversification programme. One of the weaknesses of sorghum is its low protein digestibility because it contains anti-nutritional substances such as tannins and kafirin (71.40%) which have many disulfide bonds (550.43 µmol/g) making it difficult to digest by human digestion. One way to increase protein content and protein digestibility of sorghum is the process of germination and substitution with cowpeas. In 100 grams of cowpea contains 22.9 grams of protein and 6.8 grams of amino acid lysine. In this study, sorghum rice and sorghum sprouted rice substituted with cowpea were produced [1].

MATERIALS AND METHODS

The materials used were sorghum Bandung Local Cultivar, cowpea from West Java Indonesia. The research method used was experimental with the comparison of sorghum rice or sorghum sprouts and cowpea as follows:
A. SR 91 = Sorghum Rice:Cowpea = 90:10 (w/b)
B. SR 73 = Sorghum Rice:Cowpea = 70:30 (w/b)
C. SR 55 = Sorghum Rice:Cowpea = 50:50 (w/b)
D. SS 91 = Sorghum Sprouted Rice:cowpea= 90:10 (w/b)
E. SS 73 = Sorghum Sprouted Rice:cowpea = 70:30 (w/b)
F. SS 55 = Sorghum Sprouted Rice:cowpea = 50:50 (w/b)

Method of making sorghum sprouts is following [2], the method of making Cowpea-Substituted Sorghum Rice is following [3], both with slight modification.

In-vitro protein digestibility test refers to [4]. The enzymes used in the test are pancreatin, trypsin, and chymotrypsin from Sigma, Germany. The calculation is as follows:

$$\text{Protein Digestibility (\%)} = \frac{\text{sample absorption-sample blank absorption}}{\text{control absorption-control blank absorption}} \times 100\%$$

RESULTS AND DISCUSSION

Tannin Content

The tannin content of sorghum rice and sorghum sprouted rice with cowpea can be seen in Fig. 1. The cowpea substitution with a ratio of 50:50 exhibited the highest tannin content, with values of 0.45% and 0.27%. The germination process resulted in a decrease of 0.18% in tannin content. This can be attributed to the dissolution of tannins present in sorghum during soaking, as stated in statement [5].

Protein Content

The protein content of sorghum rice and sorghum

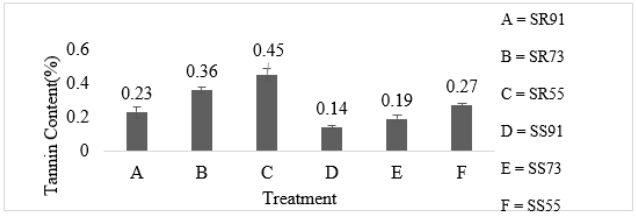

Figure 1: Tannin Content of Sorghum Rice Substituted by Cowpea

sprouted rice substituted with cowpea can be seen in Fig. 2. The highest protein content was observed in the 50:50 cowpea substitution, reaching 7.52% in sorghum rice and 11.79% in sorghum sprouted rice. This evidence suggests that cowpea substitution enhances protein content, particularly during the germination process. The synthesis of amino acids and protease enzymes during germination results in a quantifiable increase in protein content [1].

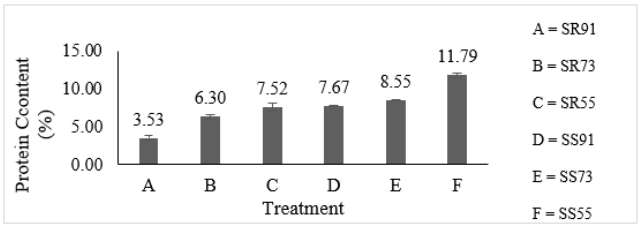

Figure 2: Protein Content of Sorghum Rice Substituted by Cowpea

In-Vitro Protein Digestibility

The *in-vitro* protein digestibility of sorghum rice and sorghum sprouted rice is shown in Fig. 3. The highest in-vitro protein digestibility of sorghum rice and sorghum sprouted rice was observed in the 50:50 (w/b) ratio, with values of 35.29% and 49.55%, respectively. This suggests that the cowpea substitution and germination process can enhance protein digestibility by up to 14.26%, which aligns with the protein content data.

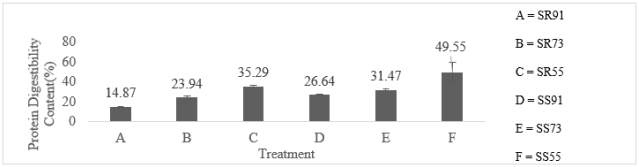

Figure 3: Protein Digestibility of Sorghum Rice Substituted by Cowpea

CONCLUSION

The sorghum germination process and cowpea substitution by 50% in sorghum rice and sorghum sprouted rice increased protein content and in-vitro protein digestibility by 4.27% and 14.26% and decreased tannin content by 0.18%.

ACKNOWLEDGEMENTS

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EXTENDED ABSTRACT

Co-Fermentation of Lactic Acid Bacteria Producing Beta-Glucosidase during *Tempeh* Development Impact Tempeh Microbiome and Nutrient Composition

Rio Jati Kusuma[1,2], Aviria Ermamilia[1]

[1] Department of Nutrition and Health, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, 55281 Yogyakarta, Indonesia
[2] Center of Herbal Medicine, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, 55281 Yogyakarta, Indonesia

Corresponding author's email: riojatikusuma@gmail.com

SUMMARY

The impact of addition lactic acid bacteria producing β-glucosidase on the nutrient and microbiome composition of *tempeh* is unknown. By enveloping amplicon 16s rRNA sequencing, we aimed to identify the impact of co-fermentation of lactic acid bacteria producing β-glucosidase from fermented cassava on microbiota as well nutrient content of *tempeh*. Significant difference was found in moisture, protein and ash, but not in fat content. Modified *tempeh* was enriched with bacterial taxa that was correlated with antioxidant and vitamin production such as *Chryseobacterium, Lactiplantibacillus* and *Klebsiella* although has lower bacterial diversity. Overall, co-fermentation with lactic acid bacteria improves the health functional properties of *tempeh*.

Keywords: β-Glucosidase, Fermented cassava, Lactic acid bacteria, Metagenomic analysis, *Tempeh*

INTRODUCTION

Tempeh is traditional fermented soybean food from Indonesia that has health promoting activity [1]. During *tempeh* fermentation, the enzyme β-glucosidase from Rhizopus mold convert malonyl isoflavones into aglycone isoflavones that pose health-promoting activity. Interestingly, addition of lactic acid bacteria producing β-glucosidase during *tempeh* fermentation increases the aglycone isoflavones and the health promoting activity of *tempeh* product [1]. However, little information is available regarding the impact of supplementing lactic acid bacteria during *tempeh* fermentation on the microbiota communities and nutrients composition of soybean *tempeh*. These information, specifically the microbiota composition, are important to address the safety of *tempeh* product. Therefore, our study was aimed to identify lactic acid bacteria producing β-glucosidase from fermented cassava or growol and to study its impact on nutrient and microbiota profiles when added during *tempeh* development.

MATERIALS AND METHODS

Lactic acid bacteria was isolated from fermented cassava or growol. Briefly, 1 gram of growol was homogenized with 9 mL of sterile NaCl 0.9% and serially diluted. One mL from each serial dilution was pipetted into MRS broth supplemented with esculin iron agar (16.5 g/L MRS broth). The plates was incubated for 48 hours at 37° C. Colonies that produced dark brown color around the colonies were isolated. The β-glucosidase activity was checked using β-glucosidase activity assay kit (Solarbio). Modified and regular *tempeh* were developed according to our previous study [2]. Proximate analysis including moisture, ash, fat and total protein were analyzed from both *tempeh*. Total DNA was extracted from both *tempeh* using stool DNA isolation kit (Favorgen) according to manufacturer protocol. Metagenomic analysis was performed using V3-V4 16s rRNA amplicon sequencing in Illumina platform. Raw data were analyzed using QIIME2 followed by microbiome analyst version 2.

RESULTS AND DISCUSSION

We found four lactic acid bacteria isolates with different morphology. Among four solates, isolate one produce the highest β-glucosidase activity (14.73±1.74 U/L) compared with other isolates (Figure 1). Thus, we used isolate one to develop modified *tempeh* by applying it (2.5% v/v) into second soybean immersion during *tempeh* development.

Next, we characterize nutrient value of both *tempeh*. There were significant difference ($p<0.05$) on moisture, ash, and protein contents of both *tempeh*. However, no significant difference ($p>0.05$) was observed on fat level. Compared with control *tempeh*, supplementation of

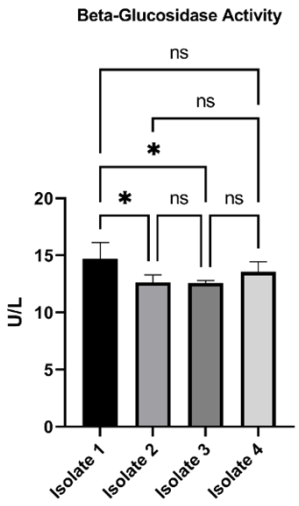

Figure 1: β-Glucosidase activity from lactic acid bacteria isolates of growol. The enzyme activity was obtained from 10^4 CFU/ml isolates growth in MRS media from three replicates (n=3)

lactic acid bacteria during soybean immersion increases moisture, ash and protein content. The proximate values were presented in Table I.

Control *tempeh* has high level of Proteobacteria, while modified *tempeh* increased the Actinobacteria and Firmicutes. This indicated that lactic acid bacteria was able to survive and grow in *tempeh*. At genus level, *Chryseobacterium, Kocuria* and *Staphylococcus* were dominant taxa in modified *tempeh* group, while *Comamonas* and *Acinetobacter* were dominant taxa in control *tempeh* (Figure 2).

According to alpha diversity index, we did not find any significant difference (p>0.05) in Chao1 and Shannon diversity indexes, but not in Simpson index (Table II). These data indicated that bacterial diversity among two groups of tempeh were similar, but some bacterial were dominant in modified *tempeh* compared with control *tempeh*.

CONCLUSION

In conclusion, addition of lactic acid bacteria producing β-glucosidase enzyme is safe and increase nutrient of *tempeh*. Future study is needed to evaluate the health promoting activity of this type of *tempeh*.

Table I: Nutrient value of *tempeh* (n=3)

Variable	*Tempeh* Group		p-value
	Control *Tempeh*	Modified *Tempeh*	
Moisture	60.56±0.11	65.81±0.05	<0.001*)
Ash	1.31±0.05	1.53±0.04	0.012*)
Protein	20.02±0.30	22.35±0.17	0.023*)
Fat	2.49±0.10	2.53±0.16	0.634

Values are expressed as mean±standard deviation.
*) The asterisk sign indicated significant difference according to independent sample t-test (Welch test)

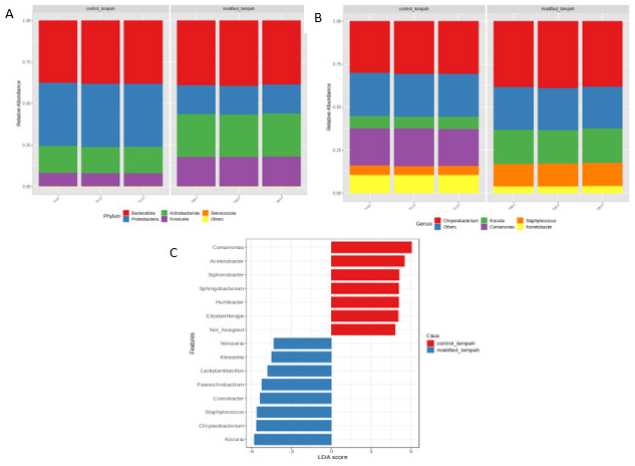

Figure 1: Microbiota composition of control and modified *tempeh*. The relative abundance of microbial taxa from both *tempeh* at phylum (a) and genus (b) level. The linier discriminant analysis (LEfSe) of control vs modified *tempeh* indicated significant microbial taxa that were enriched in each *tempeh*.

Table II: Alpha diversity indices of *tempeh* (n=3)

Variable	*Tempeh* Group		p-value
	Control *Tempeh*	Modified *Tempeh*	
Chao1	98.71±13.39	94.28±17.94	0.751
Shannon	2.61±0.023	2.43±0.089	0.063
Simpson	0.87±0.001	0.82±0.008	0.014*

Values are expressed as mean±standard deviation.
*) The asterisk sign indicated significant difference according to independent sample t-test (Welch test)

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EXTENDED ABSTRACT

Assessing Lipid Degradation as an Indicator of Rancidity in Spirulina Snack Bar Fortified with Collagen

Erika Wahyu Dewanti[1,2,3], Kustiariyah Tarman[1,2], Joko Santoso[2], Nurjanah[2], Safrina Dyah Hardiningtyas[2]

[1] Division of Marine Biotechnology, Center for Coastal and Marine Resources Studies (PKSPL), International Research Institute of Maritime, Ocean and Fisheries (i-MAR), IPB University, 16127 Bogor, Indonesia
[2] Department of Aquatic Product Technology, Faculty of Fisheries and Marine Science, IPB University, 16128 Bogor, Indonesia
[3] Directorate of Processing, Directorate General of Product Competitiveness, Ministry of Marine Affairs and Fisheries, Republic of Indonesia, 10110 Jakarta, Indonesia

Corresponding author's email: kustiaz@apps.ipb.ac.id

SUMMARY

In this study, the impact of lipolysis on snack bars containing spirulina and varying amounts of collagen was examined. Monitoring rancidity is crucial for maintaining product quality, as demonstrated through evaluations of collagen protein levels, texture improvement, and peroxide levels indicating lipid oxidation. Analysis of peroxide and anisidine values revealed that the highest levels were observed at 3% collagen, with level decreasing at higher concentrations. Increased anisidine and total oxidation values indicate elevated oxidation products and lipid breakdown. This degradation affects the flavor, aroma, and nutritional value of the food product, consequently influencing taste, scent, and shelf life.

Keywords: Freshness, Oxidation, Peroxide value, Quality assessment, Shelf life

INTRODUCTION

An essential indicator of rancidity in food products, particularly functional treats such as Spirulina snack bar fortified with collagen, is the assessment of lipid degradation [1]. This study examines the influence of collagen supplementation on the breakdown of lipids in snack bars, providing insights into the possible implications for product quality and shelf life. Collagen, renowned for its high protein content and its ability to improve texture, plays a crucial role in enhancing snacks [2]. This research aimed to analyse the levels of lipid oxidation by using markers such as peroxide, anisidine, and total oxidation values [3]. The objective was to gain significant insights into the correlation between collagen dosage levels and lipid degradation. Understanding the mechanisms of lipid rancidity can lead to improved formulations that effectively combine nutritional benefits with sensory characteristics, ensuring the creation of exceptional functional snack products for consumers.

MATERIALS AND METHODS

The snack bars were produced by including 2% Spirulina powder and varying concentrations of collagen. The assortment of nuts, which includes cashews, almonds, sesame seeds, pumpkin seeds, and sunflower seeds, along with the binding agents such as honey, palm sugar, and lemon juice, were precisely measured by weight when purchased from commercial sources [5]. The nuts were then dried in an oven at 125 C for 15 minutes. An experiment was conducted to investigate the impact of different levels of collagen (0%, 1%, 3%, and 4.5%) on peroxide, anisidine, and total oxidation (Totox) values. The analysis was performed using ANOVA, following the standard procedure specified by AOAC 965.33 (2005) and ISO 6885:2016. On the seventh day, samples were processed and stored under controlled conditions. Lipid degradation markers were analyzed using spectrophotometry at a wavelength of 350nm, with an absorbance of 0.0003.

RESULTS AND DISCUSSION

The control group, which did not receive collagen supplementation, was chosen as the baseline for the study. It demonstrated standard protein content, texture, and levels of lipid oxidation. It serves as a major reference for evaluating the effects of collagen fortification. Notably, the peroxide values were not detected at any of the dose levels. The addition of 1% collagen led to small increases in protein content and texture, along with a considerable drop in anisidine and Totox readings, suggesting a decrease in lipid oxidation compared to the control group. When the collagen concentration

increased to 3%, the anisidine and Totox readings reached their maximum, indicating significant lipid breakdown despite improvements in protein content and texture. Remarkably, when the collagen content was increased to 4.5%, there was a decrease in anisidine and Totox readings compared to the 3% level (Table I). This suggests that there is an optimal collagen dosage that can reduce lipid oxidation while still enhancing protein content and texture. The results illustrate the complex relationship between collagen levels and lipid breakdown in Spirulina snack bars. Collagen had a positive impact on the protein content and texture, but increasing concentrations led to a rise in lipid oxidation, which could have detrimental consequences for the quality and shelf life of the product. It is vital for formulators to carefully balance these variables to effectively meet both nutritional requirements and sensory expectations. Similar to the research conducted by [5], which indicates that collagen improves protein content and texture, enhancing nutritional value and mouthfeel, higher collagen levels were found to increase lipid oxidation, impacting product quality and shelf life. Balancing collagen quantities is crucial to maintain both nutritional benefits and sensory appeal.

CONCLUSION

The study revealed the complex relationship between collagen levels and lipid oxidation in Spirulina snack bars. An optimal collagen dosage at 1% showed potential for minimizing lipid oxidation while enhancing protein content and texture. Further research should explore strategies to maximize the benefits of collagen while mitigating lipid degradation.

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Table I: Total oxidation value (Totox) of Spirulina snack bar at different concentrations of collagen

Collagen concentration (%)	Total lipid (%)	Peroxide Value (mEq O_2/kg)	Anisidine Value	Totox Value
0	20,59	n.d	0.4	0.4
1	23,45	0.2	1	1
3	30,74	1.1	6.7	6.7
4.5	32,46	3.8	3.7	3.7

Note: n.d (not detected/ less than the limit of determination)

EXTENDED ABSTRACT

Exploration of Marine Fungal Endophytes from Buton Island, Southeast Sulawesi: Potential Antibacterial Metabolites for Functional Foods

Ismi Isti'anah[1,2,3], Kustiariyah Tarman[1,2], Endang Lukitaningsih[4], Marianti A. Manggau[5], Wen Chien Lee[6], Safrina Dyah Hardiningtyas[1], Rizfi Fariz Pari[1], Sugeng Heri Suseno[1]

[1] Department of Aquatic Product Technology, Faculty of Fisheries and Marine Science, IPB University, 16680 Bogor, Indonesia
[2] Division of Marine Biotechnology, Center for Coastal and Marine Resources Studies (PKSPL), International Research Institute for Maritime, Ocean and Fisheries (i-MAR), IPB University, 16127 Bogor, Indonesia
[3] Department of Marine Biotechnology, Tual State Fisheries Polytechnic, 97611 Maluku, Indonesia
[4] Department of Pharmacy, Gadjah Mada University, 55281 Yogyakarta, Indonesia
[5] Department of Pharmacology, Faculty of Pharmacy, Hasanuddin University, 90245 Makassar, Indonesia
[6] Department of Chemical Engineering, Systems Biology and Tissue Engineering Research Center, National Chung Cheng University, 621301 Chia-yi County, Taiwan

Corresponding author's email: kustiaz@apps.ipb.ac.id

SUMMARY

Marine endophytic fungi are promising sources of bioactive compounds that can serve as alternative nutrition-rich ingredients. This study investigates potential of marine endophytic fungi samples which isolated from Buton Island in Southeast Sulawesi. There are 32 purified marine endophytic fungi isolates. Most isolates showed flat elevation, with variations in smooth and rough textures. The antibacterial compound is suggested to be beta-glucan with a molecular weight of 35 kDa. These antibacterial properties hold significant potential as functional health foods, enhancing food safety, and extending shelf life.

Keywords: Aquaculture, Food preservation, Mangrove, Marine fungi, Nutrition

INTRODUCTION

Marine endophytic fungi found in the roots, rhizomes, and leaves of marine plants produce bioactive compounds as secondary metabolites, classified based on their biological activities. Coastal areas of Buton Island, including coral reefs, mangrove forests, and seagrass beds, are home to these fungi. One notable species, *Aspergillus terreus*, discovered in mangrove roots, shows antimicrobial, anticancer, antifilarial, and anti-inflammatory properties. This research aims to identify and analyze bioactive compounds from marine endophytic fungi in seaweed, seagrass, and mangrove samples from Buton Island, Southeast Sulawesi. The focus is on their efficacy against pathogenic bacteria, specifically *Escherichia coli*. These bioactive compounds have not been previously recorded, making this study a novel contribution to the field. Understanding the role of these compounds in food and nutrition may lead to innovative applications, enhancing food safety and nutritional health, particularly by offering new solutions for food preservation and the development of functional foods with health-promoting benefits [1].

MATERIALS AND METHODS

Seaweed samples, potential hosts for endophytic fungi, were collected from Buton Island, Southeast Sulawesi. The fungi were isolated and identified through morphological examination on potato dextrose agar. To evaluate their antimicrobial activity, the isolates were tested against *Vibrio harveyi* [2]. The fungi *Aspergillus terreus* grown on CMC media, were analyzed using SDS-PAGE for protein profiling [3] and HPLC for determining cellulose-related sugars. The HPLC utilized a Biorad Aminex HPX-87H column for precise quantification [4]. Data were interpreted through descriptive statistics and compared with existing studies to validate the findings. This methodical approach provides critical insights into the bioactive properties of marine fungi, contributing to innovations in food safety and nutrition.

RESULTS AND DISCUSSION

Purified colonies of marine endophytic fungi exhibited diverse morphological characteristics on PDA plates, highlighting their variability in color, texture, and structure (Fig. 1).

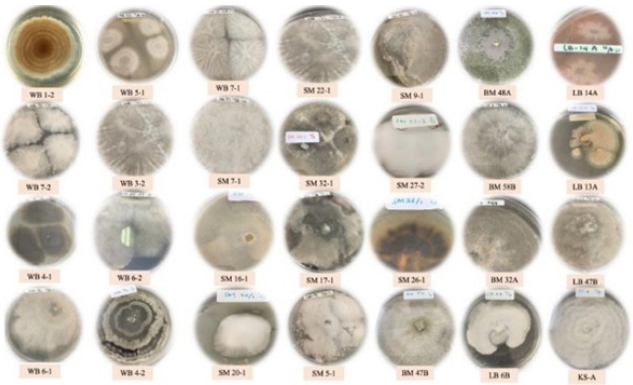

Figure 1: Purification results of endophytic sample isolates and morphological characteristics

Colonies were predominantly circular with entire margins, displaying colors ranging from white, brown, pink, to black. Most isolates showed flat elevation, with variations in smooth and rough textures. Notably, several strains such as WB 4-2, SM 9-1, SM 26-1, BM 32B, LB 47B, and KS-A exhibited distinct radial concentric rings, indicative of their unique growth patterns. SDS-PAGE analysis of Aspergillus terreus culture revealed a prominent band at 17 kDa, resembling an endoglucanase enzyme [5]. The gel also displayed bands in the 35 to 45 kDa range, indicating potential protein diversity within the fungal extract (Fig. 2).

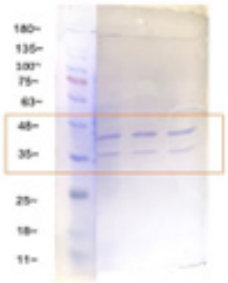

Figure 2: SDS page result cellulase from *Aspergillus terreus* extract

HPLC profiling of *A. terreus* hydrolyzed β-glucan demonstrated a peak at a retention time of 9 min, suggesting the presence of smaller molecular weight metabolites. Another peak at 6 min indicated glucose, 8 min indicated cellobiose, 10 min indicated glucose oxidase, and 13 min indicated cellotriose (Fig. 3). Marine fungi, including *A. terreus*, are increasingly being recognized as bioactive compounds with potential nutritional benefits for human health. These fungi are rich sources of bioactive metabolites such as β-glucans, which have been associated with immune-modulating and cholesterol-lowering properties [1]. The presence of proteins such as endoglucanase further underscores their enzymatic potential, possibly contributing to biotechnological applications in food and pharmaceutical industries [3]. These findings underscore the morphological diversity and biochemical potential of marine endophytic fungi, particularly *A. terreus*, and highlight their significance in nutrition and health. Further exploration of their bioactive components is promising for the development of novel functional foods and therapeutic agents.

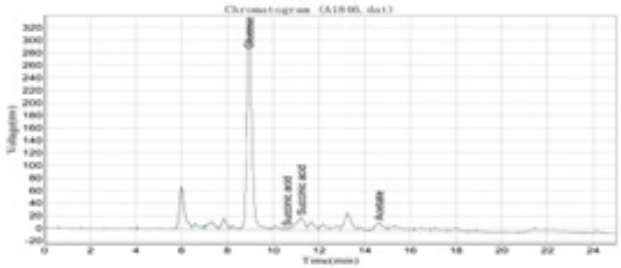

Figure 3: HPLC Result of *A. terreus* extract

CONCLUSION

The study reveals the antibacterial potential of A. terreus from Buton Island seaweeds against *Vibrio harveyi*, indicating its applicability in food safety. The identification of bioactive β-glucan and endoglucanase suggests promising biotechnological uses, advocating for further exploration of marine fungi in health and nutrition innovations.

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EXTENDED ABSTRACT

Preliminary Study on The Effects of Nixtamalization on Nutrition and Anti-Nutrition Properties of Red Sorghum (*Sorghum bicolor* L.)

Erma Maryana[1], Iim Sukarti[1], Ade Saepudin[2], Nila Kusumawaty[1], Donowati Tjokrokusumo[1], Ika Mulawati P.N.[1], Umi Purwandari[3]

[1] Research Center for Food Technology and Processing, National Research and Innovation Agency of Indonesia, 55861 Yogyakarta, Indonesia
[2] Reasearch Center for Agroindustrial, National Research and Innovation Agency of Indonesia, 16911 Bogor, Indonesia
[3] Agroindustrial Technology Department, University of Trunojoyo, 69162 Madura, Indonesia

Corresponding author's email: erma007@brin.go.id

SUMMARY

One of the limitations of red sorghum as a food ingredient is its anti-nutrition. The objective of this study is to assess the effect of nixtamalization on the nutrition and anti-nutrition content of red sorghum. This study used a completely randomized design consisting of two factors: the variation of $Ca(OH)_2$ concentration and processing time. It found that nixtamalization of 1% $Ca(OH)_2$ and 30-minutes processing time have the highest the protein content (14,34%) and the lowest phytate content (3,28%) significantly, however the tannin content were not significantly reduced. Thus, it is the best nixtamalization condition to improve nutrition and reduce anti-nutrition content.

Keywords: Anti-nutrition, Nixtamalization, Phytate, Red sorghum, Tannin

INTRODUCTION

Indonesia has great potential in diversifying food products, especially cereals [1]. Excessive consumption of wheat flour must be reduced by substituting with local commodities, such as red sorghum. The nutrition content of red sorghum varies depending on the variety [2]. The red sorghum contains anti-nutrition like tannins and phytate which can interact with proteins and minerals to reduce digestibility and nutrition availability[3]. Several technologies have been developed to reduce the anti-nutrition such as extrusion, grinding, roasting, and fermentation but it needed expensive equipment and longer processing time [4]. Nixtamalization, combine the soaking and boiling process, has known the simple technic to solve this problem. Since, there are no information about proximate and phytate content in various nixtamalization process, especially on red sorghum from Garut, Indonesia. The aims of this study were to observe effect of $Ca(OH)_2$ concentration and cooking time of nixtamalization on nutrition and anti-nutrition content of red sorghum from Garut.

MATERIALS AND METHODS

The red sorghum was procured from the local market in Garut, West Java, Indonesia. All chemicals were purchased from Merck. The sorghum seeds were washed and followed by nixtamalized in 95°C with addition of $Ca(OH)_2$ in various concentration and cooking time. The experiment design was carried out by a complete randomized design with 2 replications. The data obtained were analyzed using one-way analyze variance method (ANOVA) and continued with the Duncans Multiple Range Test. Analysis of nutrition content was carried out through including moisture, ash, crude protein, fat and carbohydrates contents by standard methods of AOAC. The content of carbohydrates was calculated by difference. The analysis of anti-nutrition was carried out through phytate and tannin content.

RESULTS AND DISCUSSION

Nixtamalized is a cooking process which combining the alkaline soaking and boiling. In this study used $Ca(OH)_2$ as alkaline. The study showed that the addition of $Ca(OH)_2$ caused an increase of protein content significantly (Table I). It's because alkaline was improved the balancing of essential amino acid (FAO,1992). These results are related to research by Osman et.al [3]. It stated that modification of red sorghum with alkaline has increased the protein content in the range of 8 - 14%. Likewise with the addition of processing time. Longer processing times give the higher protein content. Nixtamalization process also seems to affect the carbohydrate content caused by changing the shape

Table I: Nutrition content of sorghum nixtamal

Samples	Nutrition content (%)				
	Moisture	Ash	Crude protein	Fat content	Carbohydrate
C1Ta	8.23±0.05	0.77±0.03[a]	8.78±0.10[a]	1.16±0.52[a]	81.06±0.5
C1Tb	8.81±0.10	0.71±0.03[a]	9.02±0.15[b]	3.64±0.06[a]	77.82±0.37
C1Tc	8.43±0.07	0.72 ±0.08[a]	11.25±0.19[a]	1.04±0.008[b]	78.56±0.33
C2Ta	9.06±0.09	1.48±0.04[b]	12.32±0.04[ab]	2.48±0.06[c]	74.66±1.78
C2Tb	9.2±0,14	1.44±0.007[b]	13.38±0.03[b]	3.64±0.06[d]	72.33±0.36
C2Tc	9.44±0.06	1.48±0.04[b]	14.34±0.02[a]	1.12±0.03[e]	73.62±0.05

Data are stated as mean ± standard deviation. Values followed superscript letters are significantly different ($p<0.05$), analysed using one-way ANOVA and DMRT. Notation of sample: C: $Ca(OH)_2$ concentration, 1: 0,1 %, 2: 1%; T: Prosessing time, a: 10-minute, b: 20-minute, c: 30 minutes

of carbohydrates especially starch which led to total gelatinization of starch granules of the external layers of the endosperm and partial gelatinization in the most internal layers. The addition of $Ca(OH)_2$ dan processing time slightly reduce the total carbohydrate. C2Tc sample which refer to 1% $Ca(OH)_2$ and 30-minute processing time showed the best condition in increasing protein content.

Table II showed the anti-nutritional content of nixtamalized red sorghum consist of phytic acid and tannin. The addition of $Ca(OH)_2$ and processing time reduced the phytic acid significantly. The presence of alkaline combined with boiling caused the damage of phytic structure. On the other hand, the variation both $Ca(OH)_2$ concentration and processing time were not significant in reducing tannin content. However, tannin content in this process lower than raw sorghum [5]. Research by Gunawan et.al [5] states that unmodified red sorghum has a phytic acid content of 13.50% and a tannin content of 6.73%. C2Tc sample have a lowest phytic acid and tannin content as showed in table II.

CONCLUSION

Modification of red sorghum trough nixtamalization was changed in nutrition and anti-nutrition content. This study proves that nixtamalization has increased the protein content and reduce the phytic content significantly. The sample which 1% $Ca(OH)_2$ and 30-minutes processing time showed the best condition of nixtamalization.

Table II: Anti-nutrition content

Samples	Anti-nutrition content (%)	
	Phytic acid	Tannin
C1Ta	5.65 ± 0.02[e]	0.0116 ± 0.01[ab]
C1Tb	5.76 ± 0.04[d]	0.0123 ± 0.05[ab]
C1Tc	4.46 ± 0.01[b]	0.0127 ± 0.01[b]
C2Ta	7.26 ± 0.06[f]	0.0102 ± 0.10[a]
C2Tb	4.93 ± 0.12[c]	0.0114 ± 0.14[b]
C2Tc	3.28 ± 0.03[a]	0.0109 ± 0.01[ab]

Data are stated as mean ± standard deviation. Values followed superscript letters are significantly different ($p<0.05$), analysed using one-way ANOVA and DMRT.

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EXTENDED ABSTRACT

A Comparison of the Nutritional Content between Fillet and Whole Grasshopper (*Valanga nigricornis*)

Nabila Sukma Priyatnasari[1], Eny Palupi[1], Katrin Roosita[1], Ahmad Sulaeman[1], Ade Chandra Iwansyah[2]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 43400 Bogor, Indonesia
[2] Research Center for Food Technology and Processing, National Research and Innovation Agency, BRIN, Indonesia

Corresponding author's email: enypalupi@apps.ipb.ac.id

SUMMARY

Grasshoppers have potential to be an alternative protein source because high in nutrient and environmentally friendly. Grasshoppers can be used either as a fillet or whole. The research stages consisted of grasshopper preparation, proximate, and mineral analysis. The whole grasshoppers have higher protein (81.8±0.9%db) and carbohydrate (10.9±1.1%db) than the fillet. The mineral content of whole grasshoppers, namely Ca, Fe, Zn were 14.39±0.06; 5.43±0.11; 1.76±0.03 mg/100g respectively, and higher than fillets due to the ability of chitin that contained in the exoskeleton to bind minerals. It can be concluded that whole grasshoppers have a higher nutritional content than fillets.

Keywords: Chitin, Fillet grasshopper, Mineral, Protein, Whole grasshopper

INTRODUCTION

One of the socio-economic challenges in Indonesia is the issue of high population growth rates. Based on the projection, there will be a supply gap up to 44% between protein demand and availability in 2035 [1]. A deficiency in protein consumption contributes to the nutritional deficiencies, including stunting. The prediction of the supply gap has led to the urgency to identify alternative proteins that concern in water use, land use, global warming potential, and food conversion ratio. Grasshopper is halal and familiar to be consumed, especially in the Gunung Kidul, Yogyakarta. Previous research has been conducted, made fillet grasshoppers into analog meat [2]. Grasshoppers can be used either as a fillet or whole. A comparative analysis of fillet and whole grasshoppers has yet to be conducted. This study aims to compare the nutritional content of fillet and whole grasshoppers as a materials to be used as food products.

MATERIALS AND METHODS

Raw materials consisted of grasshoppers (Valanga nigricornis) from Gunungkidul, Central Java Province. Chemical analysis materials included distilled water, petroleum jelly, sulphuric acid (H2SO4), selenium mix, boric acid (H3BO3), hydrochloric acid (HCl), sodium hydroxide (NaOH), methyl red and methyl blue indicators, hexane, ethanol, acetone, amylase, protease, and glucoamylase enzymes, HNO3, and aqua bidest (doubly distilled water). The research was conducted in two replications, consisted of grasshopper preparation, proximate (AOAC 2005), and mineral analysis (AOAC 2012). The research data were analyzed with Microsoft Excel 2019 and IBM 43 SPSS 26.0 for windows with independent T-test.

RESULTS AND DISCUSSION

Grasshoppers were first prepared into fillet and whole grasshoppers (Fig. 1 and 2). Fillet grasshoppers is the abdominal part that has been cleaned from its faeces. Whole grasshoppers consist of the head, thorax, and abdomen, which have been cleaned of faeces and weeded of wings and antennae. Fillet grasshoppers can be an alternative preparation for making grasshopper paste, because have a softer texture than whole grasshoppers. However, fillet grasshoppers have only 20% edible weight, and 60% for whole grasshoppers.

Proximate analysis results are presented using %db because moisture content can affect the percentage of nutrient content (Table I). The moisture content of fillet grasshoppers is higher (66.52%wb) than whole grasshoppers (64.24%db) because the abdominal end contains higher water than other parts of the grasshoppers. Whole grasshoppers have a higher ash content (0.93%db) than fillet grasshoppers (0.78%db) which is in line with the results of Ca, Fe, Na, and Zn mineral content of whole grasshoppers higher thasn the mineral content in fillet grasshoppers. The carbohydrate

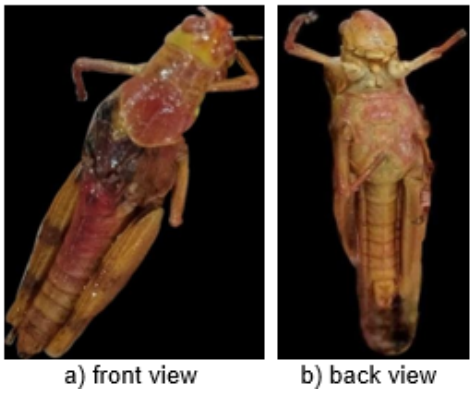

Figure 1: Whole grasshopper

Figure 2: Grasshopper fillet

and protein content of whole grasshoppers is higher than that of fillet grasshoppers. Whole grasshoppers have a higher chitin content than fillets, because chitin is abundant in the exoskeleton of grasshoppers. Chitin is a modified polysaccharide that contains protein, composed of glucosamine monomer [3]. The fat 74 content of fillet grasshoppers (13.14%db) is higher than whole grasshoppers (4.85%db) because the grasshopper stomach contains eggs that are high in fat for embryonic growth. Whole grasshoppers have higher mineral content, both Ca, Fe, Na, and Zn, because the minerals in grasshoppers mostly bound by the chitin matrix [4]. Chitin fibers are embedded in a matrix of calcium carbonate and calcium phosphate so that the calcium content of whole grasshoppers is higher. Iron is also known to be bound as much as 90% in chitin components [5].

CONCLUSION

In conclusion, whole grasshoppers have a higher nutritional content than fillets, including protein, carbohydrates, and minerals (Ca, Fe, Na, and Zn). Therefore, the fillet and whole grasshoppers can be considered as a raw material for food products because it has a high nutritional content, such as meat analogues.

Table I: Nutritional value of fillet and whole grasshopper

Parameters	Unit	Fillet grasshopper	Whole grasshopper
Moisture	%wb	66.52±0.21[a]	64.24±0.11[b]
Ash	%db	0.78±0.01[a]	0.93±0.04[b]
Protein	%db	76.86±0.37[a]	81.85±0.94[b]
Fat	%db	13.14±0.79[a]	4.85±0.15[b]
Carbohydrate	%db	7.37±0.96[a]	10.96±1.1[b]
Energy	%db	138.90±0,11[a]	162.78±0,72[b]
Calcium (Ca)	mg/100g	9.42±0.15[a]	14.39±0.06[b]
Iron (Fe)	mg/100g	1.42±0.05[a]	5.43±0.11[b]
Natrium (Na)	mg/100g	4.62±0.02[a]	5.54±0.05[b]
Zinc (Zn)	mg/100g	1.57±0.01[a]	1.76±0.03[b]

Note: Different superscript letters are significantly different ($p<0.05$), analyzed using independent T-test

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EXTENDED ABSTRACT

Nutritional Powder Made from Spirulina sp. and Petek Fish (*Leiognethus splendens*) for Pregnant Women to Prevent Stunting in Their Babies

Rina Maryati, Eny Palupi, Drajat Martianto

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Jawa Barat, Indonesia

Corresponding author's email: rinamaryati@apps.ipb.ac.id

SUMMARY

Stunting is a nutritional problem in Indonesia that remains unresolved. Pregnant women with nutritient deficiencies are at risk of giving birth to babies with low birth weight, low immune resistance, premature births, and including stunting. This study evaluates a nutritional sprinkle powder made from Spirulina sp. and petek fish as an alternative to source of the nutrients for pregnant women. The nutritional content analysis of the selected formula F2 includes moisture 6.39%wb, ash 14.1%db, fat 14.44%db, protein 50.33%db, carbohydrates 21.12%db, energy 415.81 kcal, calcium 1200.1 mg, phosphorus 1294.84 mg, iron 18.05 mg, and zinc 0.26 mg. This indicates that nutritional sprinkle powder is a potential formula to be given to the pregnant women as an effort to prevent stunting.

Keywords: Minerals, Petek fish, Pregnant women, Spirulina sp, Stunting

INTRODUCTION

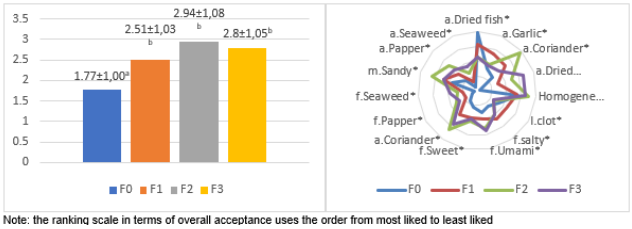
Stunting remains a major nutritional issue in Indonesia, with a high prevalence rate of 21.6% [1]. The first 1000 days of life, including pregnancy, are vital for a child's growth. During pregnancy, the body's increased nutritional needs can result in nutrient deficiencies, which elevate the risk of giving birth to babies with low birth weight, weak immunity, prematurity, and stunting [2]. One potential solution for addressing these deficiencies is providing nutritional sprinkle powder to pregnant women. This study explores the development of a nutritional powder made from Spirulina sp. and petek fish. The powder is believed to be rich in protein and minerals like calcium, phosphorus, iron, and zinc. To evaluate its effectiveness, tests on physical characteristics, sensory properties, proximate composition, and mineral content are necessary. This approach could offer a promising solution to enhancing the nutritional status of pregnant women and preventing stunting.

MATERIALS AND METHODS

The research involved various equipment, including a drum dryer to produce Spirulina granules and fish flour, a photoelectric colorimeter for color testing, and an analytical balance scale for measuring bulk density. Sensory evaluation tools and devices for nutritional content analysis were also utilized. Materials used included Spirulina sp., salt, sugar, pepper, anti-caking agents, maltodextrin, water, and petek fish. The research stages were as follows: (1) Creating the nutritional sprinkle powder, (2) Formulating the nutritional sprinkle powder, (3) Testing physical characteristics such as color and bulk density, (4) Conducting sensory evaluations using Quantitative Descriptive Analysis (QDA) with 8 trained panelists and a hedonic quality test with 35 semi-trained panelists using a 9-point scale, (5) Analyzing nutritional content through proximate and mineral analysis, and (6) Determining the nutrient contribution to the Nutrition Label Reference and making nutrition claims based on the selected formulation. Nutritional sprinkle powder starts with the preparation, making granules of Spirulina sp. and fish flour, and then dry mixing the nutritional sprinkle powder. The formulation design of the nutritional sprinkle powder is conducted to obtain the best formula with the right ratio of ingredients.

RESULTS AND DISCUSSION

The formulation was developed using Spirulina sp. and petek fish with 4 formulas, namely F0 as control (0:100), F1 (20:80), F2 (30:70), and F3 (60:40). The physical characteristic testing of the nutritional sprinkle powder includes color testing and bulk density (g/ml). The statistical test showed that the comparison of Spirulina sp. and petek fish had a significant effect ($p<0.05$) on red-green color (a*), yellow-blue color (b*), and texture. Sensory evaluation includes organoleptic tests such as hedonic rating and ranking tests, as well as Quantitative Descriptive Analysis (QDA) (Fig. 1). The



Note: the ranking scale in terms of overall acceptance uses the order from most liked to least liked

Figure 1: Results of sensory evaluation: organoleptic (ranking) and quantitative descriptive analysis (QDA)

proximate analysis results of the nutritional sprinkle powder showed that the moisture content ranged from 6-7%wb, ash content from 12-14%db, fat content from 14-19%db, and protein content from 44-50%db. Subsequently, carbohydrate content was determined by difference, based on the ash, protein, and fat content calculations. The carbohydrate content by difference ranged from 15-27%db. Additionally, the energy content was determined based on the known fat, protein, and carbohydrate levels. The energy content of the nutritional sprinkle powder ranged from412-442 kcal per 100 g. The mineral analysis results of the nutritional sprinkle powder showed that F3 had higher mineral content compared to other formulations in terms of calcium, phosphorus, and zinc, while F2 had higher iron content than the other formulations. The mineral content of calcium, phosphorus, and iron in each formulation met or exceeded the recommended levels. However, the zinccontent was deemed insufficient according to the standards for supplementary food for pregnant women with chronic energy deficiency as stipulated in Regulation of the Minister of Health of the Republic of Indonesia Number 51 of 2016 [3]. (Table I). Additionally, the determination of nutritional contribution per serving size to the RDA and claims from the selected formula is also conducted. Formula F2 can claim high protein, high fibre, and high minerals (calcium, phosphorus, and iron) (Table II).

Table I: Nutritional content analysis

Indicator	Comparison (Granola *Spirulina sp.* dan petek fish flour)			
	F0(0:100)	F1(84:16)	F2(76:24)	F3(65:35)
Proximate analysis				
Moisture (%dw)	6.08±0.09^{a}	7.06±0.03^{b}	6.39±0.23^{a}	6.36±0.11^{a}
Ash (%, db)	14.03±0.17^{a}	12.72±1.00^{a}	14.1±0.53^{a}	13.43±0.38^{a}
Fat (%, db)	19.75±0.91^{c}	17.64±0.99^{b}	14.44±0.33^{a}	15.12±0.24^{a}
Protein (%, db)	50.95±0.35^{c}	47.27±0.62^{ab}	50.33±0.13^{bc}	44.28±0.05^{a}
Carbohydrate by difference (%, db)	15.27±3,14^{a}	22.37±3.52^{b}	21.12±0.34^{ab}	27.17±0.09^{b}
Energy (kcal)	442.66±3.87^{b}	437.34±0.97^{b}	415.81±3.77^{a}	412.89±2.76^{a}
Mineral analysis				
Ca (mg)	973.08±11.23^{a}	1162.71±3.84^{b}	1200.1±3.30^{c}	1190.89±11.78^{c}
P (mg)	1248.30±8.04^{a}	1302.90±4.07^{b}	1294.84±9.80^{b}	1310.25±1.15^{b}
Fe (mg)	8.70±0.05^{a}	17.61±0.23^{b}	18.05±0.03^{c}	17.17±0.08^{d}
Zn (mg)	0.15±0.00^{a}	0.28±0.01^{bc}	0.26±0.01^{b}	0.30±0.01^{c}

Note: The nutritional content per 100 grams.
Different superscript letters are significantly different (p<0.05), analysed using one-way-ANOVA and Duncan's honestly significant difference test.

Table II. Nutritional information of the selected formula (F2)

Nutrients	Nutrients/ Serving size	Nutrients/100g	RDA-Score	%Nutritional Requirements/ 100g	Claim requirements+	Claim+
Energy (kcal)	33	415	2510	1	-	-
Protein (g)	4	50.33	76	5	35% RDA per 100 g	High/ Rich
Fat (g)	1.16	14.44	84	1	-	-
Carbohydrate(g)	1.69	21.12	345	1	-	-
Fibre	0.5	6.8	35	2	6 g per 100 g	High/
Calsium (mg)	96.01	1200.10	1100	9	2 times the amount of "source" (30% Nutritional requirements per 100 g)	Rich
Phosphorus (mg)	103.59	1294.84	700	2	2 times the amount of "source" (30% Nutritional requirements per 100 g)	High/ Rich
Iron (mg)	1.44	18.05	22	7	2 times the amount of "source" (30% Nutritional requirements per 100 g)	High/ Rich
Zinc (mg)	0.02	0.26	13	0	-	-

Note: nutritional claims refer to the calculation approach and the results of laboratory test analyses.

CONCLUSION

The nutritional powder can be an alternative for preventing stunting in the babies of pregnant women with chronic energy deficiency due to its high content of protein and minerals. Formula F2 with a ratio of Spirulina sp. to petek fish of 30:70 is considered to have better acceptance, physical characteristics, and nutritional content.

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EXTENDED ABSTRACT

Knowledge Drives Food Choices: Meltique Meat Purchase Decisions in Urban Indonesian Households

Nunung Cipta Dainy[1], Wardina Humayrah[2], Astari Apriantini[3], Aida Khairun Nisa[1]

[1] Nutrition Study Programme, Faculty of Medicine and Health, Universitas Muhammadiyah Jakarta, 10510 Jakarta, Indonesia
[2] Nutrition Study Programme, Faculty of Food Technology and Health, Sahid University, 12870 Jakarta, Indonesia
[3] Department of Animal Production and Technology, Faculty of Animal Science, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: astari87@apps.ipb.ac.id

SUMMARY

A new food innovation has made it possible to produce affordable Wagyu-like beef, known as Meltique meat, by injecting it with vegetable oil. Despite its potential, urban consumers have low awareness of Meltique due to a lack of information. This cross-sectional study used a questionnaire of 260 urban households in Jabodetabek and found that less than 50% were aware of Meltique meat, indicating a significant awareness gap. This lack of awareness has a direct impact on purchasing decisions, as higher levels of knowledge correlate with an increased likelihood of purchasing Meltique meat. Buyers had a median knowledge score of 70, while non-buyers 60.

Keywords: Food innovation, Meltique meat, Knowledge, Purchase decision, Wagyu-like

INTRODUCTION

Meltique meat is beef injected with vegetable oil to produce marbling. Marbling is a white fibre-shaped fat on a piece of meat that makes the texture of the meat more tender [1,4]. Knowledge affects purchasing, a study conducted in Japan found that increased consumer knowledge led to more factors considered when buying Meltique meat [2,5]. Factors such as quality, price and nutritional content of meat are considered by consumers in making purchasing decisions, so knowing product information is very important [3]. However, currently there is still little research and information about meltique meat so this study aims to determine the relationship between household consumers' knowledge of meltique meat and their purchasing decisions in urban areas.

MATERIALS AND METHODS

This study used a cross-sectional design with a questionnaire instrument consist of question about gender, living area, knowledge and purchase decisions of meltique meat. This study validated the questionnaire with a Cronbach's Alpha (CA) of 0.672 indicating moderate reliability, the value of CA between 0.6 and 0.8 is considered acceptable.The sampling technique used was convenience sampling with a total number of subjects who could participate up to 260 households from urban areas. The research was conducted online in the areas of Jakarta, Bogor, Depok, Tangerang and Bekasi (Jabodetabek) by distributing questionnaires in the form of Google Forms through culinary communities on social media. The statistical software used for this analysis is IBM SPSS Statistics. The Spearman Rank Correlation Test was used to analyse the relationship between knowledge scores and purchase decisions for melted meat.

RESULTS AND DISCUSSION

Based on the data, the study participants were predominantly female (91%) and male (8.8%). The regional distribution was as follows: Jakarta (35.4%), Depok (25.4%), Bogor (19.6%), Bekasi (11.9%) and Tangerang (7.7%). The high representation of women could affect insights into consumer behaviour due to potential differences in preferences and purchasing decisions between the gender. The analysis in Table I shows that respondents' knowledge of Meltique meat remains below 50%, indicating a significant awareness gap. This lack of awareness is likely to contribute to reluctance to purchase Meltique meat products. Increasing public awareness through targeted educational campaigns could potentially increase consumer confidence and drive sales.

Table II details the knowledge scores for Meltique meat. Notably, higher levels of knowledge are positively correlated with increased purchase likelihood. The higher the level of knowledge about Meltique meat, the more likely people are to buy it [5]. However, the results of the Spearman correlation test in Table II show that the

Table I: Subjects who gave the correct answer about the knowledge of meltique meat

Knowledge about meltique meat	n	%
List of statements*		
Update on the development of the meltique industry	138	53.1
Safety when eating Meltique	48	18.5
Meltique has more marbling than regular meat	13	5.0
Packaging label on Meltique differentiator	35	13.5
Texture quality of Meltique is better than regular meat	116	44.6
Distinction between Wagyu and Meltique	196	75.4
Meltique is injected with vegetable oil	23	8.8
The halalness of Meltique	88	33.8
Frequent consumption of Meltique is good	161	61.9
Meltique is cheaper than Wagyu	15	5.8
Classification of knowledge		
Low	38	14.6
Medium	218	83.8
Good	4	1.5
Total	260	100.0

*n and % for subject who answer the correct answer

Table II: Correlation between Meltique meat knowledge and its purchase decision

Purchase decision	Knowledge score			p-value	r
	Median	Min	Max		
Yes	70	30	100	0.004	0.180**
No	60	30	80		

*Correlation test using Rank-Spearman, significan at p-value <0.05

public's knowledge of meltique meat is still low. This lack of knowledge results in fewer decisions to purchase meltique meat. Improving consumer awareness and understanding of Meltique meat could potentially increase its purchase rate among the general public [5].

Figure 1 highlights that the primary motivation for purchasing Meltique meat among respondents is its soft texture, cited by 50.5% of participants. Conversely, the perceived high cost is the predominant deterrent, with 85.4% expressing cost concerns. These findings highlight the key role of texture and price in shaping consumer behaviour towards Meltique meat. Strategies aimed at mitigating cost perceptions and highlighting the unique textural attributes of Meltique meat could potentially increase its market appeal and broaden its consumer base.

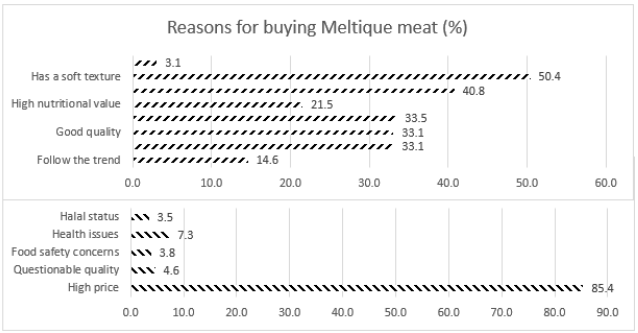

Figure 1: Reasons for buying meltique meat

CONCLUSION

The study shows that 91% of respondents were female and that low awareness of Meltique meat (below 50%) influences purchase. Soft texture (50.5%) encourages purchase, while high cost (85.4%) discourages purchase. There is a weak relationship between knowledge and purchase decisions (p-value 0.004, coefficient 0.180) among urban Indonesian households.

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EXTENDED ABSTRACT

Meltique Meat: Urban Household Consumer Behaviour and Perceptions

Wardina Humayrah[1], Nunung Cipta Dainy[2], Astari Apriantini[3], Salwa Nailil Ulya[1]

[1] Nutrition Study Programme, Faculty of Food Technology and Health, Sahid University, 12870 Jakarta, Indonesia
[2] Nutrition Study Programme, Faculty of Medicine and Health, University of Muhammadiyah Jakarta, 10510 Jakarta, Indonesia
[3] Department of Animal Production and Technology, Faculty of Animal Science, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: astari87@apps.ipb.ac.id

SUMMARY

The research examines consumer behavior and perceptions of Meltique Meat, a Wagyu-like product, in Jabodetabek, Indonesia. Conducted in Jabodetabek, one of Indonesia's urban areas, this research involved 200 household consumers and was conducted using online platforms. Findings indicate a preference purchasing from supermarkets, primarily frozen Saikoro (diced tenderloin), for home and restaurant steak cooking. Purchases are typically monthly or quarterly, averaging 200-500 grams. Consumer perceptions are mixed, with concerns about accessibility, halal status, processing difficulties, and perceived quality and authenticity. The study highlights the needs for improved marketing strategies and product innovation to meet consumer preferences and address these concerns.

Keywords: Consumer behavior, Household, Meltique meat, Perception, Urban area

INTRODUCTION

As time goes by, so does technology. Meltique Meat is one of the results of advancement in meat production technology. Meltique meat is beef that is injected with vegetable fat or emulsion into the meat tissue to create a marbling similar to Wagyu meat [1]. In Indonesia, meltique meat tends to be still very common in the community, leading to positive and negative views, as well as a significant amount of information about meltique meat regarding product knowledge and health implications. The impact of divided views on meltique meat affects purchasing habits. Behaviour and habits are the most important factors in purchasing beef [2]. A research gap exists in understanding how misinformation and mixed perceptions about Meltique Meat's product knowledge and health implications specifically influence consumer purchasing behavior and habits in Indonesia.The aim of this research is to identify household consumer behaviour and perceptions when purchasing meltique meat.

MATERIALS AND METHODS

This research was conducted online with target respondents in the cities of Jakarta, Bogor, Depok, Tangerang and Bekasi (Jabodetabek), Indonesia through the Instagram, WhatsApp and Telegram platforms of the culinary and food lover community. The method used is descriptive-quantitative, employing a convenience sampling technique and a cross-sectional research design, with a potential participation of 200 urban household consumers who have experience buying Meltique meat. This sample size captures diverse opinions and behaviours, ensuring that the findings on Meltique meat are reflective of the urban population. This size also ensures statistically significant results, reducing margins of error and confirming that observed behaviours truly represent consumer trends. Variables consisted of items related to consumer behaviour and perception of Meltique meat. Data were analyzed descriptively using proportions (n, %) and standard deviation.

RESULTS AND DISCUSSION

Table I shows the purchasing behaviour of domestic consumers of meltique meat. The majority of consumers chose supermarkets as their main place of purchase, with about three-fourths of the subjects travelling more than 500 meters from their place of purchase. The majority of respondents usually buy frozen meat, with one of the most popular purchase is saikoro. When preparing meat at home and in restaurants, steak is the first choice for more than half of consumers. The preferred doneness of meat is medium well, followed by well done, each with having a share of more than 25%.

Most consumers buy meat on a monthly or quarterly basis, with an average purchase of 200-500 grams each time. This research provides information on consumer behaviour in purchasing and using meltique

Table I: Consumer behaviour

Consumer behaviour	n	%	Consumer behaviour	n	%
Where to buy*			Distance to shop		
Online shop	76	38.0	< 500 m	51	25.5
Supermarket	130	65.0	> 500 m	149	74.5
Traditional market	12	6.0	Purchase amount		
Meat retailer	58	29.0	< 200 g	18	9.0
Restaurant	57	28.5	200 - 500 g	108	54.0
Other place	1	0.5	500 g - 1 kg	66	33.0
Product form			> 1 kg	8	4.0
Frozen	114	57.0	Meat doneness		
Fresh meat	35	17.5	Rare	7	3.5
Chilled meat	31	15.5	Medium rare	38	19.0
Processed meat	20	10.0	Medium rare	42	21.0
Variants*			Medium well	59	29.5
Tenderloin	102	51.0	Well done	54	27.0
Rib Eye	32	16.0	Frequency of Purchase		
Sirloin	100	50.0	Once a week	31	15.5
Saikoro	108	54.0	Once a month	69	34.5
Home processed form			Once every 3 months	65	32.5
Steak	93	46.5	Other	35	17.5
Traditional Preparations	66	33.0	Source of product information*		
Japanese preparations	26	13.0	Friends/relatives	78	39.0
Western dishes	9	4.5	Social media	136	68.0
Other dishes	6	3.0	Electronic media advertisement	23	11.5
Type of restaurant preparations			Print media	11	5.5
Steak	149	74.5	Display in shopping centre	103	51.5
Traditional dishes	9	4.5	Menu in restaurants	114	57.0
Japanese dishes	28	14.0	Other media	1	0.5
Western dishes	8	4.0			
Other dishes	6	3.0			

**The respondent is allowed to answer more than 1*

meat, which can help the industry to develop product marketing strategies and guide innovation in meltique meat production to better meet the preferences of urban household consumers (Table I).

Consumer perceptions of meltique meat include both positive and negative aspects. According to Table II, perceptions regarding the accessibility and halal status of meltique meat remain low, suggesting that consumers face challenges in obtaining it and verifying its halal status. On the other hand, negative perceptions include difficulty in processing, quality not worth the price, and the image of meltique meat as an imitation product. These concerns indicate potential areas for improvement and suggests the need for better marketing approaches.

This research finding provides important insights into local consumers' purchasing behaviour and perceptions of Meltique meat. Most consumers prefer to purchase frozen Saikoro steak from supermarkets, despite challenges such as accessibility and verification of halal status. Consumer preferences for medium-well

Table II: Perception of meltique meat

Perception of Meltique Meat	Scale 1-4*	
	Mean	SD
More nutritious than normal meat (+)	2.77	0.950
Accessible (+)	1.91	0.840
Better appearance and texture than regular meat (+)	3.45	0.693
Affordable price (+)	3.40	0.709
Definitely halal (+)	1.99	0.905
Healthy for all ages (+)	2.96	0.937
Difficult to process (-)	3.07	0.883
Does not keep well in storage (-)	2.73	0.902
Quality not worth the price (-)	2.98	0.841
Known as imitated meat (-)	2.98	0.929
Cleanliness and hygiene are questionable (-)	2.83	0.984
Wagyu meat is of better quality than Meltique (-)	1.67	0.875

**Scale means 2 indicating high preference and < 2 indicating low preference [3]*
+: positive aspect
-: negative aspect

and well-done preparations guide marketing strategies and highlight areas for improving product quality and perception, which are critical to industry innovation and market competitiveness [4].

CONCLUSION

Meltique meat, using advanced production technology, is prevalent in Indonesian communities, leading to mixed consumer perceptions. This study emphasizes the importance of understanding consumer behavior to develop effective marketing strategies. Future research should focus on improving accessibility, addressing halal certification issues, and enhancing product quality to align with consumer preferences and ensure sustained market acceptance.

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EXTENDED ABSTRACT

Effect of Retort Process on Quality of Traditional Meat Products During Storage: Physical and Sensory Aspects

Siti Nurhasanah, Kevin AR Oktaviano, Syamsul Huda

Department of Food Industry Technology, Faculty of Agroindustrial Technology, Universitas Padjadjaran, 45363 Bandung, Indonesia

Corresponding author's email: siti.nurhasanah@unpad.ac.id

SUMMARY

"Oseng Mercon" is a traditional Indonesian beef product from Java with a short shelf life of 1-2 days. This study examines the effects of the retort process on its physical and sensory qualities using an experimental descriptive method. Four treatments were tested: plastic jar without sterilization, aluminum foil without sterilization, aluminum foil with retort, and aluminum foil with a pressure cooker. Results showed a continuous decline in all parameters from day 0 to day 14. The best treatment was the retort method with aluminum foil packaging, followed by the pressure cooker method with aluminum foil packaging.

Keywords: Physical properties, Retort, Sensory properties, Sterilized,Traditional food

INTRODUCTION

Traditional beef foods with high nutritional content provide an excellent medium for the growth of spoilage bacteria. Therefore, advanced processing is necessary to extend the shelf life products. Retort technology, which involves the use of heat and pressure is a well-established method in food preservation but remains relatively novel for traditional food products to extend shelf life. This study focuses on the thermal process oseng mercon a traditional Indonesian beef product from Java known for its spicy flavor and short shelf life. This study aims to investigate the extent to which the retort process can influence the production of oseng mercon with a longer shelf life. Specifically, this study aims to determine the impact of retort processing on the physical and sensory properties of the product to ensure it remains safe for consumption. This research aims to support the sustainability of local products and expand their market reach.

MATERIALS AND METHODS

Fresh beef is sourced from the local market, red chilies, and cayenne pepper. Other ingredients include garlic, shallots, bay leaves, lime leaves, brown sugar, coconut oil, and lemongrass. The research method used is complete randomized design. This study consists of four treatments and two replications: plastic jar packaging without sterilization, aluminum foil packaging without sterilization, aluminum foil packaging sterilized with a retort, and aluminum foil packaging sterilized with a pressure cooker. The color of the product (L*, a*, b*) was tested with a CM-5 chromameter using the Spectra Magic NX program. Texture parameters, including hardness and springiness, were analyzed using a texture analyzer TA.XT Express with the P36 R probe using the Exponent Lite Express program. Sensory tests were performed through hedonic and descriptive tests with 22 semi-trained panelists, evaluating texture, color, and flavor parameters.

RESULTS AND DISCUSSION

The retort treatment of "oseng mercon" during storage resulted in the highest color different (ΔE*) (Table I). By the final day of storage (day 14), both retort and pressure cooker treatments exhibited significant color changes (ΔE* greater than 6) compared to the sample without treatment. The hedonic test showed that the longer the storage period, the lower the assessment score given by the panelists (scale 7) (Table II).

Texture analysis showed a continuous decrease in the hardness of "oseng mercon" from day 0 to day 14. Springiness values for all samples on day 0 were not significantly different from days 3, 7, and 10 but significantly different on day 14. The average springiness also decreased continuously from day 0 to day 14, indicating reduced elasticity. Initially, the meat was highly elastic, but by day 14, its ability to return to its original shape after compression diminished, reflecting a decline in meat quality. All samples exhibited a decline in color scores from day 0 to day 14 as storage time increased. Descriptive tests confirmed that the color quality of "oseng mercon" deteriorated over time

Table I: Color different characteristics after 14 days of observation

Treatment	ΔE*				
	Day 0	Day 3	Day 7	Day 10	Day 14
UJP	1.76	2.18	2.74	1.80	2.98
ASRP	4.41	5.38	7.06	7.59	8.83
PSAP	3.23	3.61	4.79	6.12	7.64

UJP : Unsterilized Jar Packaging UAP : Unsterilized aluminum foil packaging
ASRP : retort sterilized aluminum foil packaging
PSAP : pressure cooker sterilized aluminum foil packaging
Unsterilized aluminum foil packaging as a comparison

Table II: Hedonic test result

Parameter	Sample	Day 0	Day 3	Day 7	Day 10	Day 14
Color	UJP	5.7	5.2	3.8	3.7	2.8
	UAP	5.7	5.7	4.2	4.1	3.3
	ASRP	6.0	5.6	4.7	4.4	4.0
	PSAP	6.1	5.6	4.8	4.6	3.6
Texture	UJP	5.3	4.7	3.5	3.4	3.0
	UAP	5.4	5.3	3.8	3.5	3.3
	ASRP	6.6	6.2	4.7	4.5	3.9
	PSAP	5.9	5.7	4.7	4.2	3.7
Flavour	UJP	5.7	4.7	2.6	2.3	1.7
	UAP	5.9	5.4	4.4	4.2	3.9
	ASRP	5.8	4.8	2.8	2.7	2.2
	PSAP	6.0	5.3	4.6	4.3	4.2

due to changes in meat pigment exposed to oxygen, resulting in a lighter hue (pink). Meat color depends on myoglobin, hemoglobin, and cytochrome C catalase content in skeletal muscle [1].

Descriptive tests also indicated a decline in the texture quality of "oseng mercon" from day 0 to day 14. Changes in beef texture could be attributed to microbial activity degrading protein structure [2, 3]. Despite their potent aroma and flavor-enhancing properties that can extend food shelf life, spices did not completely prevent texture degradation due to microbial activity [4] . Bacterial protein degradation releases odorous gases such as ammonia, hydrogen sulfide, and methyl mercaptan, contributing to changes in meat aroma during the storage period [5].

CONCLUSION

All analyzed parameters of oseng mercon (hardness, springiness, colour, texture, and flavor) decreased continuously from day 0 to day 14. Panelists can still receive the product until the last day of storage (on the 14th day) for the retort process.

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Table III: Hardness characteristics after 14 days of observation

Treatment	Day 0	Day 3	Day 7	Day 10	Day 14
UJP	1042.85±38.06a	827.98±34.20b	551.31±24.63bc	534.79±21.64bc	278.67±13.77c
UAP	934.92±38.21a	783.54±65.64b	636.51±16.42bc	614.33±19.11bc	333.48±30.81c
ASRP	1121.2±38.82a	1046.16±37.57ab	493.18±39.84b	459.17±18.67b	397.27±25.69c
PSAP	1043.11±23.56a	972.88±63.04ab	423.22±32.93c	680.98±33.90b	406.50±11.25c

Description : Numbers followed by different letter superscripts on the same line show significant differences ($p<0.05$).

Table IV: Springiness characteristics after 14 days of observation

Treatment	Day 0	Day 3	Day 7	Day 10	Day 14
UJP	0.85±0.02a	0.79±0.01a	0.77±0.04ab	0.76±0.07ab	0.73±0.03b
UAP	0.87±0.06a	0.80±0.00a	0.69±0.08ab	0.69±0.02ab	0.57±0.04b
ASRP	0.99±0.00a	0.90±0.01a	0.85±0.09ab	0.84±0.02ab	0.61±0.09b
PSAP	0.84±0.09a	0.93±0.07a	0.75±0.04ab	0.81±0.07ab	0.63±0.03b

Description : Numbers followed by different letter superscripts on the same line show significant differences ($p<0.05$).

EXTENDED ABSTRACT

Development of Plant-Based Milk from Pigeon Peas and White Rice for Vegetarians

Rifka Elisabeth, Reisi Nurdiani, Zuraidah Nasution

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: zuraidah.nasution@apps.ipb.ac.id

SUMMARY

With the growing number of consumers adopting vegetarian diets, there is an increasing demand for vegetarian products. Plant-based products need to consider complementary protein concept to ensure their protein quality. This study aimed to develop vegetarian milk from pigeon peas and white rice. The results showed that increasing the amount of pigeon peas lead to a lower carbohydrate content, reduced viscous, and lighter color in the samples. This also highlighted the nutritional implications of the study, demonstrating the potential of pigeon peas in developing beverage products for vegetarians, thereby addressing their nutritional needs.

Keywords: Milk, Pigeon peas, Plant-based protein, Vegetarians, White rice

INTRODUCTION

The vegetarian diet has become popular among people around the world. Adopting a vegetarian diet can affect an individual's nutritional intake, making them susceptible to deficiencies in nutrient such as protein, iron, zinc, and vitamin B12. Protein intake is generally lower in the vegetarian group compared to the non-vegetarian group. Milk consumption in Indonesia is still limited, particularly dairy products, which cannot be consumed by vegetarian groups [1]. Pigeon peas contain 20-22% essential amino acids, especially lysine; 18-35% protein; 65% carbohydrates; and 1.2% fat [2]. Meanwhile, the use of pigeon peas is still low despite their potential as an alternative plant-food source. To increase its nutritional content, white rice is added as a source of protein and amino acids, particularly methionine. Therefore, this research aims to develop plant-based milk from pigeon peas, with the addition of white rice, for a complementary protein effect.

MATERIALS AND METHODS

The research applied a completely randomized design and was conducted from June to December 2023. The research stages started with determining the formulas of pigeon peas and white rice milk. Peanuts were added to support the required fat content. This research resulted in three formulas with the following percentage ratios of pigeon peas, white rice, and peanuts: F1 (90:0:10), F2 (75:15:10), and F3(60:30:10). Each formula has a different composition of pigeon peas and white rice, which is expected to produce varying nutritional content. The samples were analyzed for their water, ash, protein, total fat, carbohydrate, and calcium contents, as well as viscosity, color, total soluble solids, and pH. An acceptance test (9-cm hedonic scale) and attribute intensity test (9-cm rating scale) were also conducted. The data obtained were then processed using Statistical Program for Social Sciences (SPSS) 25.0 for Windows and reported as mean ± standard deviation.

RESULTS AND DISCUSSION

Plant-based milk samples made from pigeon peas and white rice had a nutritional composition, as shown in Table I. The proportion of pigeon peas to white rice in the production of vegetarian milk significantly affected the samples' water, ash, and carbohydrate content. As the quantity of pigeon peas decreases, both the water and ash content also decrease. Additionally, the carbohydrate content increases with a higher proportion of white rice. This is likely due to white rice having a higher carbohydrate content (77.1%) compared to pigeon peas (58.0%) [3], which explains the observed results.

Amino acid scores, one of the parameters which describe protein quality, showed a score of 99 for the sample, classifying it as a "good quality" protein source. The amino acid score of a sample is determined based on the composition of the main ingredients [2]. This score is attributed to the combination of legumes and cereals, which provide complementary essential amino acids, enhancing the protein quality of the milk.
Table III shows the viscosity, color, total soluble solids,

Table I: The nutrient content of vegetarian milk from pigeon peas and white rice

Nutrient	Formulas (Pigeon peas: White rice: Peanuts)		
	F1 (90:0:10)	F2 (75:15:10)	F3 (60:30:10)
Water (g/100 g)	89.88±1.01[b]	88.85±0.35[ab]	88.21± 0.09[a]
Ash (g/100 g; DB)	1.67± 0.08[c]	1.44± 0.10[b]	1.21± 0.10[a]
Protein (g/100 g; DB)	13.92± 0.69[a]	13.11±0.58[a]	12.85± 0.80[a]
Fat (g/100 g; DB)	6.38± 0.18[a]	6.25± 0.37[a]	6.10± 0.43[a]
Carbohydrate (g/100 g; DB)	78.03± 0.76[a]	79.20±0.12[b]	79.83± 0.34[b]
Calcium (mg/100 g; DB)	194.36± 4.69[a]	198.12±8.70[a]	190.54± 6.88[a]

Notes: Treatment Fn (x:y:z) = a mixture of x% pigeon peas, y% white rice, and z% peanuts for the n treatment; Values followed by the same superscript letters in a row are not significantly different (p>0.05)

Table II: Physical properties of vegetarian milk from pigeon peas and white rice

Parameter	Formulas (Pigeon peas: White rice: Peanuts)		
	F1 (90:0:10)	F2 (75:15:10)	F3 (60:30:10)
Viscosity (cP)	24.58±1.91[a]	119.58±8.51[b]	330.83±5.05[c]
Color (L*)	55.66±0.47[c]	53.34±0.12[b]	51.71±0.23[a]
Total soluble solids (°Brix)	6.67±0.57[a]	8.00±1.00[a]	9.67±0.57[b]
pH	6.49±0.01[a]	6.59±0.01[b]	6.69±0.01[c]

Notes: L* = lightness; Treatment Fn (x:y:z) = a mixture of x% pigeon peas, y% white rice, and z% peanuts for the n treatment; Values followed by the same superscript letter in a row are not significantly different (p>0.05)

Table III: Sensory scores of vegetarian milk from pigeon peas and white rice

Sensory attribute	Formulas (Pigeon peas: White rice: Peanuts)		
	F1 (90:0:10)	F2 (75:15:10)	F3 (60:30:10)
Acceptance test		**Hedonic scores**	
Appearance	5.13±2.02[a]	4.87±1.79[a]	4.86±1.84[a]
Aroma	5.12±1.16[a]	4.66±1.56[a]	4.48±1.79[a]
Texture	4.98±2.10[a]	5.67±1.82[a]	5.11±2.21[a]
Taste	5.71±1.90[a]	5.21±1.83[a]	5.15±2.21[a]
Aftertaste	5.43±2.07[a]	4.95±2.01[a]	4.67±1.58[a]
Overall acceptance	5.65±1.66[a]	5.57±1.47[a]	5.55±1.95[a]
Attribute intensity test		**Intensity scores**	
Color (darkness)	4.21±1.77[a]	5.17±1.58[b]	6.06±1.54[c]
Aroma (beany)	4.90±2.21[a]	4.19±2.31[a]	4.22±2.02[a]
Texture (viscosity)	2.00±1.91[a]	4.00±1.96[b]	6.40±1.53[c]
Taste (typical of pigeon peas)	4.94±2.42[a]	4.74±2.38[a]	4.57±1.91[a]
Taste (typical of peanuts)	4.31±2.21[a]	5.35±2.05[a]	4.91±2.62[a]
Taste (sweet)	5.15±2.21[b]	4.91±1.41[b]	3.87±2.05[a]
Mouthfeel (grittiness)	3.01±2.42[b]	4.81±2.45[b]	5.04±2.12[a]
Aftertaste (bitter)	3.99±2.34[a]	4.54±2.00[a]	4.91±1.73[a]

Notes: Scale = 0 [lowest]- 9 [highest]; Treatment Fn (x:y:z): a mixture of x% pigeon peas. y% white rice, and z% peanuts for the n treatment; Values followed by the same superscript letter in a row are not significantly different (p>0.05)

and pH of the samples. Significant differences were observed among the samples for all parameters. As the amount of white rice in the formulas increased, the milk samples had higher total soluble solids, darker color, increased viscosity, and higher pH, These changes are attributed to the starch content in the white rice [4].

There were no significant differences among samples for their acceptance scores. However, the attribute intensity test showed significant differences, with the samples' colour (darkness), viscosity, and mouth-feel (grittiness) increasing as the amount of pigeon peas decreased. Higher soluble solids were associated with greater perceived grittiness in the mouth-feel [5]. Additionally, panelists detected a less sweet taste in samples using fewer pigeon peas.

CONCLUSION

In the development of vegetarian milk, using fewer pigeon peas resulted in a lighter color, sweeter taste, lower water and ash content, higher carbohydrate content, viscosity, total soluble solids, pH, and grittiness of the samples. Improving these characteristics will benefit by providing better alternatives to vegetarian milk.

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EXTENDED ABSTRACT

Physicochemical and Sensory Characteristics of Yoghurt with Added Mesocarp or Epicarp and Endocarp from Pumpkin (*Cucurbita moschata*)

Jia Jing Ang[1], Kim Yee Lim[1], Ai Ling Ho[2]

[1] Faculty of Food Science and Nutrition, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Malaysia.
[2] Food Security Research Laboratory, Faculty of Food Science and Nutrition, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Malaysia.

Corresponding author's email: alho@ums.edu.my

SUMMARY

This study explored the potential of employing underutilized pumpkin by-products i.e. epicarp (peel) and endocarp (fibrous strands) in yoghurt production apart from the pumpkin mesocarp (flesh). A total of six yoghurt formulations were developed by incorporating varying percentages (1%, 3%, and 5%) of mesocarp or by-products (a mixed of epicarp and endocarp). Compared to the control yoghurt, incorporating pumpkin components caused physicochemical changes. The addition of pumpkin by-products could further improve the yoghurt nutritionally, however, the added 3% pumpkin mesocarp was the best formula based on physicochemical and sensory characteristics.

Keywords: By-products, Physicochemical properties, Pumpkin, Sensory characteristics, Yoghurt

INTRODUCTION

As health consciousness and yoghurt consumption increase, interest in developing yoghurt using natural ingredients with functional potencies has grown. Pumpkin, a globally appreciated vegetable, is nutrient-rich with carbohydrates, fibre, amino acids, vitamins, and antioxidants, making it valuable as a dietary resource [1, 2]. Studies showed that pumpkin epicarp has double the dietary fibre content and slightly higher levels of ascorbic acid, phosphorus, and iron than mesocarp [3], suggesting that pumpkin by-products may enhance nutritional content compared to mesocarp. This study aimed to integrate pumpkin mesocarp into yoghurt production and assess the viability of using pumpkin by-products (epicarp and endocarp). Quality attributes were evaluated based on physicochemical properties, sensory perception, nutritional composition, and storage quality.

MATERIALS AND METHODS

A whole matured pumpkin was used. The mesocarp, epicarp and endocarp were separated, washed, dried and ground into powder [4]. Six yoghurts were formulated using full cream milk, added with sugar (3%), pectin (2%) and varying percentages (1, 3, and 5%) of pumpkin mesocarp powder or pumpkin by-products (a mixed epicarp-endocarp powder in 2:1 ratio). A commercial starter culture, 0.05% (YO-MIX™, Danisco) was added to the pasteurized ingredients. Physicochemical analysis comprised of total acidity, colour and viscosity was determined. Forty panelists were involved in the sensory evaluation using a nine-hedonic scale with the highest score representing the best acceptance. The chosen formula was then analysed for its nutrient content estimated using proximate analysis. For the storage study, the syneresis and viability of the starter culture were determined. Analysis of variance (ANOVA) was performed using IBM SPSS Statistics ver. 28. Data were analyzed for significant differences using Tukey's test ($p<0.05$).

RESULTS AND DISCUSSION

The pumpkin's epicarp and endocarp powder had significantly higher ($p<0.05$) levels of protein, fat, crude fibre, and dietary fibre content compared to mesocarp powder (Table I). This showed a higher nutritional composition in pumpkin by-products. Various studies have determined the proximate composition of pumpkin mesocarp and epicarp, and the value ranges widely [2].

Increasing the amount of pumpkin powder (1 to 3%) reduced the titratable acidity and colour lightness value (L*) in yoghurt but higher in viscosity especially for the yoghurt with the addition of pumpkin by-products (Table II). The use of pumpkin mesocarp, in general, scored higher in most sensory attributes, whereby formula YPM3 (3% mesocarp) had the highest mean score

Table I: Nutrient composition of mesocarp, epicarp, and endocarp powder from pumpkin

Composition (% dwb)	Mesocarp	Epicarp	Endocarp
Moisture	6.28±0.28^{b}	5.06±0.06^{a}	9.91±0.16^{c}
Ash	6.26±0.44^{a}	5.80±0.12^{a}	15.15±0.12^{b}
Fat	1.94±0.21^{a}	4.29±0.11^{b}	5.69±0.32^{c}
Protein	8.10±0.01^{a}	15.90±0.04^{b}	22.44±0.06^{c}
Crude fibre	8.52±0.04^{a}	20.18±0.22^{c}	10.54±0.03^{b}
Carbohydrate	68.89 ± 0.56^{c}	48.77±0.41^{b}	36.27±0.35^{a}
Dietary fibre	18.43 ± 0.14^{a}	41.38±0.46^{c}	30.36±0.38^{b}

Mean ± SD with different superscript letters (a-c) in the same row are statistically different ($p<0.05$).
dwb – dry weight basis

Table II: Physicochemical properties of yoghurt with added pumpkin mesocarp, epicarp, and endocarp

Sample	Titratable acidity (%)	Colour-Lightness (L*)	Viscosity (cP)
Y0	0.87±0.06^{d}	88.26±0.06^{g}	2901.33±15.04^{a}
YPM1	0.83±0.02^{cd}	84.38±0.14^{f}	3116.67±33.50^{b}
YPM3	0.76±0.03^{bc}	80.35±0.13^{e}	3450.00±44.03^{c}
YPM5	0.73±0.06^{abc}	76.10±0.02^{c}	3866.67±43.84^{d}
YPE1	0.80±0.03^{bcd}	79.12±0.03^{d}	4005.67±41.79^{e}
YPE3	0.70±0.01^{ab}	73.11±0.11^{b}	4961.33±41.79^{f}
YPE5	0.65±0.03^{a}	67.54±0.05^{a}	6272.33±42.25^{g}

Mean ± SD with different superscript letters (a-g) in the same column are statistically different ($p<0.05$).
Y0 – yoghurt without added pumpkin powder (control).
YPM1, YPM3, YPM5 – yoghurt added with pumpkin mesocarp powder at 1, 3, 5%.
YPE1, YPE3, YPE5 - yoghurt added with pumpkin epicarp and endocarp (2:1) powder at 1, 3, 5%.

Table III: Sensory acceptance of yoghurt with added pumpkin mesocarp, epicarp, and endocarp

Sample	Sensory attributes				
	Colour	Aroma	Texture	Taste	Overall acceptance
YPM1	6.78±1.35^{b}	7.00±1.65^{bc}	4.70±1.73^{a}	6.84±1.68^{d}	6.74±1.10^{d}
YPM3	7.34±1.14^{bc}	7.16± 1.75^{bc}	6.42±1.73^{bcd}	7.94±1.04^{e}	8.02±0.98^{e}
YPM5	8.10±0.91^{c}	7.34±1.38^{c}	6.86±1.69^{cd}	6.52±1.45^{cd}	6.98±1.51^{d}
YPE1	5.74±1.77^{a}	6.30±1.75^{b}	6.22±1.62^{bc}	5.78±1.62^{c}	5.84±1.61^{c}
YPE3	7.68±1.13^{c}	4.78±1.86^{a}	7.34±1.30^{d}	4.34±1.51^{b}	4.70±1.71^{b}
YPE5	4.98±1.76^{a}	4.36±2.03^{a}	5.48±1.89^{ab}	3.18±1.82^{a}	3.56±1.67^{a}

Mean score ± SD with different superscript letters (a-e) in the same column are statistically different ($p<0.05$).
YPM1, YPM3, YPM5 – yoghurt added with pumpkin mesocarp powder at 1, 3, 5%.
YPE1, YPE3, YPE5 - yoghurt added with pumpkin epicarp and endocarp (2:1) powder at 1, 3, 5%.

($p<0.05$) for the taste, and overall acceptance (Table III). Compared with the 3% of pumpkin by-products, YPE3 scored much lower in overall acceptance but with a similar preference with YPM3 on the colour and texture attributes ($p>0.05$).

For the proximate analysis, formula YPM3 had a higher content ($p<0.05$) of ash, protein, crude fibre, and carbohydrate content (0.78%, 3.29%, 0.65%, and 7.66%, respectively) compared to Y0 (0.35%, 2.74%, 0.03% and 5.82%, respectively) while the addition of 3% of of pumpkin by-products further increased the ash, protein, crude fibre, and carbohydrate content (1.05%, 3.86%, 1.01%, and 8.13%, respectively).

Similar to the control sample, yoghurt incorporating with 3% pumpkin mesocarp (YPM3) and pumpkin by-products (YPE3) maintained the viability of yoghurt cultures at 6 log CFU/g for up to 15 days. The syneresis was significantly lower ($p<0.05$) in YPM3 (1.54%) and YPE3 (0.68%) compared to the control yoghurt, Y0 (2.79%) over the same storage period. The fibre content in the pumpkin was more likely to increase water-binding capacity, resulting in a thicker gel and higher yoghurt viscosity [5]. This contributed to an increase in texture acceptance and reduced syneresis.

CONCLUSION

Incorporating pumpkin mesocarp or epicarp and endocarp into yoghurt significantly altered its properties. The best yoghurt formula was incorporated with 3% mesocarp powder. Pumpkin by-products could enhance nutrition and sustainability but might need pretreatment or combination with mesocarp for better sensory acceptance.

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EXTENDED ABSTRACT

Assessment of the Nutrient Content and Acceptance of Bread Fortified with Moringa Leaf Powder

Kezia Bess, Yonnique Wallace

Department of Chemistry, Faculty of Natural Sciences, University of Guyana, Turkeyen Campus, Guyana

Corresponding author's email: kezia.bess@uog.edu.gy

SUMMARY

The diverse benefits of has potential for applications in the food sector. This study evaluated the acceptance and nutritive content of breads fortified with *Moringa oleifera* leaf powder. Five samples were prepared with 0- 20% Moringa leaf powder and a panel of ten rated the organoleptic properties. Nutritional analysis using NIR spectroscopy revealed that Moringa increased ash (2.00-2.55%), fat (5.30-9.99%), and crude fiber (2.90-7.80%) while moisture content (10.22%-14.00%) was reduced with increased fortification level. Breads made with 5% Moringa leaf powder showed better acceptability with no significant difference from the control and significantly improved the protein and mineral content of bread.

Keywords: Bread, Fortification, Moringa leaf powder, *Moringa oleifera*, Nutrient content

INTRODUCTION

Moringa oleifera is a multifunctional plant that contains a wide range of food components such as proteins, vital amino acids, vitamins, antioxidants, etc. [1]. Almost every part of the Moringa oleifera plant is edible. The leaves especially contain high amounts of vitamin A, B and C, essential amino acids and can be added to the diet to improve nutritional quality [2]. The diverse benefits of Moringa oleifera has excellent potential for applications in the food sector. This study evaluates the acceptance and nutritive value of a local bread (tennis rolls) fortified with Moringa leaf powder. Bread samples were prepared using wheat flour supplemented with Moringa leaf powder with an incorporation rate of 0-20%. These products are expected to reduce reliance on imported wheat flour, which is increasingly costly and also improve nutrient intake of citizens.

MATERIALS AND METHODS

Bread samples were prepared using wheat flour supplemented with Moringa leaf powder at incorporation rates of 0%, 5%, 10%, 15%, and 20%. A standard bread recipe was followed and sensory evaluation was conducted with ten untrained judges rating the Moringa fortified bread samples on a seven-point hedonic scale for colour, aroma, texture, flavor and overall acceptability. NIR spectrophotometer was used for the determination of moisture, crude fibre, ash, fat, starch, and protein contents of the fortified breads. Samples were ground to approximately 1mm, and dried in an air oven at 55°C for 48 hours prior to analysis. The data obtained from both sensory and proximate analyses were collected in triplicate and analyzed with SPSS software. Analysis of Variance (ANOVA) was applied to the date obtained. The sensory evaluation results were further tested for significance using the Paired Comparison t-Test.

Table I: Standard formulation for breads

Ingredients	Composition				
	0%	5%	10%	15%	20%
Wheat flour (g)	500	475	450	425	400
Moringa powder (g)	0	25	50	75	100
Water (ml)	500	500	500	500	500
Margarine (g)	100	100	100	100	100
Sugar (g)	60	60	60	60	60
Yeast (g)	12	12	12	12	12
Salt (g)	10	10	10	10	10

RESULTS AND DISCUSSION

There were gradual increases in the fat content (5.30-9.99%), ash (2-2.55%) and crude fibre (2.90-7.80%) content of the breads with increasing Moringa leaf powder ratios. Conversely, the moisture content decreased as Moringa fortification increased. The moisture content of bakery products have a great impact on their physical and sensory properties [3]. This was evident in the organoleptic test results. Surprisingly, Moringa leaf powder did not enhance the protein content as expected; and this may be attributed to degradation during the preparation for NIR analysis, rather than following the standard AOAC method for protein analysis. Although

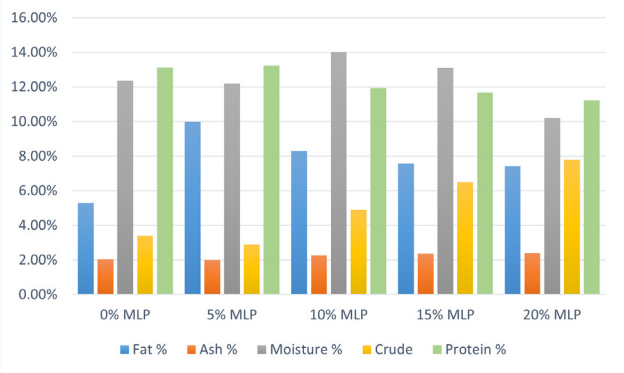

Figure 1: Fat, ash, protein, fibre and moisture content of bread samples

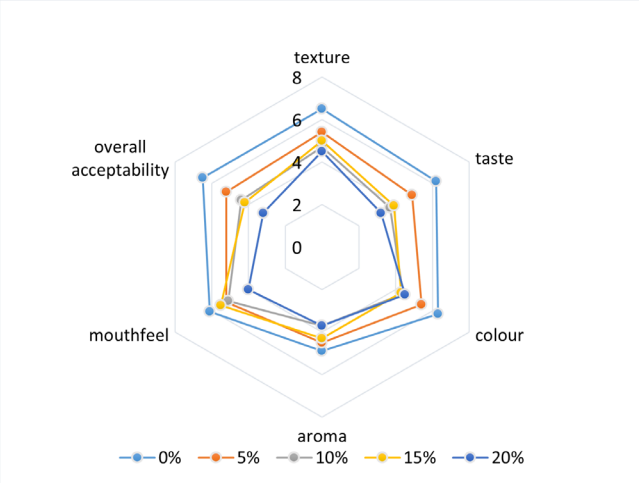

Figure 2: Organoleptic tests for bread samples

it was expected that an increase in protein content would occur with increased addition of Moringa leaf powder was expected, only the 5% fortification with Moringa showed a noticeable rise in protein content. This finding contrast those of similar studies of Moringa fortification and could be due to some unidentified error in the process. Notably, bread prepared with a 5% replacement of wheat for Moringa leaf powder was most comparable to the control (100% wheat flour) in terms of sensory attributes and overall acceptability. There were significant differences ($p<0.05$) observed in the sensory attributes between the unfortified bread and the samples fortified with proportions of Moringa leaf powder greater than 5%.

CONCLUSION

The data indicate that *Moringa olifera* leaf powder is a suitable means of fortifying flour for bread making using a 5% substitution of wheat flour, since it can increase the protein and fat content of the bread.

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EXTENDED ABSTRACT

Consumers and Producer Preferences for Sugar, Salt, and Fat Content Information and Health Messages Design on Processed and Ready-to-serve Food

Rimbawan Rimbawan[1], Zuraidah Nasution[1], Syifa Qolbiyah Nasir[1,3], Deannisa Fajriaty[1,2], Aang Sutrisna[4], Eny Kurnia Sari[4], Eva Susanti[5]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, Bogor, Indonesia 16680
[2] Nutrition Study Program, STIKes Bogor Husada, Bogor, Indonesia
[3] Department of Nutrition, Universitas Negeri Semarang, Semarang, Indonesia 16680
[4] Global Alliance for Improved Nutrition, Indonesia
[5] Directorate General of Disease Prevention and Control, Ministry of Health Indonesia

Corresponding author's email: rimbawan@apps.ipb.ac.id

SUMMARY

Many risk factors, including sugar, salt, and fat (SSF) consumption, influence non-communicable diseases (NCDs). This study provides information on consumers and food producers' preferences for designing SSF information and health messages on processed and ready-to-serve foods in Indonesia. Data were obtained using a structured questionnaire and focus group discussion (FGD). The results indicated that consumers and producers of processed and ready-to-serve foods had different preferences for designing SSF content information and health messages. Therefore, rigorous discussion with all stakeholders are necessary to agree on the most suitable design.

Keywords: Food label, Health messages, Nutrition facts label, Processed food, Ready-to-serve food

INTRODUCTION

Obesity, high blood pressure, and high blood sugar were among the top five risk factors contributing to the global disease burden in 2019 [1]. Many factors, including eating habits, influence these non-communicable diseases (NCDs). Data from Individual Food Consumption Survey (SKMI) 2014 showed that 29.7% of Indonesia's population exceeded the WHO daily intake recommendations for sugar (>50 g/day), salt (>5 g/day), and fat (>67 g/day) [2]. Increasing awareness of food choices is critical for changing consumer behavior toward healthier eating habits. Food producers can contribute by providing nutrition information and health messages to help consumers make more informed food choices. This study aimed to explore consumers' and food producers' preferences for the design of SSF content information and health messages on processed and ready-to-serve food.

MATERIALS AND METHODS

The study was conducted from May to September 2023 accross five locations in Indonesia: Jakarta, Bandung, Bogor, Bekasi Regency, and Bandung Regency. It involved interviewing 100 consumers using a structured questionnaire. Additionally, an online survey was conducted with 45 large- and medium-sized processed food producers, while 28 small- and micro-sized food producers were surveyed offline. The FGD method was utilized to collect data from 80 food service entrepreneurs, including those from restaurants, catering services, and food stalls. The respondents were presented with three design options for SSF content information and health messages on processed food labels, four options for ready-to-serve food, and two options for digital food service platforms (Fig. 1). They were then asked to select the option they found most straightforward to understand and apply on processed and ready-to-serve food labels.

RESULTS AND DISCUSSION

Consumers and processed food producers had different preferences for designing health messages regarding SSF consumption on processed food labels. Consumers favored placing the information at the front of the packaging, while producers preferred its placement under the nutrition facts label (Table I). Scapin et al.'s [4] meta-analysis revealed that increased exposure to textual or color-coded symbols indicating sugar levels improved consumer understanding of sugar content. Formats such as warning signs, health messages, traffic light symbols with "high in sugar" text, and graphical representations using spoon images had the most positive impact on consumer choices and reduction in sugar intake [3]. The producers' preferences align with the current food labeling policy (Regulation of The Indonesian Food and Drug Authority (BPOM) No. 31 of 2018 and No. 26 of 2021).

Figure 1: Options for the design of salt, sugar, and fat (SSF) content information and health message on the label of processed food (A), on the packaging of ready-to-serve food (B), and digital marketing platforms for ready-to-serve food (C)

Consumers and ready-to-serve food producers have differing preferences regarding the placement of SSF content information and health messages. This divide is evident across both physical and digital marketing channels. Consumers tend to prefer having this information directly on menu cards and digital platforms, while producers prefer its' placement on takeaway packaging (Table I). Research by Falbe et al. [3] indicates that providing added-sugar warning labels on restaurant menus can positively influence consumer behavior by reducing orders for high-sugar items and increasing awareness about added sugar content. However, some producers either reject all available options for displaying SSF information or find them unsuitable for their products due to their unique characteristics. Despite the validation of the Indonesian Health Ministry Regulation (Permenkes) No. 30 of 2013, there is a lack of clear technical instructions for implementing SSF information and health messaging on processed and ready-to-serve foods. As consumer awareness regarding nutritional content increases, finding common ground between consumer preferences and producer constraints becomes increasingly essential for promoting informed food choices.

CONCLUSION

The competence (KAP) in Balanced Nutrition Messages among parents or guardians of Raudhatul Athfal and Kindergarten students in Semarang City is rated as very good (95.1%). Parental competence in Balanced Nutrition Messages is highlighted as promising intervention for RA and Kindergarten children.

ACKNOWLEDGEMENTS

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Table I: Consumers and food producers' preferences on the design of SSF content information and health messages on the label of processed food (A), on the packaging of ready-to-serve food (B), and digital marketing platforms for ready-to-serve food (C)

Options for the design of SSF information and health message	Consumers (n=100)[1]	Processed Food Producers		Ready-to-serve Food Producers (n=80)[3]
		LM (n=45)[1]	SM (n=28)[2]	
On the label of processed food				
(A1) Under the nutrition facts label	38.0%	60.0%	39.3%	
(A2) At the front part of the packaging	51.0%	15.6%	32.1%	
(A3) Everywhere on the label in written form	11.0%	24.4%	28.6%	
On the packaging of ready-to-serve food				
(B1) On menu cards	48.0%			32.5%
(B2) Printed on a piece of paper and put on a food tray	6.0%			1.3%
(B3) On the digital menu board	21.0%			10.0%
(B4) On the package of takeaway food	25.0%			32.5%
Abstained	0.0%			23.8%
On digital marketing platforms of ready-to-serve food				
(C1) Directly on the digital platforms	72.0%			23.8%
(C2) On the packaging of the digitally-ordered food	28.0%			46.3%
Abstained	0.0%			30.0%

Note: SSF = salt, sugar, and fat; LM = Large-Medium; SM = Small-Micro; data retrieved using [1]offline survey and interviews, [2]online survey, and [3]Focus Group Discussion (FGD)

EXTENDED ABSTRACT

Effect of Nudging on Food Waste among High School Adolescents: A Narrative Review

Andi Eka Yunianto[1,2], Hadi Riyadi[3], Ali Khomsan[3], Yayuk Farida Baliwati[3]

[1] Postgraduate in Nutrition Science, Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Dramaga, Bogor, Indonesia
[2] Medical Education Study Program, Faculty of Medicine, Universitas Lampung, 35145 Bandar Lampung, Lampung, Indonesia
[3] Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Dramaga, Bogor, Indonesia

Corresponding author's email: hadiri@apps.ipb.ac.id

SUMMARY

Nudging is a method used to reduce food waste among adolescents in school dining services. The purpose of this study was to review the scientific literature on the effect of nudging on food waste in among adolescents in school dining settings. Nudging interventions have been shown to reduce food waste among adolescents in school food services. Therefore, posters are effective medium for encouraging and evaluating food waste reduction in school settings.

Keywords: Adolescent, Food waste, Food service, Nudging, School

INTRODUCTION

Food Waste (FW) is a global issue that has been addressed through various policies and campaigns, particularly in the food sector at the consumption stage. One popular approach to reducing food waste is through nudging. Nudging involves making small changes to people's behavior in a predictable way without restricting choices or significantly altering economic incentives [1]. Previous studies have shown that many adolescents waste food at school, which has significant impact on the environment [2-5].To reduce food waste in schools, nudging can be used as a strategy to support the Sustainable Development Goals (SDGs). The purpose of this study was to review the scientific literature on the effect of nudging on food waste among adolescent in school dining settings.

MATERIALS AND METHODS

The method used was a narrative review of electronic databases: Google Scholar, PubMed, and Scopus electronic databases, covering the last five years (from 2014 to the present). The keywords for the database search include intervention, nudging, food waste, adolescent, and food service. The studies selected focused on nudging interventions aimed at reducing food waste in food service settings. The articles reviewed involved adolescents subjects and utilized a pre-post experimental design. A total of 133 articles were screened by title and abstract, resulting in 39 relevant journal. Of these, eight journals were accessible in full, and four met the study's inclusion criteria. The inclusion criteria in this study were: teenagers aged 10-21 years who dined in school cafetraia and received nudging media interventions aimed at reducing food waste.

RESULTS AND DISCUSSION

The study by Malefors et al. demonstrated a reduction in FW among adolescents at school using various nudging media, including tasting spoons, posters, plate waste tracking devices, and student attendance [2]. These findings align with those of Qi et al., who reported an increase in vegetable consumption when students were provided with smaller plates. The interventions involved changing the size of the students' plates [3]. The study by Vidal-Mones et al. demonstrated a significant reduction in daily FW, amounting to 46 g (41%) per dinner, through three nudging approaches: visual (posters), participatory approach (canteen staff involvement), and educational approach (discussion on FW during lessons) [4]. These findings are supported by research of Ergul et al., who used nudging media such as posters, brochures, flyers, emails, and messages to effectively reduce FW among students [5].

The analysis revealed a reduction in FW among adolescents in school dining settings through the use of cognitive-oriented visual nudging media, such as posters, brochures, flyers, and emails. In addition, affective-oriented nudging, such as participatory approaches involving canteen staff, and behavior-oriented nudging, such as using tasting spoons and smaller plates also

Table I: Review of studies on nudging intervention for adolescents in reducing FW at school

Research and country of origin	Research design and subjects	Intervention and duration	Finding
[2], Sweden	- Pre - post study design - School children aged 6-19 years (n = 187)	- Taster spoons, poster campaigns, plate waste tracking devices, and canteen attendance estimates) - 3 months duration	All interventions reduced total FW (by 6 to 44 g/guest) compared to the baseline.
[3], United States of America	- Pre - post study design - Students, staff, and lecturers (n = 488)	- Plate size, meals with more vegetables than meat, paper plates, message about leftovers - Duration a few weeks	Study finds increased consumption of 50% more vegetables with smaller plates
[4], Spain	- Experimental case pilot study with pre - post design - Students, staff, and faculty (n = 488)	Three different intervention approaches: 1. Visual (poster) 2. Participatory approach (involvement of canteen staff) 3. Educational approach (based on FW problem talk during learning) Duration 81 days	The study resulted in a daily FW of 46 g per dinner and a 41% impact on reducing FW when applying the nudging strategy.
[5], Turkey	- Experimental Pre - post study design - Students (n = 157)	- Nudging in the form of posters, brochures, flyers, emails and messages. - Duration 8 weeks	The nudging intervention can reduce only bread are reduced.

contributed to reducing food waste. The results indicate that nudging effectively reduces FW among adolescents in school settings (Table I).

CONCLUSION

There was a decrease in FW among adolescents at school through the use of media nudging in food organizations. Posters are one of the effective tools for encouraging school food services to evaluate and address food waste.

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EXTENDED ABSTRACT

Indonesian Consumers' and Food Producers' Preferences for Sentence Style in Health Messages about Sugar, Salt, and Fat on Processed and Ready-to-serve Food

Rimbawan Rimbawan[1], Zuraidah Nasution[1], Deannisa Fajriaty[1,2], Syifa Qolbiyah Nasir[1,3], Aang Sutrisna[4], Eny Kurnia Sari[4], Eva Susanti[5]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, Bogor, Indonesia 16680
[2] Nutrition Study Program, STIKes Bogor Husada, Bogor, Indonesia
[3] Department of Nutrition, Universitas Negeri Semarang, Semarang, Indonesia 16680
[4] Global Alliance for Improved Nutrition, Indonesia
[5] Directorate General of Disease Prevention and Control, Ministry of Health Indonesia

Corresponding author's email: rimbawan@apps.ipb.ac.id

SUMMARY

Excessive intake of sugar, salt, and fat (SSF) is a major risk factors for non-communicable diseases (NCDs). This study explores the preferences of Indonesian consumers and producers regarding the style of health messages on labels of processed and ready-to-serve foods. Data was collected through a structured questionnaire and focus group discussion. The results showed that household units were preferred for measurement. Additionally, shorter sentence were preferred over those in the current guidelines. Intensive discussions involving all stakeholders are necessary to agree on the most suitable health message regarding SSF content to help reduce the risk of NCDs.

Keywords: Consumers, Food labels, Food purchasing behaviour, Health messages, Sugar, salt, and fat

INTRODUCTION

The prevalence of NCDs continues to rise, with eating habits, particularly the consumption of sugar, salt, and fat (SSF), contributing to the incidence of NCDs [1]. Reducing NCD risks requires more than consumer education; it also involves influencing food purchasing behavior. A systematic review demonstrated that nutrition warnings have a direct impact on adults' food and drink choices [2]. The Ministry of Health of Indonesia has issued a policy regarding SSF content information and health messages on packaged food. However, its' implementation has faced challenges [3]. The policy requires more detailed technical guidelines, and the sentence style used in the health message needs to be reviewed and updated. This study aimed to investigate the preferences for SSF health messages among consumers and food producers in Indonesia.

MATERIALS AND METHODS

The study was conducted from May to September 2023 in five locations accross Indonesia (Jakarta, Bandung, Bogor, Bekasi Regency, and Bandung Regency) using a structured questionnaire. Interviews were conducted with 100 consumers, while the survey was administered online to large- and medium-sized food manufacturers (n=45) and offline to small- and micro-sized food manufacturers (n=28). Data from food service entrepreneurs (n=80), including restaurants, catering services, and food stalls, was collected through focus group discussion (FGD). Respondents were asked to choose one of three options provided (Fig. 1) for health message sentence styles, selecting which was more informative and for processed and ready-to-serve food labels.

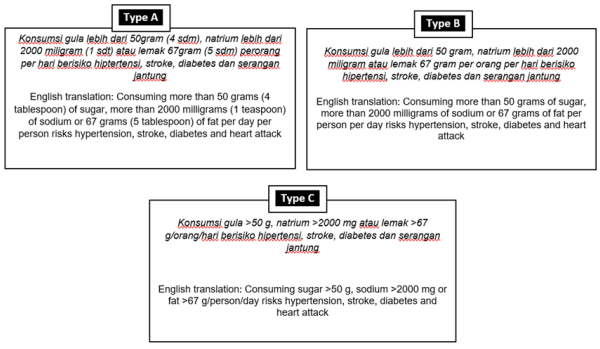

Figure 1: Options for sentence style for health message on salt, sugar, and fat on the label of packaged food

RESULTS AND DISCUSSION

Consumers and producers of packaged food were presented with three sentence styles for the SSF health message, and Table I displays the respondents choices.

Among the three choices of health message sentence style, Type A was more frequently selected by consumers (55%), large- and medium-sized food manufacturers (31.1%), and small- and micro-sized food manufacturers (42.9%). In contrast, ready-to-serve food producers primarily preferred Type C (51.3%), with Type A being the second choice (46.3%). Type C was selected more due to its shorter sentence. An exploratory study on food packaging in the USA found that simple health message, without lengthy sentences, generally had a positive effect on the participants' perception [5].

Meanwhile, Type A was favored by ready-to-serve food producers as it was considered more straightforward and informative. This preference was due to the inclusion of household measurement systems, which estimates food quantities in familiar units for consumers. Kliemann et al. (2018) found a connection between portion size and consumer health, noting that portion size can be used as a marketing strategy by the food industry to alter product sizes and present food products as healthier options [4].

Table I: Most preferred sentence style for health messages on SSF by consumers and food producers

Respondent		Most preferred sentence style for health message on SSF (%)			
		Type A	Type B	Type C	Others
Consumers (n=100)		55.0	26.0	19.0	0
Processed food producer	Large and medium-sized food manufacturers (n=45)	31.1	17.8	8.9	42.2
	Small- and micro-sized food manufacturers (n=28)	42.9	17.9	14.3	14.3
Ready-to-serve food producers (n=80)		46.3	2.5	51.3	0

Note: n number of respondents; others editorial input and suggestions for health messages made by consumers and producers

Consumers prefer health messages that are easy to understand and engaging, while food manufacturers seek flexibility in message placement and style rules. Approximately 42.2% of large- and medium-sized food manufacturers suggested additional sentence styles for SSF health messages beyond the three options provided. The options include: "*Konsumsi pangan dengan bijak* (consume food wisely)," *Makan semua makanan secukupnya* (eat moderately)," and "*Batasi konsumsi gula, garam, lemak* (limit the consumption of sugar, salt, and fat)." These suggestions must be further evaluated to prevent any potential misunderstanding by consumers.

CONCLUSION

In conclusion, there were statistically no significant differences of the average calcium and magnesium concentrations between four formulas. The F2 sprinkle had "high" claim terms especially in calcium content. The further study about mineral bioaccessibility and bioavailability are important to do for investigating its potential for absorption and utilization.

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EXTENDED ABSTRACT

Enhancing Food Security and Nutrition in Indonesia Through Optimization of Post-Harvest Management Strategies

Yeni Katon Rahmawati Sujarnoko[1,2], Nancy Dewi Yuliana[1], Hanifah Nuryani Lioe[1]

[1] Department of Food Science and Technology, Faculty of Agricultural Engineering and Technology, IPB University, 16680 Bogor, Indonesia
[2] Directorate of Dietary Diversification, National Food Agency, 12550 Jakarta, Indonesia

Corresponding author's email: katonsujarnoko@gmail.com

SUMMARY

Indonesia, one of the largest food producers globally, faces significant challenges with high food loss and waste (FLW). The nation's food security and nutrition (FSN), which ranks second in the world for FLW, is still vulnerable. This study investigates the potential of improving Post-Harvest Management (PHM) to reduce FLW and enhance FSN. Using the Analytic Hierarchy Process (AHP), the research prioritizes the key pillars of food security, identifying accessibility as the most critical factor. The analysis suggests that integrated policy implementation focused on PHM can be crucial in addressing food security issues in Indonesia.

Keywords: Accessibility, Analytical hierarchy process, Food loss and waste, Food security and nutrition, Post-harvest management

INTRODUCTION

Despite being a major food producer, Indonesia struggles with significant food security challenges. In the Food Sustainability Index (FSI) 2022, Indonesia is ranked 63rd out of 113 countries, with scores lower than average for the world in sustainable agriculture, waste management, and food loss. The country's annual FLW is estimated at around 8 million tonnes of agricultural produce before reaching the market, exacerbating the high cost of food and leading to uneven access across the population [1]. To illustrate, rice in Indonesia costs approximately 50% more than in neighboring countries such as Thailand and Vietnam [2]. This significant price disparity leads to higher food expenses for Indonesian families. Goals 2 and 12 of SDGs highlight the importance of FSN and PHM. This study aims to explore how PHM can enhance FSN in Indonesia, using the AHP method to identify priority pillars and assess the potential benefits of improved PHM practices.

MATERIALS AND METHODS

The study adopts a multi-phase approach to assess the role of PHM in enhancing FSN in Indonesia. Initially, secondary data were gathered from literature, government reports, and organizations like WFP and BPS-Statistics Indonesia, supplemented by interviews and surveys with stakeholders (farmers, academicians, and policymakers) to understand current PHM practices. Secondly, The AHP method was employed to prioritize the key factors of food security (availability, accessibility, utilization, and stability) based on stakeholder input. The process followed guidelines outlined by Goepel and analyzed with AHP software[3]. A review and gap analysis of existing PHM policies identified areas needing improvement. Finally, statistical tools, including Pearson correlation analysis, quantified PHM's impact by exploring the relationships between the cost of an energy-only diet (CoEOD), the cost of a nutritious diet (CoND), and the Desirable Dietary Pattern (DDP) score, providing a comprehensive understanding of PHM's influence on FSN.

RESULTS AND DISCUSSION

The Analytic Hierarchy Process (AHP) analysis, reveals that among the four pillars of food security, accessibility holds the highest priority, weighing 33.6% (Fig. 1). This indicates that ensuring people have physical and economic access to sufficient food is the most critical factor in achieving food security in Indonesia. The other pillars, namely availability (29%), utilization (23%), and stability (14.4%), also play significant roles but are less critical than accessibility.

The distribution of FLW across 12 major commodities in Indonesia is illustrated in Fig. 2. Cereals, which are a staple and crucial for energy intake, contribute the highest to FLW, with an alarming annual loss ranging from 4.3 to 4.8 million tonnes between 2018 and 2022. These inefficiencies in post-harvest management (PHM)

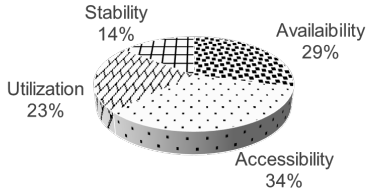

Figure 1: Weight of FSN Pillars by AHP

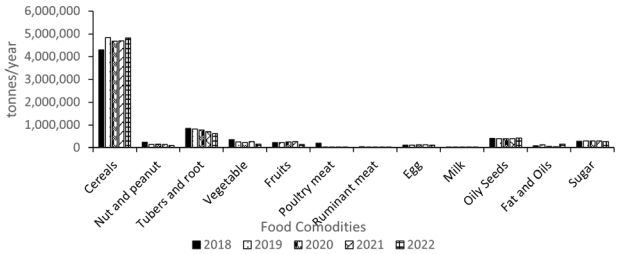

Figure 2: FLW of 12 commodities in Indonesia (tonnes/year)

systems affect food accessibility and availability, aligning with the AHP findings. Improving PHM practices in the handling, storing, and transporting of cereals could significantly reduce FLW. This reduction is projected to increase GDP by 4-5% and provide food for 61-125 million [4].

Moreover, effective PHM practices can maintain the nutritional quality of food, reduce prices, and improve health outcomes. This is evidenced by the negative correlation between the CoEOD, the CoND, and the DDP score across 34 provinces (Fig. 3). Provinces with higher CoEOD and CoND values tend to have lower DDP scores, indicating that as the cost of achieving a balanced diet rises, populations struggle to maintain optimal dietary patterns, negatively impacting food security and nutrition.

The study reveals key gaps in PHM policy implementation, such as limited access to advanced technologies, inadequate farmer training, and poor infrastructure. Future efforts to improve food security should prioritize technological innovation, capacity building, and integrated policy approaches. Collaborative efforts from the government, private sector, and communities are essential to establishing effective and sustainable PHM practices.

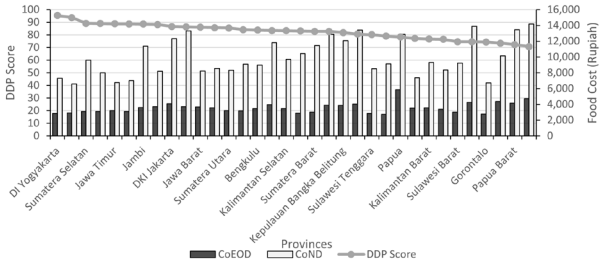

Figure 3: CoEOD, CoND, and DDP score of 34 provinces in Indonesia

CONCLUSION

PHM has significant potential to improve FSN in Indonesia by reducing FLW. Despite existing efforts, food insecurity and malnutrition remain prevalent. Enhancing PHM can help make food more affordable and support better health outcomes. This study underscores the importance of integrated and coordinated policy efforts to leverage PHM in addressing Indonesia's FSN challenges.

ACKNOWLEDGMENT

We would like to thank the National Food Agency team for providing the requisite data for this study.

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EXTENDED ABSTRACT

Patient Satisfaction and Food Waste: A Public Hospital Study

Fathira Armanda, Reisi Nurdiani, Tiurma Sinaga

Department of Community Nutrition, Faculty of Human Ecology, IPB University, 16680 Bogor, Indonesia

Corresponding author's email: reisi2013@apps.ipb.ac.id

SUMMARY

Good quality meals provided by food services have a positive impact on patient satisfaction and food waste. A cross-sectional study involved 93 subjects who were observed for 10 consecutive days. The average level of satisfaction for all aspect has been assessed and received well by patients. The highest food waste is found at breakfast (25.2%) and vegetables (30.5%). Satisfaction with hospital food services is not significantly related to food waste. Various factors in hospital food services, especially food quality, need to be improved to motivate patients to consume hospital food.

Keywords: Food service, Food waste, Hospital, Level of satisfaction, Patient

INTRODUCTION

Quality health services can increase patient satisfaction with the services provided. The success of a food service can be seen from the level of food satisfaction. Research results show the level of patient satisfaction with food service hospitals in Indonesia, is 40.9% to 96.7% (Nuryani et al. 2020). This shows that the quality of hospital services still varies greatly, so are a need to improve. Apart from that, the challenge of organizing food in hospitals is that there is still a lot of leftover food from patients. The high level of patient food waste which is still below the Minimum Service Standards (SPM) target is an illustration that the nutritional services provided are not good enough or not optimal (Fatkhurohman et al. 2017). This research aims to determine the relationship between level of patient satisfaction and food waste at public hospitals.

MATERIALS AND METHODS

The primary data studied were (age, gender, occupation, education, income, treatment room, treatment class, nutritional status). Patient satisfaction with hospital food services was measured using the Acute Care Hospital Foodservice Patient Satisfaction Questionnaire (ACHFPSQ) instrument consisting of 18 questions (Aminuddin et al. 2018; Rapo et al. 2021). The questionnaire has been translated into Indonesian and has been modified according to Indonesian hospital food service conditions. The ACHFPSQ employs a 5-point Likert scale, where responses are scored as follows: Always = 5, Often = 4, Sometimes = 3, Rarely = 2, and Never = 1. The data is processed into an average value for each question and an average value for each dimension (factor score). Measuring food waste can be done by weighing directly or estimating the amount using a visual estimate with 6 scales (William and Walton 2011). An estimate of the actual weight of food waste is obtained by multiplying the Comstock scale in percent by the initial weight of the food served based on portion standards.

RESULTS AND DISCUSSION

Table I displays the statements from ACHFPSQ along with their mean scores. The highest-rated factors were "I am able to choose a healthy meal in the hospital" and "The crockery and cutlery provided by the hospital are clean and spotless," both scoring 5.0. Conversely, the statements "I eat food from outside the hospital," "I like the way the vegetables are cooked," and "The meal tastes nice/good" received lower ratings of 3.2, 3.7, and 3.8, respectively. The highest score (4.9) was given for staff/service-related factors. A higher score reflected greater satisfaction, and the findings highlighted that food quality and the physical environment were the areas of hospital food services where patients were least satisfied.

The average food waste by food group and meal time is presented in Fig. 1. The cause of high food waste at breakfast time is that the patient is still asleep so the food served is not consumed immediately, and this results in the food temperature decreasing. Consumers tend to have less appetite when consuming food at low temperatures. Some patients don't like the vegetables menu because of the bland taste, and prefer processed vegetables using boiling techniques such as soup. The high level of vegetable residue is due to the bland taste, the temperature is cold, and the color does not increase appetite. The Pearson Spearman colleration test results

Table I: Patient's satisfaction level

Food service dimension	Statement (item)	Mean score	Factor score
Food Quality	The hospital food has been as good as I expected	4.4	4.4
	I am able to choose a healthy meal in hospital	5.0	
	The meal taste nice/good	3.8	
	I like the way the vegetables are cooked	3.7	
	The menu has enough variety for me to choose meals that I want to eat	4.7	
	The meals have excellent and distinct flavours	4.0	
	The meat is tough and dry	4.7	
	I like to be able to choose different sized meals	4.7	
Meal service quality	The hospital served the food at the right temperature	4.8	4.8
Staff/ Servive issue	The staff who deliver my meals are neat and clean	4.9	4.9
	The staff who take away my finished meal tray are friendly and polite	4.9	
	The staff who deliver my menus are helpful	4.9	
	Food delivery is done on time	4.9	
	Response to service needs is fast and responsive	4.8	
Physical environment	The hospital smells stop me from enjoying my meals	4.7	4.3
	I eat food from outside the hospital	3.2	
	The crockery and cutlery provided by the hospital are clean and spotless	5.0	
	I am disturbed by the noise of finished meal trays being removed	4.1	

identified no significant correlation between patient satisfaction with gender, age, education, employment, income, treatment class, and treatment room (p>0.05). Similar results also show no significant relationship between food waste and food quality, waiter/service, and physical environment (p>0.05). There was no significant relationship between the level of satisfaction with patient food waste, and nutritional status (p>0.05).

CONCLUSION

Monitoring patient satisfaction with hospital food services is crucial. The study found that while patients were generally pleased with the food and service quality, food waste remained significant. Addressing weaker areas by aligning offerings with patients' preferences and needs can enhance food quality and reduce waste.

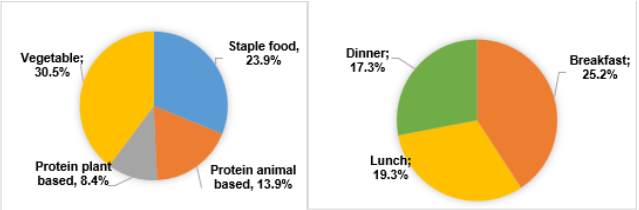

Figure 1: Distribution of food waste based on food group and meal time

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EXTENDED ABSTRACT

A Survey of Sodium Content in Processed Food in Bengkulu City based on Food Labels

Risda Yulianti[1], Okdi Natan[1], Vina Dwinata[1], Dahrizal[2]

[1] Department of Nutrition, Poltekkes Kemenkes Bengkulu, 38225 Bengkulu, Indonesia
[2] Department of Nursing, Poltekkes Kemenkes Bengkulu, 38225 Bengkulu, Indonesia

Corresponding author's email: risda@poltekkesbengkulu.ac.id

SUMMARY

Sodium intake is a public health concern linked to hypertension and cardiovascular diseases. This study examined the sodium content in processed foods in Bengkulu city using a cross-sectional approach. Sodium content in 12 food categories (n=500) was converted to mg/100 grams from food labels. The average content ranged from 23 to 4,718 mg/100g, with condiments/seasonings highest at 4,718 mg/100g, followed by cereal products (1,021 mg/100g), fats/oils (910 mg/100g), fishery products (743 mg/100g), and meat products (712 mg/100g). These results highlighted the high sodium content in certain processed foods, suggesting they should be consumed wisely according to dietary recommendations.

Keywords: Food label, Hypertension, Packaged foods, Processed foods, Sodium.

INTRODUCTION

Non-communicable diseases (NCDs) continue to rise in Indonesia, with hypertension being a major concern. Lifestyle changes and unbalanced dietary patterns such as high sodium intake, excess energy intake, and high-fat diets have contributed to the increasing prevalence of these NCDs, including hypertension [1]. WHO data shows that 1.13 billion people worldwide suffer from hypertension, highlighting the magnitude of this issue, particularly in low- and middle-income countries [2]. Studies show high sodium intake strongly correlates with hypertension and cardiovascular diseases. Processed foods often exceed healthy sodium limits, as they use high levels for preservation [3]. Nutrition labels provide valuable information for consumers to manage sodium intake, but research on sodium content in Indonesian processed foods is lacking. Exploring the sodium content in various food categories is crucial for developing effective dietary guidelines and public health strategies. This study aimed to investigate the sodium content of processed food sold in Bengkulu City.

MATERIALS AND METHODS

This descriptive cross-sectional study evaluated the sodium content in processed foods from a modern retail minimarket in Bengkulu City. The study population included all processed food and beverage products (N=1137). Sample of 500 products were selected using proportional random sampling across 12 food categories. Eligible products had readable labels, approval numbers, net weight, composition, and expiration dates. Exclusion criterias were fresh food, 100% fruit juice, baby food, and food for specific uses. Data of food label was collected through products purchases and online searches (official websites) and revalidated through field checks. Categories and sample sizes of processed foods were: cereals (53), dairy (67), fats/oils (4), fruit/vegetable (22), confectionery/chocolate (51), bakery (73), meat (19), fish and fishery (4), condiments (32), edible ice (32), beverages (81), and ready-to-eat snacks (62). Sodium content was calculated as: 100 g or ml/weight per serving (g or ml) Ч sodium content per serving (mg).

RESULTS AND DISCUSSION

In this study, 500 processed foods were categorized into 12 food categories according to BPOM Regulation No.3 of 2023, as presented in Table I. Overall, the mean value (mg/100 g or mL) of processed food groups with the highest sodium content was found to be in condiments and seasonings (4,718), followed by cereal products (1,021), fats and oils (910), fishery products (743), and meat products (712). The Indonesian government has mandated health warnings indicating that sodium consumption exceeding 2000 mg per person per day poses risks of hypertension, stroke, diabetes, and heart attack. This recommended maximum sodium limit includes sodium from table salt using in food preparation.

Table I: The sodium content of processed foods (mg/100 g or ml)

Processed food categories	n	%	Minimum	Maximum	Mean ± SD
Cereals and cereal products	53	11	7	2463	1021 ± 657.0
Dairy products and their analogs	67	14	15	1680	240 ± 451.6
Fats and oils	4	1	833	1000	910 ± 78.3
Fruit and vegetable products	22	4	13	2200	517 ± 626.2
Confectionery and chocolate	51	10	0	556	49 ± 97.0
Bakery products	73	15	57	1500	276 ± 198.2
Meat and meat products	19	4	255	1250	712 ± 216.4
Fish and fishery products	4	1	560	950	743 ± 178.9
Condiment and seasonings	32	6	76	24242	4718 ± 6912.3
Edible ice, including sherbet and sorbet	32	6	0	80	23 ± 24.1
Beverages excluding dairy products	81	16	0	500	66 ± 95.5
Ready-to Eat Snacks	62	12	71	1389	537 ± 250.2
	500	100			

One gram of table salt contains approximately 400 mg of sodium. Given the average sodium contents listed in Table I, uncontrolled consumption of processed foods may exceed the daily recommended sodium intake. According to the 2014 Individual Food Consumption Survey, 52.7 percent of the population in Indonesia consumes more than 2000 mg of sodium daily. WHO through global sodium benchmark targets has set maximum limits for each category and sub-category of processed food [4]. However, the limitations of regulatory products in Indonesia, especially concerning sodium restrictions, make it challenging to directly compare this study's results with the WHO global benchmark target. Nevertheless, overall, when compared to the WHO benchmark, the average sodium content of products exceeding the maximum limits included cereal and cereal products (e.g., instant noodles), fats and oils (e.g., margarine), and bakery products (e.g., bread and biscuits).

CONCLUSION

Processed foods with the highest average sodium content are condiments and seasonings, followed by cereal products, fats and oils, fish and fishery products, and meat and meat products. Standardizing maximum sodium levels in ready-to-eat foods is crucial, as high sodium content in condiments may not accurately represent overall sodium consumption.

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