

## ORIGINAL ARTICLE

# Food Craving and Symptoms of Premenstrual Syndrome among University Students

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## ABSTRACT

**Introduction:** Food craving was one of the common symptoms of premenstrual syndrome (PMS) among women. This study aimed to examine level of food craving during pre-menstruation and PMS symptoms; its association and predictor of PMS symptoms on food craving during pre-menstruation among university students. **Methods:** A cross-sectional study was conducted among female undergraduate students from International Islamic University Malaysia, Kuantan Campus. Screening phase for eligibility was conducted. Three questionnaires consisted of Health History Questionnaire, Food Craving Questionnaire-Trait-reduced and Premenstrual Tension Syndrome Rating Scale were distributed among eligible students. Descriptive analysis, Pearson correlation test and multiple linear regression were performed using SPSS version 22.0. P value was set at  $p < 0.05$  as statistically significant. **Results:** 129 students were eligible as study respondents. A total of 48% of the respondents showed clinically relevant traits of food craving. The highest food craving among respondents were sweet foods (45.7%) followed by fatty (18.6%), spicy (10.9%), salty (8.5%) and sour (2.3%) food. 60% respondents had moderate to severe PMS symptoms level. There was a significant association between food craving and PMS symptoms ( $p = 0.001$ ). PMS symptoms significantly predicted food craving ( $p = 0.002$ ). **Conclusion:** This study is at the forefront in reporting food craving and PMS symptoms among undergraduate students which were prevalent during pre-menstruation. Food craving was significantly associated with PMS symptoms. This research provides further insight related to food craving among women particularly the role of PMS symptoms as predictor. Strategies in preventing substantial calories intake during pre-menstruation is therefore required in this population.

**Keywords:** Food craving, Pre-menstruation, Premenstrual syndrome (PMS) symptom, University student

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A balanced diet and healthy lifestyle are therefore vitally important towards maintenance of normal body weight. Interestingly, researchers demonstrated that different phases of menstrual cycle have effects on appetite and dietary intake among women (4,5).

## INTRODUCTION

Globally, overeating has now become a new concern instead of hunger with the number of people becoming obese shooting up in the statistics as compared to the number of underweight. According to the World Health Organization (WHO) the rate of obesity has multiplied twice in number over the past four decades, and obesity rate worldwide has soared from 105 million in 1975 to 641 million in 2014 (1). Global prevalence showed 13% adults were obese; with females recorded higher rate than their male counterpart (2). According to National Health Malaysia Survey (NHMS) 2015, the prevalence of obesity was significantly greater in females (33.6%) compared to males (27.8%) (3). The findings also highlighted on growing trends of obesity (2.6%) and abdominal obesity (2.0%) compared to previous NHMS in the year 2011.

Menstruation may affect various physical, metabolic, and psychological aspects that regulate women's wellbeing. Hasim and Abdul Khaiyom gathered in their review that there was a prevalence of PMS and menstrual-related symptoms among Malaysian university and college students (6). Almost 80 to 90% of menstruating women encounter some menstruation symptoms during their reproductive periods. The level of craving was found to be 66% higher during seven days prior to onset of menses in comparison to other days throughout the menstrual cycle (7). Other studies also revealed that women tend to consume more with heightened frequency or intensity of food cravings several days before menses begin (4,8,9). Pelchat also discovered that 45% women stated that a minimum of one food craving was linked to the phase of their menstrual cycle (8). Another study also highlighted

that food desires and eating behaviour were remarkably intensified in luteal phase (10).

A review of food craving among women indicated that this phenomenon was commonly apparent during premenstrual period (11). Women ingested more calories in luteal phase than in periovulatory phases in the menstrual cycle (12,13). During luteal phase, hormonal imbalance affecting food cues which indirectly affecting dietary pattern (4). Food craving is one of the well-known characteristics of PMS (4). One of the contributing factors was non-homeostatic system in the body that holds back the signal of being full due to overconsumption of palatable food (14).

Food craving and PMS symptoms can be assessed using validated questionnaires. Previous studies have used Food Craving Questionnaire-Trait-reduced (FCQ-T-r) to assess food craving (15,16). Meanwhile, the Premenstrual Tension Syndrome (PMTS) Rating Scale was widely utilized to identify the level of PMS among women (17,18).

However, studies on the craving for food among women with premenstrual syndrome (PMS) throughout the menstrual cycle and its association and predictor are still scarce, particularly among Malaysian university students using validated instruments. Hence, this study aimed to determine the extent of food craving and PMS symptoms; its association during luteal phase among university students and predictor of PMS symptoms.

## MATERIALS AND METHODS

### Study design and study population

A cross sectional study was employed to identify level of food craving and its association with PMS symptoms among university students. Students from International Islamic University Malaysia (IIUM) Kuantan Campus were chosen as study participants using convenience sampling. Potential respondents were identified based on the following criteria: i) Healthy undergraduate female students; ii) age between 18 to 35 years old; iii) have normal menstrual cycle within 25 to 34 days in each cycle which is in accordance with previous research (19); and iv) students in the same academic system in which their faculties adopted semester system compared to other faculties in Kuantan campus which were using block system. The students were selected as their perceived stress was lower compared to those using block system such as medical (20) and nursing students (18). Respondents were ineligible if they were taking exogenous hormones such as oral contraceptives, injections and implant in the past six months, planning to get pregnant in the next two months, having irregular menstrual cycle which is less than 25 days or  $\geq 35$  days in each cycle, using medication that may affect appetite and intensive exercise (more than seven hours per week). Sample size required for this study with 5%

margin of error, 95% confidence interval level and 10% attrition rate is 124. The prevalence of food craving in menstrual cycle among university students was used in sample size calculation which was 8% (21). Sample size calculation is shown as follows:

$$n = \frac{Z^2 P (1-P)}{d^2}$$

$$= \frac{(1.96)^2(0.08)(1-0.08)}{(0.05)^2}$$

$$= 113 + 10\% \text{ attrition rate}$$

$$= 124 \text{ subjects}$$

### Study instruments and methods

Details and objectives of the study were explained to potential respondents. Respondents submitted informed consent form prior to their participation. Pilot study was performed to test the research instruments prior to the start of the study. Number of individuals involved in the pilot study was 10% of total number of respondents (22). All respondents were required to answer a set of questionnaires via online forms. The questionnaires consist of two parts; the screening and assessment. The initial stage of the study was the screening phase to identify the potential respondents' eligibility to be included in assessment phase. Data collected during screening phase were demographic data, health status question and general food craving (Health History Questionnaire), body mass index (BMI), length and frequency of menstrual cycle, medical status, hormonal use, physical activity and previous food craving (12).

Meanwhile, the assessment phase consisted of two sets of questionnaires; the Food Craving Questionnaire-Trait-reduced (FCQ-T-r) and The Premenstrual Tension Syndrome (PMTS) Rating Scale. The original FCQ-T was created by Cepeda-Benito et al. (23) and the short version (FCQ-T-r) was formulated by Meule et al. (24). FCQ-T-r aims to measure four domains of food craving that include intensity, anticipation of positive and negative reinforcement from specified food, lack of control, and physiological aspects of craving. FCQ-T-r was used in the present study to assess food craving intensity during pre-menstruation. Response options were on a 5-point Likert scale ranging from 1 = never to 5 = always. A higher score demonstrating greater level of food craving. Cronbach's  $\alpha$  for FCQ-T-r was 0.94 which showed high internal consistency (24).

PMTS Rating Scale which consists of eleven domains was developed by Steiner et al. to identify the PMS symptoms (19). Respondents were required to rate based on five levels (4=severe, 3=moderate, 2=mild, 1=doubtful, and 0=not at all) and another two domains with 3 levels (2, 1 and 0) (19). The questions include physical, psychological and behavioural symptoms of PMS. The score less than 20 or equivalent to 20 indicates none to mild PMS; whilst score more than 20 indicates severe PMS (19). PMTS Rating Scale had high internal consistency with Cronbach's  $\alpha = 0.89$  (25).

The focus of this research was recent experience of PMS and food craving among the participants. In this research, permission to use the questionnaires was obtained from the authors. FCQ-T-r and PMTS questionnaires in English version were used in this research as all participants were IUM students and they are well-versed in English language.

### Data analysis

Descriptive analysis was performed to determine eligibility as study respondents; and to identify level of food craving and PMS symptoms. Association between the score of food craving level and PMS symptoms was analysed using Pearson correlation test. Multiple linear regression was performed to predict the influence of PMS symptoms on food craving. Statistical analysis was conducted by using SPSS version 22.0. Statistically significant value was set at  $p < 0.05$ .

### Ethical approval

Ethical approval for this study was obtained from IUM Research Ethics Committee (IREC 2018-051).

## RESULTS

A total of 220 respondents participated in the study. However, 91 (41.4%) of the respondents were excluded from the final sample population being studied based on exclusion criteria; which were related to menstrual history or factors affecting eating habits. Hence, only 129 students were eligible to be included for the assessment phase.

### Screening phase

Most of the recruited respondents reported normal menstrual cycle ( $n=184$ , 83.6%). However, those who had 25 to 34 days period between two cycles were fewer ( $n=131$ , 59.28%). Table I shows the factors which might affect normal menstrual cycle. All students engaged

**Table I: Screening criteria involving female undergraduate students (n=220)**

Characteristics		N	%
Normal menstrual cycle	Yes	130	59.1
	No	90	40.9
Day between two menstrual cycle	20-24 days	48	21.9
	25-29 days	91	41.1
	30-34 days	39	17.8
	35-40 days	14	6.4
	Varies	28	12.5
Physical activity that require more than 7 hours/week	Yes	0	0
	No	220	100
Use hormonal contraceptives	Yes	0	0
	No	220	100
Plan to get pregnant in the next two months	Yes	0	0
	No	220	100
Medication that affect appetite	Yes	3	1.4
	No	217	98.6
Medical disorders that affect appetite	Yes	0	0
	No	220	100

in regular and non-vigorous physical activity ( $n=220$ , 100%), with a mean  $\pm$  SD of  $62.37 \pm 70.79$  minutes of physical activity per week.

Majority of the respondents reported of having no medical or psychological condition (100%), or using any medications that might influence appetite (98.6%). However, three of the respondents (1.4%) reported intake of vitamin B complex, interferon beta-1b and steroids. In addition, all respondents did not use hormonal contraceptive or planning to get pregnant in the next two months.

### Assessment phase

In the assessment phase, a total of 129 respondents completed all three questionnaires which were Health History Questionnaire, FCQ-T-r and PMTS Rating Scale. Most respondents age ranged between 20 to 35 years old ( $n=128$ , 99.2%). Only one respondent was below 20 years old ( $n=1$ , 0.8%). According to BMI classification by World Health Organization (WHO) (2), majority respondents had normal body weight ( $n=79$ , 61.4%), 20.0% were underweight, 15.9% identified as overweight and 2.7 % were obese.

Notably, 84.5% ( $n=109$ ) respondents reported that they had food craving whilst 15.5% ( $n=20$ ) of total participant did not experience food craving during previous luteal phase. The respondents rated the greatest food craving was sweet food (45.7%,  $n= 59$ ) followed by fatty (18.6%,  $n= 24$ ), spicy (10.9%,  $n= 14$ ), salty (8.5%,  $n=11$ ) and sour food, (2.3%,  $n=3$ ). Meanwhile, the remaining 14% ( $n=18$ ) claimed that they did not have food craving.

### Food Craving among Respondents

Table II shows the score of FCQ-T-r for the previous premenstrual phase of respondents. About half of the total respondents portrayed clinically relevant traits of food craving, with the overall score of 50 and above ( $n=62$ , 48.1%).

**Table II: Traits of food craving among respondents (n=129)**

Traits	Frequency (N)	Percent (%)
Non-clinically food craving trait	67	51.9
Clinically food craving trait	62	48.1

The present study identified mean  $\pm$  SD FCQ-T-r score of  $50.19 \pm 15.12$ . The score range from 15 to 87. Table III shows mean  $\pm$  SD for each question in FCQ-T-r. The highest mean  $\pm$  SD was from question 'whenever I have cravings, I find myself making plans to eat' ( $4.17 \pm 1.21$ ). Besides, the least mean  $\pm$  SD was from the question 'If I give in to a food craving, all control is lost' ( $2.51 \pm 1.21$ ), in which it means "disagree".

### PMS Symptoms among Respondents

Table IV shows the score of PMS symptoms level for the previous premenstrual phase of respondents. More than half of the total respondents showed moderate to severe

**Table III: The mean score of Food Craving reduced-trait questionnaire**

Questions	Mean ± SD
Whenever I have cravings, I find myself making plans to eat	4.17 ± 1.21
It is hard for me to resist the temptation to eat appetizing foods that are in my reach	3.92 ± 1.41
I crave foods when I feel bored, angry, or sad	3.91 ± 1.51
I feel like I have food on my mind all the time.	3.85 ± 1.56
Food cravings invariably make me think of ways to get what I want to eat	3.78 ± 1.37
My emotions often make me want to eat	3.57 ± 1.38
Whenever I have a food craving, I keep on thinking about eating until I actually eat the food	3.53 ± 1.51
I find myself preoccupied with food	3.50 ± 1.39
If I am craving something, thoughts of eating it consume me	3.25 ± 1.40
I have no will power to resist my food crave	3.13 ± 1.25
When I crave something, I know I won't be able to stop eating once I start	2.90 ± 1.22
If I eat what I am craving, I often lose control and eat too much	2.89 ± 1.26
I can't stop thinking about eating no matter how hard I try	2.67 ± 1.25
Once I start eating, I have trouble stopping	2.56 ± 1.19
If I give in to a food craving, all control is lost	2.51 ± 1.21
<b>TOTAL SCORE</b>	<b>50.19 ± 15.12</b>

**Table IV: PMS symptoms score (n=129)**

Level of PMS symptoms	Frequency (N)	Percent (%)
No to mild PMS	52	40.3
Moderate to severe PMS	77	59.7

PMS symptoms level with a score of 20 and more (n=77, 59.7%).

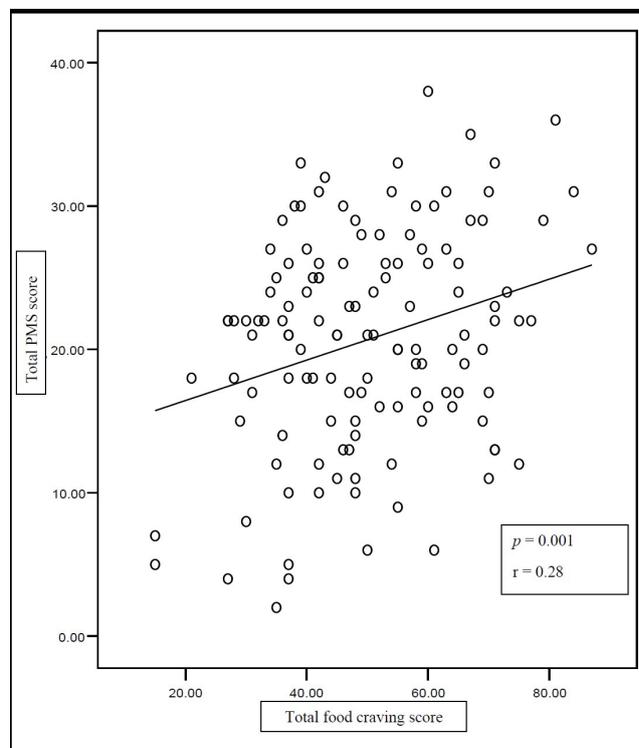
Mean ± SD PMS symptoms score in this study was 21.40 ± 7.76. The score range from 2 until 39. The highest mean was from affective lability symptom and the least mean score was from physical symptoms as shown in Table V.

**Table V: Mean score for eleven PMS symptoms in PMTS Rating Scale (n = 129)**

Items	Mean ± SD
Affective Lability	2.51 ± 0.95
Sleeping Habits	2.43 ± 1.25
Depressed Mood	2.19 ± 1.24
Marked Lack of Energy	2.16 ± 1.24
Anxiety/Tension	2.02 ± 1.17
Irritability/Hostility	1.94 ± 1.24
Overwhelmed	1.91 ± 0.89
Eating Habits	1.90 ± 1.16
Decreased Interest in Usual Activities	1.72 ± 1.32
Concentration Difficulties	1.52 ± 1.28
Physical Symptoms	0.39 ± 0.55
<b>TOTAL SCORE</b>	<b>21.40 ± 7.76</b>

**Food Craving and Its Association with PMS Symptoms among Respondents**

A significant association was found between food craving and PMS symptoms among respondents (p=0.001). The strength of a linear relationship between two continuous variables was assessed using scatterplot. A positive weak correlation between food craving and PMS symptoms score with r= 0.28 was identified as shown in Figure 1.



**Figure 1: Scatterplot on association between food craving and PMS symptoms level among respondents**

**PMS Symptoms as a Predictor of Food Craving among Respondents**

Multiple linear regression was run to predict food craving from PMS symptoms. Table VI shows PMS symptoms significantly predicted food craving, F (1, 127) = 10.480, p=0.002, R<sup>2</sup> = 0.076. PMS symptoms explain 7.6% of the variance and was identified as the predictor of food craving among respondents.

**Table VI: Standardized regression coefficients in predicting food craving**

	B	SE	β
Food craving	38.681	3.781	
PMS symptoms	0.538	0.166	0.276*

\*p < 0.01, R<sup>2</sup> = 0.076

**DISCUSSION**

This study found that food craving across premenstrual week occurred among 48.1% of the respondents. Higher scores indicated clinically relevant levels of “food craving trait” and vice versa (24); which was also parallel with findings by others. A study demonstrated that the

increased food craving was associated with menstrual cycle specifically during late luteal phase among three quarters of 5549 women (4). This was further supported with the finding of a study which stated that women consumed 15% excess energy intake during luteal phase compared to follicular phase, according to their self-reported measures (26). Other studies also claimed that upsurge in food cravings is obvious for several days before menstruation (27). Our study identified mean FCQ-T-r score of  $50.2 \pm 15.1$ . It was markedly greater compared to another study that also used FCQ-T-r which obtained a mean score of  $31.5 \pm 11.1$  ( $n=432$ ) (24). Meule et al. stated that the score of 50 and above demonstrates clinically relevant levels of food craving trait across individuals (24).

This present study found that sweet food was the highest type of food craved among almost 50% of respondents. A lower percentage was demonstrated in a study conducted in United States among undergraduate students which revealed that 30.9% of total respondents experienced chocolate craving; a type of sweet foods during premenstrual week and it positively correlated with cultural norms (28). However, foreigners in the same university were less likely to crave for chocolate before menstrual days (28). Our study also indicated that fatty food was the second type of food being craved for among respondents. Cross et al. also demonstrated parallel findings with our study in which overweight women experiencing PMS have desire to consume fatty and sugary food (29). It should be noted that our participants were mostly in normal BMI category which demonstrates that food craving is regardless of BMI category. Other studies also found sweet and fatty food cravings among women especially chocolate (30,31). Bruinsma and Taren suggested deficiency in certain nutrients may cause food craving among women (32). Chocolate craving might also be related to changes of hormones in menstrual cycle (32). In the similar review article, it had been proposed that a deficiency of magnesium could further complicate PMS and as chocolate is high in magnesium, it might have promoted chocolate craving associated with PMS (32). On different perspective, a recent research suggested that chocolate craving prompted by PMS and menstruation was distinguished as an excuse to consume chocolate (28).

Our study found 59.7% of 129 respondents experienced moderate to severe PMS symptoms. In a population-based survey, 12.2% of 2836 French women respondents indicated moderate to severe PMS (33). Several previous studies also showed some quite significant prevalence of PMS among female university students such as 50.1% in South-western Nigeria, 39.85% in southern Taiwan, and 56.1% in Egypt (33-36). Meanwhile, Steiner and Born also indicated that more than three quarters of women with normal menstrual cycles also reported some PMS symptoms (37).

The highest PMS symptom mean in this present study was on affective lability. Similarly, Hylan, Sundell and Judge found that the primary symptoms of PMS were irritability and anger in three quarters of 1045 respondents from three developed countries (38). The finding was also in line with another study in China that reported irritability as the most frequent premenstrual symptoms (91.21%) (39). Affective lability or mood instability was also observed among women with PMS which exhibited greater unstable moods in all menstrual cycle phases and the most prominent symptoms were identified in premenstrual phase which might be due to hormonal changes during this phase (40). In a qualitative study, researchers found that a woman could barely control her emotional condition and can become a completely different person during premenstrual week (41).

Meanwhile, the present study also found that physical symptom of PMS had the lowest mean. Similar finding was observed in a study among Thai women where there were more concerns on emotional changes than physical changes (42). One previous study had suggested that physical symptom could be a stressor for psychological symptoms and both could be affected by the hormonal fluctuations and the reactivity differed in different individuals (43). However, the same study also highlighted that the physical and psychological symptoms could be in synchrony. Nonetheless, some physical symptoms of PMS may not occur during premenstrual cycle but take place at different period of menstrual cycle (43). Another study discussed that symptoms might be contrasting in different levels of PMS such as mild and moderate PMS sufferers mostly experienced physical symptoms such as breast tenderness, abdominal bloating and headache; while both physical & psychological symptoms were observed in severe PMS cases (44).

In addition, this study also found that food craving was significantly associated with PMS symptoms ( $p=0.001$ ). Several studies also indicated that food craving has relationship with high level of anxiety and negative mood (45). Similarly, a study where negative moods were induced in the sample showed food cues influence higher attentional bias and subjective appetite which were positively associated (46). Another study found food craving experienced by women is significantly higher in luteal phase than ovulation, follicular and menstrual phases (30). However, Albeshri identified three quarters of the respondents experienced food cravings in all menstrual cycle phases, and it occurred at least twice per cycle (12). The findings indicated that previous studies demonstrated that food craving occurred inconsistently throughout phases of menstrual cycle.

Food craving among women is due to body response to the increased energy expenditure level or related to insufficient nutrients. It resulted from hormonal

fluctuations which cause negative emotions and stress (4). It is noted that common feature of PMS is increased appetite from food craving or dietary consumption during luteal phase (4). Our study demonstrated that PMS symptoms significantly predicted food craving by 7.6%. This finding suggests that PMS symptoms may influence food craving to some extent even though the prediction percentage is low. To the best of our knowledge, this present study is at the forefront in reporting the predictor as most studies only examined the link between PMS symptoms and food craving (12,30).

Moreover, previous research also highlighted that food craving was more intense among women with PMS (4,47). PMS sufferers have desire to eat more foods especially food containing high fat during luteal phase in comparison to follicular phase (48). Apart from hormonal fluctuations, Dye and Blundell also found that PMS has relationship with low serotonin activity (4). The luteal phase is identified as a period when women have high tendency to food craving, excessive dietary intake and depression. In order to have adequate serotonin level, glucose is required (49). Thus, it is recommended for women to practice healthy eating and lifestyle to minimize adverse consequences of PMS as well as food craving, as lower body mass index significantly decreased PMS risk (33). Mindful eating can be adopted due to its beneficial impact on body weight and body mass index among young women (50).

Limitation of this study is only general food craving was assessed. Therefore, specific example of food craving and its contribution in increasing energy intake could not be determined. In spite of that, the use of tight screening criteria to identify eligible respondents was prominent strength of this study. Besides, 15-item FCQ-T-r ability to generally measure food craving frequency and intensity matches well with this study objective.

## CONCLUSION

Food craving during pre-menstruation among undergraduate students was prevalent; while most students experienced moderate to severe PMS symptoms. Furthermore, food craving was significantly associated with PMS symptoms during luteal phase in normal menstrual cycle. PMS symptoms significantly predicted food craving. Thus, strategies to manage food craving are required to be planned and implemented accordingly such as healthy eating awareness programme. For future studies, it is recommended to compare food craving specifically during every phase of menstrual cycle which are follicular, ovulation, luteal and menstruation phases in different populations. Therefore, further insight on food craving frequency and intensity during each of the phases involved can be identified. Specific type of the food craving needs to be examined particularly energy dense food; so that increased and excessive dietary intake can be traced throughout menstrual cycle. Other

possible factors which can contribute to food craving such as different age group and stress level are also advocated to be examined.

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