ORIGINAL ARTICLE

Factors Associated With Weight Gain During Weekend Day Among Adolescents In Urban City: A Case Control Study

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ABSTRACT

Introduction: The quality of food consumption on weekends is worse than on weekdays, due to higher consumption of soft drinks and other sugary drinks, alcoholic beverages and fats, and lower participation of whole foods, leading to higher energy intake over the weekend, resulting in weight gain. This study aims to analyze the factors associated with weight gain on weekends in Indonesian adolescents. **Methods:** This research was a case control study involving 72 high school students (each group consists of 36 subjects) in Surabaya Indonesia. The dependent variable was the weight gain while the independent variables were age, class, gender, pocket money, father's income, mother's employment status, nutritional status, physical activity, food intake (energy, carbohydrate, lemak, and protein adequacy), and eating out patterns. Data were analyzed using multiple logistic regression. **Results:** The results showed that pocket money, mother's employment status, eating out patterns, and energy adequacy were related to weight gain on weekends. The more pocket money adolescents have, working mothers, eating out more often and over energy, the greater the risk of gaining weight on weekends. **Conclusion:** An effective and holistic public health campaign should focus on reducing the consumption of energy-dense foods of low nutritional quality especially at weekends.
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INTRODUCTION

In several countries in recent decades, there have been significant changes in food consumption (1). In developing country, there is an increase in consumption processed foods and sugary products in adolescent diets (2,3). Those who live in rural areas, consume a plant-based diet based on cereals, roots, and tubers, with minimal intake of animal source foods (2). However, unlike those who live in urban areas, they consume more animal sources (3). As in China and Indonesia, adolescents often consumes western food, so the consumption of fat increases but is low in fiber (4,5). Studies of metabolically unhealthy obesity in adolescents in Asia show that they consume fewer grains, fewer polyunsaturated fat and have lower cognitive eating patterns restraint (6). Changes in food consumption result in being overweight and obesity and other diet-related, non-communicable disease has become a major public health problem (1,4). As many as 1 billion people worldwide are obese – 39 million children, 340 million adolescents and the rest are adults (7). In Indonesia, the prevalence of obesity in children aged 13-15 years is 4.8% (8), this prevalence has increased by 2.3% compared to 2013 (9).

There have been many studies examining factors associated with food consumption with weight gain and obesity (1,10–13). Furthermore, eating on weekends is considered one of the factors that contribute to the incidence of obesity in adolescents (14–18). There are many differences between weekdays and weekends, both structurally and culturally, that affect food intake patterns, where they will eat more food and snack than on weekdays(15,19,20). Other studies have shown that the quality of food consumption on weekends is worse than on weekdays, due to higher consumption of soft drinks and other sugary drinks, alcoholic beverages and fats, and lower participation of whole foods, leading to higher energy intake over the weekend (1,15–17,21). In addition, a study in Denmark showed that parents have

a tradition of giving sugar-rich foods over the weekends, to reward their children (15).

Adolescents tend to have repetitive activities and habits. Every weekday they have to go to school and do other activities, they get weekends off, where they tend to eat out (14,22,23). They choose to go to fast-food and full-service restaurants (14). This results in increased calorie intake from energy-dense and nutrient-poor foods (22,23).

Other research has shown that on weekends, adolescents tend to be less physically active than on weekdays (24–27). They spend the weekend engaging in sedentary activities, including watching television and other screen time (24–26), thereby further increasing their risk of weight gain during weekend days. In addition, spending more time watching television was found to be associated with food preferences and less healthy eating habits in school-age children (27). This will further increase their chances of getting fatter.

Increased consumption over the weekend will increase energy and potentially gain weight. A longitudinal study stated that there was an increase in body weight in adolescent girls (42 kg to 58 kg) and adolescent boys (38 kg to 74 kg) because they consumed more food on weekends than weekdays (28). Furthermore, research conducted by McCarthy showed that an increase in energy of 100 kcal every weekend all year round cause weight gain of 2 kg which contribute to the increase in prevalence of overweight and obesity (29). Another study also showed that the difference in energy on weekends and weekdays showed an increase in body weight of 0.077 kg per week (30).

Very few studies have evaluated changes in eating habits by day of the week, particularly in Indonesia. Actually in Indonesia there is a car free day event on weekends and many teenagers come to the event to buy fast food and high sugar drinks. Research on the trend of weight gain on weekends is important because it is to find out whether food intake is the main cause, or are there other factors that also play an important role. Characterization of food consumption by day of the week can contribute to improving the evaluation of food consumption and supporting the promotion of health and healthy eating. This study aims to analyze the factors associated with weight gain on weekends in Indonesian adolescents.

MATERIALS AND METHODS

Study Design

A case control study was performed at one of senior high public school at Surabaya, Metropolitan city in Indonesia. This research has obtained an ethics certificate from Faculty of Public Health, Universitas Airlangga with an ethical number is 209-KEPK.

Sampling

A total of 155 students aged 16-17 years at the school were screened and 72 participants included in this study by random sample; each group consist of 36 subjects (the ratio case to control was 1:1). Sample size was calculated by Lameshow equation for case control study with Zα 1.96 and power β 20%. The case criteria were students who experienced weight gain ≥0.5 kg per week while the control criteria were students who experienced weight loss, fixed weight, or weight gain <0.5 kg per week.

Research Tools and Variables

All participants were measured body weight for every school day for two weeks consecutively. It was called as weekdays and weekend weight. Measurement of student body weight was carried out in the non-fasting condition and taken every morning at break time before snacking at the same time. Weight measurement was carried out by trained research every Monday to Saturday.

Weekdays weight was the average weight measurement on Tuesday to Saturday (5 days), while weekend weight was result of measuring body weight on morning Monday. Weight gain at weekend day was assessed by calculating the difference between weekend weight and weekday body weight. The inclusion criteria for case subjects were students who experienced weight gain at weekend day for two weeks were consistent ≥0.5 kg while the control subjects were weight gain <0.5 kg per week. The control subjects were randomly selected from the same schools and same period of students categorized with weight gain using a computerized random number. Those who have undertake fasting, spesific diet for body lost, and intensive exercise, taken hormone-related medications before, and suffer vomitting and diarrhea were excluded.

The independent variables in this study were age, class, gender, pocket money, father's income, mother's employment status, nutritional status, physical activity, food intake (energy, carbohydrate, lemak and protein adequacy), and eating out pattern. Age was measured based on age at the time of interview, then categorized into 16 and 17 years. Class was school level at the time of interview, categorized into 11th and 12th grade. Pocket money was the amount of money given per day, categorized into ≤Rp 20,000 and >Rp 20,000. Father's income was the amount of money received by the father for one month, categorized ≤Rp. 3,583,312 and >Rp. 3,583,312. The Mother's employment status was categorized into working and not working. Nutritional status was the state of the body due to food consumption and use of nutrients, categorized based on SD where ≤1SD and >1SD. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ). We used the IPAQ questionnaire "Last 7 Days Long Self-Administered Format"(31). The results of physical

activity analysis calculations were expressed in MET units, then categorized into 3, light if the total score was <600 METs-min/weeks; moderate if total score was ≥600-1500 METs-min/weeks; and vigerous if the total score was ≥1500 METs-min/weeks. Measurement of food intake was measured using a food recall questionnaire. The food recall was carried out 4 times directly face to face, namely 2 days for weekdays and 2 days for weekends. Food intake was analyzed by Nutrisurvey Software to get intake of energy, carbohydrate, lemak and protein. From the nutrient intake, the adequacy is then calculated. Energy, carbohydrates, fat and protein were said to be adequate if they meets 80-100% of the dietary recommendation allowance and over if >100% of the dietary recommendation allowance. In this study we focused on macronutrients because they play a role in increasing body weight. The pattern of eating out was measured using the structured questionnaire that modified from the study of Hu et al (32). The questionnaire consisted of seven questions and asked about the pattern of eating outside for the past month. We modified the questionnaire from the study of Hu et al. The question consist of frequency of food habit (2x or 3x), frequency of eating out in a week (> 2-3 kali per week (often) or ≤ 2-3 kali per week (seldom)), most days eating out (Weekdays (monday-friday) or Weekend (saturday-sunday)), the most frequent meal times outside (One of the meal times (breakfast or lunch or dinner) or All meal times (breakfast, lunch and dinner) & mix (breakfast and lunch, breakfast and dinner, lunch and dinner)), Where to buy food outside (Peddlers & stalls or Restaurants, food courts, others), Types of food often purchased outside (Complete food & snacks or Drinks & mixes), The influence of people around when eating out (Friends & alone or Parents & Siblings).

Statistical Analysis

The respondent's characteristic data is presented through a frequency distribution. Furthermore, the data will be analyzed by chi-square and multiple logistic regression. All analyses were conducted using Statistical Package for Social Science (SPSS) version 21 and p-value < 0.05 was considered significant.

RESULTS

Most of the respondents in the case and control groups were in grade 11 senior high school, 16 years old, and female. The amount of pocket money in the case and control groups was Rp. 20,000 per day. The family income per month in the case and control groups was also the same, namely > Rp. 3,583,312. Most of the respondents in the case and control groups were overweight and had moderate physical activity. However, there are differences in the employment status of mothers, most of the mothers in the case group work while in the control group do not work. Students with working mothers have a 3.57x greater risk of gaining weight on weekends than students whose mothers do not work (p-value = 0.009) (Table I).

Based on table II, it can be seen that respondents in both groups have the habit of eating 3 times a day. Respondents in both groups rarely eat out of the house. Most of them eat out on weekdays for breakfast, lunch or dinner. Most of them eat in restaurants or food courts and what they buy is complete meals or snacks. They eat together with their parents or siblings. Students with a frequency of eating out more than 2-3 times per week are at risk of gaining weight 2.8 times greater than

Table I: Characteristics of Respondents

Variable	Case (n=36)	Control (n=36)	*p*-value	OR
Age	16.36 ± 0.487	16.33 ± 0.478	0.804	0.885
16	23 (63.8%)	24 (66.7%)		
17	13 (36.1%)	12 (33.3%)		
Grade			0.624	0.786
11	22 (61.1%)	24 (66.7%)		
12	14 (38.8%)	12 (33.3%)		
Sex			0.339	0.632
Male	17 (47.2%)	13 (36.1%)		
Female	19 (52.7%)	23 (63.8%)		
Pocket money	22194.44 ± 11275.31	23666.67 ± 15657.04	0.141	0.481
≥Rp.20.000	20 (55.5%)	26 (72.2%)		
< Rp.20.000	16 (44.5%)	10 (37.8%)		
Father's income			1.000	1.000
> Rp. 3.583.312	30 (83.3%)	30 (83.3%)		
≤ Rp. 3.583.312	6 (16.7%)	6 (16.7%)		
Mother's work status			0.009*	3.571
Work	22 (61.1%)	11 (30.5%)		
Does not work	14 (38.8%)	25 (69.5%)		
Nutritional Status	0.55 ± 1.34	0.27 ± 1.51	0.789	1.154
> 1SD	27 (75%)	26 (72.2%)		
≤1 SD	9 (25%)	10 (37.85)		
Physical activity (met)	1235.40 ± 597.83	1225.27 ± 663.75	0.326	0.518
Light	4 (11.1%)	7 (19.4%)		
Moderate	32 (88.95)	29 (80.6%)		

*significant, p < 0.05

Table II: Eating out pattern

Eating Out Pattern	Case (n=36)	Control (n=36)	*p*-value	OR
Frequency of food habit				
2x	10 (37.8%)	10 (37.8%)	1.000	1.000
3x	26 (72.2%)	26 (72.2%)		
Fequency of eating out				
> 2-3 kali per week (often)	16 (44.5%)	8 (22.2%)	0.046*	2.800
≤ 2-3 kali per week (seldom)	20 (55.5%)	28 (77.8%)		
Most days eating out				
Weekdays (monday-friday)	25 (69.4%)	20 (55.5%)	0.224	1.818
Weekend (saturday-sunday)	11 (30.6%)	16 (44.5%)		
The most frequent meal times outside				
Breakfast, lunch, dinner	27 (75%)	23 (63.8%)	0.306	1.696
All meal times & mix	9 (25%)	13 (36.1%)		
Where to buy food outside				
Peddlers & stalls	18 (50%)	16 (44.5%)	0.637	1.250
Restaurants, food courts, others	18 (50%)	20 (55.5%)		
Types of food often purchased outside				
Complete food & snacks	24 (66.7%)	25 (69.5%)	0.800	0.880
Drinks & mixes	12 (33.3%)	11 (30.5%)		
The influence of people around when eating out				
Friends & alone	18 (50%)	16 (44.5%)	0.637	1.250
Parents & Siblings	18 (50%)	20 (55.5%)		

*significant, p < 0.05

students with a frequency of eating out less than 3 times a week. In other words, eat out at least once every two days and every day the risk is 2.8 times greater to gain weight on weekends.

Based on the results of the 2x24 hour recall, it can be seen that the energy at the weekend was significantly different between the case and control groups (p-value=0.001). Differences in energy (p-value=0.000) and carbohydrate (p-value=0.047) intake on weekdays and weekends were also significantly different (Table III). Respondents who have energy intake on weekends were more at risk of experiencing weight gain of 4,021 times greater than those who are adequate. In addition, respondents who have increased energy on weekends and weekdays have a risk of experiencing weight gain of 4,545 times greater than those who remain/decrease (Table IV).

Table III: Energy and macronutrient intake on weekdays and weekends

Food Intake	Case (n=36) Mean ±SD	Control (n=36) Mean ±SD	*p*-value
Weekdays			
Energy (kkal/day)	1939.27 ± 143.48	1967.18 ± 150.44	0.423
Carbohydrate (gr/day)	215.98 ± 30.84	223.51 ± 26.78	0.273
Fat (gr/day)	84.65 ± 16.66	83.74 ± 12.29	0.793
Protein (g/day)	76.02 ± 13.12	80.89 17.88	0.193
Weekend			
Energy (kkal/day)	2045.04 ± 179.31	1915.84 ± 117.47	0.001*
Carbohydrate (gr/day)	240.76 ± 38.82	226.58 ± 26.82	0.076
Fat (gr/day)	82.69 ± 15.06	77.12 ± 12.52	0.092
Protein (g/day)	82.75 ± 17.15	80.75 ± 22.22	0.671
Differences/changes in food intake			
Energy (kkal/day)	105.77 ± 122.09	51.34 ± 73.38	0.000*
Carbohydrate (gr/day)	24.77 ± 53.45	3.07 ± 35.64	0.047*
Fat (gr/day)	1.96 ± 19.52	6.62 ± 14.60	0.255
Protein (g/day)	6.73 ± 21.07	0.13 ± 31.25	0.279

*significant, p < 0.05

Based on the multiple logistic regression analysis in table V, it can be seen that respondents with pocket money of IDR 20,000 have an 8.48 times risk of gaining weight on weekends compared to subjects with pocket money < IDR 20,000. Respondents who have working mothers have a 6.99 times risk of gaining weight on weekends compared to subjects whose mothers do not work. Respondents with the habit of eating out > 2-3

Table IV: odds ratio of macronutrient adequacy on weekdays and weekends

Food Intake	Case (n=36)	Control (n=36)	*p*-value	*OR (CI 95%)*
Weekdays				
Energy Adequacy			0.343	0.636
Over	14	18		
Adequate	22	18		
Carbohydrate Adequacy			0.345	0.639
Over	17	21		
Adequate	19	15		
Fat Adequacy			0.098	2.212
Over	20	13		
Adequate	16	23		
Protein Adequacy			0.629	0.791
Over	13	15		
Adequate	23	21		
Weekday				
Energy Adequacy			0.005*	4.021
Over	23	11		
Adequate	13	25		
Carbohydrate Adequacy			0.345	1.565
Over	19	15		
Adequate	17	21		
Fat Adequacy			0.059	2.469
Over	22	14		
Adequate	14	22		
Protein Adequacy			1.000	1.000
Over	16	16		
Adequate	20	20		
Differences Intake				
Energy				
Increase	25	12	0.002*	4.545
Fixed/Down	11	24		
Carbohydrate			0.458	1.446
Increase	25	22		
Fixed/Down	11	14		
Fat			0.465	1.429
Increase	15	12		
Fixed/Down	21	24		
Protein			0.479	1.397
Increase	19	16		
Fixed/Down	17	20		

*significant, p < 0.05

Table V: Results of the multivariate logistic regression analysis

Variable	Coefficient	*p*-value	OR(CI 95%)
Pocket money	2.138	0.004*	8.48(1.98-36.29)
Mother's work status	1.945	0.006*	6.99(1.73-28.24)
Frequency of eating out	1.151	0.049*	3.16(1.92-10.91)
Energy weekend	1.567	0.009*	4.79(1.4-15.59)

*significant, p < 0.05

times per week had a 3.16 times risk of gaining weight on weekends compared to subjects with 2-3 times per week. Responses with weekend energy needs had a 4.79 times risk of gaining weight on weekends compared to subjects with insufficient or sufficient energy.

DISCUSSION

The results of this study indicate that the more pocket money adolescents have, the greater the risk of gaining weight on weekends. Other things related to weight gain on weekends are mothers employment status, eating out habits, and energy consumption levels. In line with pocket money, the more often adolescents eat out and the higher the level of energy consumption, the greater the risk of gaining weight on weekends. And if the mother works, the risk of gaining weight on weekends is also greater.

This study is in line with research conducted in China (33) and India (34), which states that pocket money is associated with obesity. The higher the allowance provided by parents, the higher the risk of obesity (33,34). The more pocket money, the more likely teens are to eat out. The results of this study are in line with research conducted by Ruopeng (14) and Orfanos (22) where the more adolescents eat outside the home, the more likely they are to gain weight. Especially on Sundays, they tend to eat out more often (14,22,23). Pocket money and eating out are intertwined. Adolescents who have more pocket money spend more money on eating out (34,36). They usually choose fast food and full-service restaurants (14). Foods they usually buy in restaurants such as tea/coffee, sweets,and foods that are high in fat and high in sodium (22). These foods tend to have a high energy content, causing an increase in energy intake (37). Orfanos research shows that when eating out of the home, a person gets at least 25% of the total energy in a day, this condition causes them to have the potential to gain weight (38,39).

This condition causes adolescents to have excessive energy consumption. The results of this study are in line with research conducted by Ruopeng (14), Haines (16), Yang (23), and Post (28) where adolescents experience excess energy on weekends. This excess energy causes them to have a risk of weight gain, this is in line with research conducted by Post (28), McCarthy (29), and Racette (30). On the other hand, several studies have shown that there are differences in energy intake on weekends and weekdays (1,15,16,29). American teens have a slightly higher energy intake of nearly 20 cal per day on weekends which is a result of higher fat consumption (16). Adolescents eat foods high in sugar and saturated fat more than recommended on weekend days (1,15,29). This condition indicates a tendency to increase energy density from weekdays to weekend days, causing a decrease in the quality of eating patterns (15,40). In addition, the intake of energy-dense foods is believed to be a factor that increases body weight (15,30). Another thing that causes high energy intake on weekends is that there are lots of parties and celebrations on the weekends and there is time to eat more during the weekends. In contrast to weekdays, mealtimes are generally reduced due to work, study, and assignments (1). In addition, during the school day parents tend to keep an eye on what their children eat, they get used to healthy eating habits (41). When the weekend comes, they have a tradition of rewarding children with sweets or being able to eat the food they like (15).

In this study, adolescents with working mothers had a greater risk of gaining weight, this is supported by Lee's research (35). On holidays, teenagers tend to be lazy to do physical activity, but the results of this study did not show this, so this study is not in line with the results of Rowlands' research (25). Most mother have been been busy working during the working day. The results showed that mothers who do not work pay more attention to what their children eat so that their weight is more controlled (35).

To the best of our knowledge, this research has never been conducted in Indonesia, specifically using a case control design. In addition, an important strength of this study is that we identified weight gain by measuring body weight daily for two weeks on both weekdays and weekends and analyzing factors associated with weight gain. Another major strength is that food intake data was collected over seven weeks. Consecutive days for each respondent allow detailed analysis of food quality throughout the week. However, this research does not explain in detail the types of food that are most often consumed on weekends. We cannot determine with certainty what proportion of weight gain on weekends is due to higher food intake or lower physical activity compared to weekdays, because the accuracy of self-reported food intake varies between individuals. Finally, the small sample size may limit generalizability to other populations to clearly explain factors associated with weekend weight gain in adolescents.

Over the past few decades, there has been no public health policy that specifically regulates nutritional campaigns on weekend consumer behavior changes or targeting the weekday to compensate and offset weekend excesses. Therefore, an effective and holistic public health campaign should focus on reducing the consumption of energy-dense foods of low nutritional quality. For example, the car-free day policy only

allows sellers to sell healthy foods (low in sugar, salt, and fat) (29). The importance of health education about preventing weight gain can support the achievement of SDG's targets particularly for the SDG's 3 "Good Health and Well-Being". The associated targets of SDG's 3 about ensure healthy lives and promote well-being for all ages, aim to reduce mortality from non communicable diseases especially related to obesity (42). Through the Young Persons' Plan for the Planet (YPPP) program we can support teenagers' understanding of the SDGs so that the SDG's target in 2030 can be achieved (43). Another policy is health promotion about healthy eating behavior through peers. For teenagers, peers are role models for themselves, so if there are peers who judge healthy eating behavior, they will imitate them (44,45). Another important thing that can be done is to provide understanding to parents that giving appreciation to children does not have to be in the form of sweet foods. What parents can do on the weekends is cook together healthy food to enjoy together.

CONCLUSION

Factors associated with weight gain on weekends are pocket money, mother's employment status, eating out patterns, and energy adequacy. The more pocket money adolescents have, working mothers, eating out more often and over energy, the greater the risk of gaining weight on weekends. Public policy, parents, and peers play an important role to overcome this. Limiting the sale of unhealthy food, health promotion of healthy eating behavior through peers, and providing examples of healthy eating habits from parents can be done.

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