Jurnal Gizi dan Dietetik Indonesia
(Indonesian Journal of Nutrition and Dietetics)
Vol 12, Issue 4, 2024:273- 283

Available online at: https://ejournal.almaata.ac.id/index.php/IJND
p-ISSN 2303-3045 e-ISSN 2503-183X
DOI: https://dx.doi.org/10.21927/ijnd.2024.12(4).252-283

The energy intake, nutritional status, menarche at age, and premenstrual syndrome in female adolescents

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ABSTRAK

Latar Belakang: *Saat ini remaja mengalami pertumbuhan dan perkembangan yang lebih cepat termasuk menstruasi (menarche). Berdasarkan hasil Riskesdas tahun 2010 sebanyak 21,3% wanita di Jambi mengalami menarche pada usia ≤12 tahun. Gangguan pada siklus menstruasi yang sering dialami remaja adalah premenstrual syndrome (PMS) dengan prevalensi berkisar 80-90%.*
Tujuan: *Penelitian ini dilakukan untuk menganalisis perbedaan asupan energi, status gizi, usia menarche, dan kejadian PMS serta faktor dominan dari usia menarche dan PMS pada remaja putri di perkotaan dan perdesaan Jambi.*
Metode: *: Penelitian ini menggunakan desain cross sectional study yang melibatkan 200 remaja putri sekolah menengah pertama (SMP) negeri di perkotaan dan perdesaan Jambi dengan teknik simple random sampling. Data asupan energi dikumpulkan menggunakan food recall 2x24 jam, status gizi dengan pengukuran antropometri menggunakan Bioelectrical Impedance Analysis (BIA) dan mikrotoice, usia menarche dan PMS menggunakan kuesioner. Analisis data bivariat menggunakan Independent t-test, Mann-Whitney, dan Spearman rank, sedangkan multivariat menggunakan Regresi Logistik.*
Hasil: *Terdapat perbedaan yang signifikan pada usia menarche, asupan energi, dan status gizi (TB/U dan IMT/U) pada remaja putri di perkotaan dan perdesaan ($p<0.05$). Terdapat hubungan negatif signifikan status gizi dengan usia menarche ($p<0.05$) dan hubungan positif signifikan status gizi dengan kejadian PMS ($p<0.05$). Uji Regresi Logistic menunjukkan bahwa wilayah tempat tinggal menjadi faktor dominan berhubungan dengan usia menarche (OR: 2,591 CI 95%: 1,415-4,744) dan persen lemak tubuh menjadi faktor dominan berhubungan dengan kejadian PMS (OR: 2,468 CI 95%: 1,159-5,254).*
Kesimpulan: *Terdapat perbedaan usia menarche, asupan energi, dan status gizi (TB/U dan IMT/U) pada remaja putri di perkotaan dan perdesaan. Terdapat hubungan yang signifikan antara status gizi dengan usia menarche dan kejadian PMS. Wilayah tempat tinggal menjadi faktor dominan berhubungan dengan usia menarche dan persen lemak tubuh menjadi faktor dominan berhubungan dengan kejadian PMS.*

KATA KUNCI: *asupan energi; PMS; remaja putri; status gizi; usia menarche*

ABSTRACT

Background: *At present, many female adolescents experience faster growth and faster development phase, including menstruation (menarche). According to 2010 Riskesdas data, 21.3 % of female adolescents in Jambi experienced menarche at the age of ≤12 years, and disorder during menstrual cycle often experienced by female adolescents is premenstrual syndrome (PMS) with a prevalence ranging from 80-90 %.*

Objectives: *This research was conducted to analyze any differences from energy intake, nutritional status, age at menarche, and PMS incidence along with finding dominant factors of age at menarche and PMS in female adolescents in urban and rural areas of Jambi.*

Methods: *This research employed a cross sectional study design involving 200 female adolescents selected from State Junior High schools in urban and rural areas of Jambi province by a simple random sampling technique. The energy intake data collected by 2 x 24 food recall, whereas nutritional status data was collected through anthropometric measurements using Bioelectrical Impedance Analysis (BIA) and a microtoise, and age at menarche and PMS data were collected by a questionnaire. Bivariate data analysis was taken by Independent t-test, Mann-Whitney test and Spearman Rank test, while the multivariate data analysis was taken by the Logistic Regression.*

Results: *There were significant differences found in age at menarche, energy intake, and nutritional status (HAZ and BAZ) of female adolescents in urban and rural areas ($p<0.05$). A significant negative relationship was found between nutritional status and age at menarche ($p<0.05$) and a significant positive relationship was found between nutritional status and the incidence of PMS ($p<0.05$). The Logistic Regression Test revealed that residence area was the dominant factor related to age at menarche (OR: 2.591 CI 95%: 1.415-4.744) and body fat percentage was the dominant factor related to the incidence of PMS (OR: 2.468 CI 95%: 1.159-5.254) .*

Conclusions: *There are differences found in age of menarche, energy intake, and nutritional status (HAZ and BAZ) between female adolescents from urban and rural areas. There is a significant relationship between nutritional status and age at menarche to the incidence of PMS. Residential area becomes the dominant factor related to age at menarche and body fat percentage becomes the dominant factor related to the incidence of PMS.*

KEYWORD*: age at menarche; energy intake; female adolescents; nutritional status; PMS*

Article info:
Article submitted on March 9, 2024
Articles revised on June 6, 2024
Articles received on July 25, 2024

INTRODUCTION

Adolescence is the transition from childhood to adulthood in the age range of 10-19 years (1). Adolescence is a critical period in individual growth as it is identified as the second growth spurt. In women, entering adolescence will be marked by the start of the first menstruation called menarche. Menarche or first menstruation is a normal process and is one of the signs that adolescent girls are entering puberty. Menarche usually occurs in the age range of 10-16 years (2). Menarche is important in women's reproductive life because it is related to health status that affects women's well-being in the next stage of life. Along with the time, the age of menarche has decreased from an average age of 14 years to 12 years (3). The downward trend in menarche age also tends to occur in Indonesia (4).

There was a downward trend in the age of menarche from 1995-2017 in the United States. The age of menarche decreased from 12.1 in 1995 to 11.9 in 2017. Half of the women reached menarche at the age of 11 years and 10 months in 2017 (5). In Indonesia based on Riskesdas 2010 data, menarche occurs at an average age of 13 years (6). Indonesia ranks 15th out of 67 countries with a menarche declining age where reaches

0.145 years per decade (7). In Jambi Province, 21.3% of women experienced menarche at the age of ≤12 years, and 61.6% experienced menarche at the age of >12 years (6).

Early menarche allows adolescents to come into contact with sexual life sooner. This results in greater opportunities for adolescents to become pregnant and mothers. Adolescent pregnancy puts them at a disadvantage due to the increased nutrient requirements during pregnancy above their own needs which results in slowing and stunting of individual growth, leading to a higher risk of complications and mortality in the mother and child (8).

The age of menarche is not only related to early life factors but also reflects future health. Early menarche increases the risk of hormone-related cancers and cardiovascular disease (9). Earlier menarche is also associated with a higher risk of depression, eating disorders, and substance abuse during adolescence (10).

After experiencing menarche, women will then experience a menstrual cycle every month until the reproductive period ends. One of the disorders in the menstrual cycle that adolescents often experience is premenstrual syndrome (PMS). PMS is a collection of physical, psychological, and behavioral symptoms related to hormonal changes associated with ovulation and menstrual cycles that occur 7-14 days before menstruation (11). The prevalence of women experiencing PMS in Indonesia ranges from 80-90% (12). PMS in adolescents can have an impact on interpersonal relationships, physical health, and academic productivity. The worst impact of PMS is depression to violence against themselves and others around them (13).

Energy intake and nutritional status play an important role in the development of adolescent reproductive organs. Energy intake and nutritional status are related to body fat levels. Body fat plays a role in the production of the hormone leptin which functions as a signal to the brain to regulate the onset of puberty. High levels of leptin will trigger the hypothalamus to initiate the production of gonadotropins, which then trigger the production of the sex hormones estrogen and progesterone. This results in ovulation occurring sooner and causing menarche to occur sooner (14). Systematic review and meta-analysis research shows that there is a significant relationship between energy intake and the age of menarche (9). Research on adolescent girls in Bulukumba Regency shows that there is a relationship between nutritional status and the age of menarche (15).

Energy intake is also significantly associated with PMS (16). Energy intake will contribute to shaping the nutritional status of individuals. Energy intake and nutritional status is one of the factors that are quite important in the severity of PMS because it is related to fat levels in the body which affects the imbalance of estrogen and progesterone hormones (17).

The 2010 Riskesdas data identified differences in the age of menarche based on the area of residence, namely in urban and rural areas, where age at menarche ≤14 years was more prevalent among women in urban and age at menarche >14 years was more prevalent among women in rural (6). Differences in the area of residence will affect food access, food consumption, and nutritional status. Research in South Africa shows that women in urban areas experience menarche earlier than women in rural areas (18). Therefore, this study aimed to analyze energy intake, nutritional status, age at menarche, and the incidence of PMS among adolescent girls in urban and rural Jambi.

MATERIALS AND METHODS

This study used a cross-sectional design and was conducted in Public Junior High Schools in Jambi Province in two areas, namely urban and rural from September to November 2023. Urban areas in Sungai Penuh City and rural areas in Kerinci Regency. The determination of urban and rural areas is based on the regulation from the Head of Central Statistics Agency number 120 of 2020. The selected sub-districts are those that have all villages with urban and rural classifications. Thus, the selection of schools as the research location was determined purposively based on the results of an initial survey of the number of female students ≥100 people.

The minimum number of subjects was calculated based on Lemeshow's sample size formula with unknown population size (19) and using the prevalence of PMS in Jambi (39.7%) (20). Based on the calculation results, the

minimum number of subjects was 91 participants for each region. As an effort to anticipate subjects who drop out, 10% of this number was added, so that the minimum number of subjects was 100 participants for each region. Therefore, the total number of subjects was 200 participants selected using a simple random sampling technique.

Research data regarding subject characteristics (age, menstrual cycle, and pocket money), family characteristics (parents' education and income), and age at menarche were collected using self-administered questionnaires. The menstrual cycle was estimated by the duration between the first day of the previous menstruation to the first day of the last menstruation. The normal menstrual cycle ranges from 21 to 35 days (21). Energy intake data was obtained directly through interviews using a 2x24-hour food recall questionnaire (22) on weekdays and weekends which was then compared with the Nutritional Adequacy Rate (RDA) (22,23). Nutritional status data were obtained by measuring body weight and body fat percent using Bioelectrical Impedance Analysis (BIA) brand Omron HBF-214, while height using stature meter brand GEA SH-2A. Data on the incidence of PMS was collected by completing the Shortened Premenstrual Assessment Form (SPAF) questionnaire (24). The questionnaire has 10 questions related to PMS symptoms consisting of psychological factors (such as irritability, sadness, and/or depression), pain (such as lower abdominal pain), and fluid retention (such as swelling of the legs). Each symptom has a score of 1 (no symptoms) to 6 (extreme complaints). Next, the subject will choose one of the scores that best describes the intensity of pain felt in each symptom. Then the selected scores will be summed up to get a final score in the range of 10-60. The SPAF questionnaire has been declared valid with a calculated r value of 0.394-0.793 > r table 0.279 and reliable with a Cronbach's alpha value of 0.843 (25).

The distribution of data was tested using the Kolmogorov-Smirnov test. Bivariate data were analyzed using the Independent t-test, Mann-Whitney, and Spearman tests, while multivariate data used logistic regression. This study has passed the ethical review issued by the Health Research Ethics Commission, Faculty of Nursing, Universitas Airlangga with approval number No: 2967-KEPK.

RESULTS AND DISCUSSIONS

Characteristics of Subjects and Family

Based on **Table 1**, the age distribution of the subjects was 12-15 years old and included in the early adolescent category. In urban areas, 48% of subjects were 13 years old, while in rural areas 50% of subjects were 14 years old. The majority of subjects in urban areas (64%) and in rural areas (73%) have a normal menstrual cycle. The menstrual cycle causes hormonal changes that can affect women's emotions and behavior (26). More than three-sevenths of subjects (44%) in urban areas received IDR 15.000-20.000/day pocket money, while more than two-thirds of subjects in rural areas (89%) received <IDR 15.000/day pocket money. The amount of pocket money will increase the opportunity to consume excessive food, which can increase the risk of overnutrition (27). More than four-fifths of the subject's fathers in urban areas (82%) received education to high school/equivalent level and university. However, four-sevenths of the subject's fathers in rural areas (57%) only received education to the extent of Elementary/Junior High schools/equivalent level. These data are similar to the level of education for the subject's mothers where mothers in urban areas (90%) graduated from High School/equivalent level and university. However, more than three-fifths of mothers in rural areas (61%) received education only to the extent of Elementary/Junior High/Equivalent level, and there were even 3% of mothers who did not go to school. The level of parental education is related to the level of knowledge and understanding which will then result in better habits (28).

Parental income in this study used the cut-off poverty line of Jambi Province in 2022. Based on Table 1, four-fifths of parents' income in urban areas (80%) was ≥IDR.545.870, while five-sevenths of parents' income in rural areas (71%) was <IDR.545.870. Parental income has a positive influence on the amount of household consumption. Income reflects the ability of households to meet food needs both in terms of quality and quantity (29).

Table 1. Respondents characteristics

Variable	Urban (N=100)		Rural (N=100)		Total (N=200)	
	n	%	n	%	n	%
Age (years)						
12	2	2	1	1	3	1.5
13	48	48	37	37	85	42.5
14	42	42	50	50	92	46
15	8	8	12	12	20	10
Menstruation cycle (day)						
Regular (21-35)	64	64	73	73	137	68.5
Irregular (<21 or >35)	36	36	27	27	63	31.5
Pocket Money (IDR/day)						
<15.000	25	25	89	89	114	57
15.000-Rp 20.000	44	44	9	9	53	26.5
>20.000	31	31	2	2	33	16.5
Father's Education Level						
Never attends school	0	0	1	1	1	0.5
Elementary/equivalent level	3	3	34	34	37	18.5
Junior High/equivalent level	15	15	23	23	38	19
Senior High/equivalent level	52	52	36	36	88	44
University	30	30	6	6	36	18
Mother's Education Level						
Never attends school	0	0	3	3	3	1.5
Elementary/equivalent level	4	4	29	29	33	16.5
Junior High/equivalent level	6	6	32	32	38	19
Senior High/equivalent level	49	49	27	27	76	38
University	41	41	9	9	50	25
Parent's Income (IDR/capita/month)						
< 545.870	20	20	71	71	91	45.5
≥ 545.870	80	80	29	29	109	54.5

The food intake and nutritional status

The energy intake of subjects in urban was three-sevenths (43%) good and more than one-third (36%) were in deficit. However, in rural, more than a quarter (27%) were classified as good, and more than four-sevenths (58%) were still classified as deficit. It shows that energy intake is significantly higher in urban than rural ($p=0.001$; $p<0.05$). Similar to Systematic Review research which showed that energy intake was higher in urban compared to rural (30). The high consumption of foods containing fat, sugar, and salt such as fast food, sweet and salty snacks, and sugar-sweetened beverages results in high energy intake in urban. The busyness of adolescents in urban areas makes them tend to choose foods that are fast and easily accessible. Fast foods, processed foods, and sugary drinks are often easier to obtain and consume. Many supermarkets in urban areas provide a wide range of processed and ready-to-eat foods that are high in calories including snack foods, soft drinks, and packaged food products. In addition, many 24-hour stores in big cities allow easier access to high-calorie foods at any time. The promotion of high-calorie foods will also attract consumers, especially teenagers, to consume them. The snacks consumed by the subjects were sweet snacks such as chocolate, biscuits, bread, and cookies, snacks packaged with products such as Lays and citato, sweet drinks and sodas, ice cream, etc.

The majority of subjects in urban and rural had HAZ in the normal category. However, there were 11% of subjects classified as short in urban and 27% in rural. The mean value of HAZ in urban was -1.2±0.7 SD and in rural was -1.5±0.9 SD. This shows that the HAZ of subjects in urban is significantly higher than in rural ($p=0.014$; $p<0.05$). A study in eastern Ethiopia also found significant differences in HAZ in rural and urban adolescents where the prevalence of stunting was lower in urban adolescents (8.1%) than in rural adolescents (47.9%) (31). Differences in

diet, nutrition education, clean water, sanitation, and hygiene facilities are thought to be factors in the disparity (31,32). The majority of subjects in urban and rural had normal nutritional status based on BAZ with 61% and 81% respectively. The proportion of overweight in urban was twice as much as in rural. This shows that BAZ in urban is significantly higher than in rural (p=0.014; p<0.05). The results of the study analysis are in line with research on junior high school adolescents in Malang which shows that nutritional status based on BAZ in urban is significantly higher than in rural areas (33). Differences in family income, food consumption and quantity, and nutritional knowledge are thought to be factors in the gap. In addition, the westernization behavior of adolescents in urban areas also causes differences in nutritional status (34).

Table 2. Distribution of subjects based on energy intake and nutritional status (N=200)

Variable	Urban (N=100)		Rural (N=100)		Total (N=200)		*p-value*
	n	%	N	%	n	%	
Energy Intake (RDA)							
Deficit (<90%)	36	36	58	58	94	47.0	
Good (90%-<120%)	43	43	27	27	70	35.0	
More (≤120%)	21	21	15	15	36	18.0	
Median (min-max)	97.2 (56.2-149.4)		86.4 (32.0-174.0)		91.8 (32.0-174.0)		0.001[1)]
HAZ							
Short (z-score <-2 SD)	11	11	27	27	38	19	
Normal (-2 SD ≤ z-score ≤ 3SD)	89	89	73	73	162	81	
Mean±SD	-1.2±0.7		-1.5±0.9		-1.3±0.8		0.014[2)]
BAZ							
Deficit (z-score <-2 SD)	5	5	2	2	7	3.5	
Normal (-2 SD ≤ z-score ≤ 1 SD)	61	61	81	81	142	71	
More/Excessive (z-score ≥ 1 SD)	34	34	17	17	51	25.5	
Mean±SD	0.4±1.3		0.0±1.1		0.2±1.2		0.014[2)]
Body Fat Percentage							
Underfat (<13%)	10	10	6	6	16	8	
Healthy (13-23%)	37	37	46	46	83	41.5	
Low risk obese (24-27%)	20	20	30	30	50	25	
Overfat (28-32%)	18	18	16	16	34	17	
Obese (≥33%)	15	15	2	2	17	8.5	
Median (min-max)	25 (3.4-38.0)		23 (6.1-41.6)		24 (3.4-41.6)		0.081[1)]

The percent body fat of subjects in urban and rural is mostly in the healthy category. However, there were subjects with high percent body fat in urban as much as 33%, and in rural 18%. Statistical analysis showed no significant difference in percent body fat in urban and rural (p=0.081; p>0.05). This result is in line with a study in Kosovo which also found no difference in the percentage of body fat in adolescents in rural and urban (35).

Age at menarche and premenstrual syndrome

More than three-sevenths of the subjects in urban (45%) and almost a quarter of the subjects in rural (24%) had menarche at the age of <12 years. This indicates that adolescent girls in urban experience menarche significantly earlier than rural (p=0.014; p<0.05). The 2010 Riskesdas data showed that menarche occurred earlier in urban women than in rural (6). Modernization and lifestyle are considered to be the biggest influences on the decrease in the age of menarche (36).

Tabel 3. Distribution of subjects based on age at menarche and premenstrual syndrome (N=200)

Variable	Urban (N=100)		Rural (N=100)		Total (N=200)		*p-value*[1]
	n	%	n	%	n	%	
Age at *Menarche*							
Earlier (<12 years old)	45	45	24	24	69	34.5	
Normal (12-14 years old)	55	55	76	76	131	65.5	
Median (min-max)	12 (9-14)		12 (10-14)		12 (9-14)		0.001
Premenstrual Syndrome							
No symptoms (<10 point)	2	2	4	4	6	3	
Mild (≤30 point)	74	74	82	82	156	78	
Moderate (31-45 point)	24	24	13	13	37	18.5	
Heavy/Severe (>45 point)	0	0	1	1	1	0.5	
Median (min-max)	23 (10-44)		22 (10-50)		22.5 (10-50)		0.102

[1)]Differential Test by Mann-Whitney test

The majority of subjects in urban and rural areas experienced PMS symptoms a percentage of 98% and 96%. Most of the subjects' complaints in both areas were in the mild category. Statistical analysis showed no significant difference in the incidence of PMS in urban and rural (p=0.0102; p<0.05). Research in Gujarat stated that almost all adolescent girls (94.8%) experience PMS at least one symptom (37).

Relationship between energy intake and nutritional status with age at menarche

The results of statistical analysis showed that there was no significant relationship between energy intake and age at menarche (p=0.909; p>0.05). These results are in line with research in Jombang Regency which shows no significant relationship between energy intake and age at menarche in adolescent girls aged 9-15 years (38). Research in Bogor also showed no significant relationship between energy intake and age at menarche in adolescent girls (10-14 years) (39). The level of energy intake will have an impact on menarche if the energy intake consumed is more and affects body weight and body fat. The HAZ has a significant negative relationship with age at menarche (p=0.001; p<0.05), so the higher the HAZ, the menarche will occur at a younger age. Similar research in Bandung stated that there was a relationship between HAZ and the age of menarche in adolescent girls aged 10-15 years. Well-nourished adolescent girls have a higher growth rate in the period before puberty compared to adolescents who are malnourished. Malnourished adolescents will experience slower growth for a longer time, so menarche will also be delayed (40).

Table 4. Relationship between energy intake and nutritional status with age at menarche

Variable	Age at Menarche	
	r	*p-value*[1]
Energy Intake	0.008	0.909
HAZ	-0.233	0.001
BAZ	-0.188	0.008
Body Fat Percentage	-0.225	0.001

The BAZ has a significant negative relationship with age at menarche (p=0.008; p<0.05), so the higher the BAZ, the menarche will occur at a younger age. Similar to the study in Jombang which showed a significant negative relationship between BAZ and age at menarche (38). It was also stated that if there is an increase of one unit of BMI, there would be a decrease in menarche age of 0.902 years. BMI is related to an increase in the amount and mass of fat so there will be an increase in leptin gene expression and leptin hormone production (41). Leptin will trigger the release of follicle-stimulating hormone (FSH) and Luteinizing Hormone (LH) levels in the ovaries resulting in follicular maturation and the formation of estrogen. Estrogen causes negative feedback

to FSH. If there is an increase in FSH, estrogen levels will decrease. Decreased estrogen levels cause the proliferation of endometrial blood vessels to stop. This results in the decay of the endometrial layer, resulting in bleeding referred to as the first menstruation (menarche) (42).

Percent body fat has a significant negative relationship with age at menarche (p=0.001; p<0.05), so the higher the percentage of body fat, the menarche will occur at a younger age. These results are in line with research in Gresik which showed a significant negative relationship between percent body fat and age of menarche (43). High levels of fat in the body cause serum leptin levels to increase, triggering an increase in serum LH and the secretion of the hormones estrogen and progesterone in the ovaries. This is what causes reproductive maturity to occur earlier such as menarche (36).

Relationship between energy intake and nutritional status with premenstrual syndrome

The results of statistical analysis showed that there was no significant relationship between energy intake and the incidence of PMS (p=0.948; p>0.05). This is because most respondents have a deficit in energy intake. Research in Brazil stated that there was no significant difference in energy intake during the follicular phase and luteal phase of the menstrual cycle (44). PMS is a condition influenced by hormonal fluctuations that occur during the menstrual cycle which is influenced by body fat levels (45).

Table 5. Relationship between energy intake and nutritional status with premenstrual syndrome

Variable	*Premenstrual Syndrome*	
	r	*p-value*[1]
Energy Intake	-0.005	0.948
BAZ	0.171	0.016
Body Fat Percentage	0.286	0.001

The BAZ has a significant positive relationship with PMS incidence (p=0.016; p<0.05), so the higher the BAZ, the higher the risk of PMS. These results are in line with research on female students of SMAN 74 Jakarta which shows that there is a relationship between nutritional status based on BAZ and PMS (46). The higher the BMI of the individual, the more aggravating the complaints of PMS symptoms (47). The body fat percentage has a significant positive relationship with PMS incidence (p=0.001; p<0.05), so the higher the percent body fat, the higher the risk of PMS. In line with the research in Semarang showed that there was a relationship between the percent body fat and the incidence of PMS (48).

BMI and percent body fat are one measure to predict fat levels in the body. High-fat levels will increase the formation of estrogen hormones in the body. The high estrogen hormone will increase the production of the hormone LH so that the process of breaking down androgen into estrogen and making estrogen levels higher. It will cause the ovaries to enlarge and cause menstrual disorders such as PMS (17). High levels of estrogen can also interfere with the body's metabolic processes including vitamin B6 which plays a role in controlling serotonin production. Impaired serotonin function contributes to PMS symptoms such as mood swings, increased appetite, and flatulence (48).

This study only analyzed 2 out of a total of 11 cities/districts in Jambi Province, so it cannot describe the age of menarche and the overall incidence of PMS in Jambi Province. In addition, this study was limited to analyzing energy intake and did not analyze macronutrient intake (carbohydrates, fat, and protein).

Risk Factors of Age at Menarche and Premenstrual Syndrome

Based on the logistic regression test, the region of residence became a risk factor for the age at menarche. Adolescents living in urban areas had a 2.591 times risk of early menarche compared to subjects living in rural areas (OR: 2.591 95% CI: 1.415-4.744). Sudikno and Sandjaja's (2019) research analyzing Riskesdas 2010 data showed that the age of menarche of adolescent girls in urban areas was younger than in rural areas (4).

Percent body fat becomes a risk factor for the incidence of PMS. Adolescents with high percent body fat had a 2.468 times higher risk of having a

PMS than adolescents with normal percent body fat (OR: 2.468 95% CI: 1.159-5.254). Daniartama et al. (2021) showed that there was a relationship between percent body fat and the incidence of PMS. The study also showed that individuals with high body fat percent had a risk of 3.746 times experiencing PMS compared to individuals with normal body fat percent (OR: 3.746 95% CI: 1.303-10.771) (48).

CONCLUSIONS AND RECOMMENDATIONS

The results showed that the energy intake and nutritional status (HAZ and BAZ) of adolescent girls in urban were significantly higher than those in rural. Adolescent girls in urban significantly experienced menarche earlier than in rural. HAZ, BAZ, and percent body fat had a negative significant relationship with age at menarche. Therefore, the higher the HAZ, the fatter, and the higher the percent body fat, the younger the age of menarche. HAZ and percent body fat had a positive significant relationship with PMS. Therefore, the fatter and higher the percent body fat, the higher the risk of PMS. The risk factor for age of menarche was that adolescents living in urban had a 2.591 times risk of early menarche compared to those living in rural. Risk factors for PMS were adolescents with high body fat percent had a 2.468 times risk of PMS compared to those with normal body fat percent.

There are still many adolescents who have energy intake that is not by the RDA. Therefore, schools and related agencies need to conduct nutrition education and promotion to increase the knowledge and awareness of adolescent girls to practice a good diet by balanced nutrition guidelines and RDAs, so that it is expected to improve nutritional status and reduce complaints of PMS symptoms in adolescents in Jambi.

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