Abnormal Menstrual Period of Hockey Athlete: Association with Body Fat Percentage and Dietary Fat Intake

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Abstract: Most women athletes have an abnormal menstrual period due to decreasing estrogen and progesterone. This study aimed to analyze the association between body fat percentage and fat intake in a hockey athlete. This was a cross-sectional study with purposive sampling. This study was conducted in East Jakarta region in July 2018. The analysis involved 40 participants of Hockey Women Athlete. Body fat percentage was measured using skinfold caliper, while dietary fat intake was estimated using 24 hours recall. Most participants had oligomenorrhea (62,5%), body fat percentage less than 22% (70,0%), and low dietary fat intake (57,5%). Body fat percentage was significantly associated ($p<0,05$) with abnormal menstrual period but dietary fat intake was not associated ($p>0,05$) with an abnormal menstrual period of Hokey Women athlete.

1 INTRODUCTION

An abnormal menstrual period is a disruption during menstruation which consists of bleeding patterns, abnormalities in the amount of blood release, and duration of bleeding (Kusmiran, 2012). Abnormal menstrual period; such as polymenorrhea, oligomenorrhea, and amenorrhea; are often experienced by athletes. Female athletes are included in risk group for menstrual disorders, that is around 50%. There was an association between weekly running distance and the prevalence of amenorrhea, nearly 28% of 40-mile runners per week compared to amenorrhea, and at 80 miles of runners a week compared to amenorrhea by 45%; whereas ordinary women who experience amenorrhea are only about 2%(Bean A, & Wellington, 2010).

Low body fat is related to menstrual cycle disorders(Khans dan Burkner, 2009). Dr. Frisch, Harvard University, said that women who experienced a weight loss of 12-15% had a greater chance of experiencing a break in the menstrual cycle. Intake of energy and macronutrients, such as carbohydrates, fats, and proteins related to the composition of body fat. Also, these macronutrients also affect energy use for athletes. Hockey is a sports game that uses aerobic and anaerobic metabolism. The most important nutritional role in hockey is fat (Kemenkes, 2014).

The risk of soft tissue injury and stress fractures has happened commonly in athletes who experience a short menstrual cycle. Besides, infertility, early atherosclerosis, osteoporosis, and cancer of the reproductive organ can also occur (Mellion, Morris B., 2009). Estrogen loss is occurring in women who have an excessive activity or excessive exercise. Estrogen hormones will decrease after regular exercise (Wiarto, 2013). All sex hormones are steroids that are converted from precursor molecules through cholesterol to their final form. Cholesterol is a steroid precursor stored in large quantities in theca cells. Follicle maturation is regulated by GnRH.

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Thus, low fat in the body can interfere with GnRH secretion in female athletes and interfere with GnRH secretion that causing the menstrual irregularities athletes (Paath, Rumdasih, & Heryati, 2005).

2 SUBJECTS AND METHODS

This research belongs to quantitative research with a cross-sectional research design. The population in this research includes 45 female hockey athletes. The inclusion criteria for the sample of this research willing to be a subject in the research, aged 19-25 years, are not married. Whereas the exclusion criteria include smoking, using hormonal medicine or long-term therapeutic medicines, extremely losing weight (it's 2kg / week), menarche age> 16 years, and vegetarian. This research employs purposive sampling and selected 40 samples that fulfill the inclusion and exclusion criteria.

The primary data were collected in 2x24 hours through food recall interviews, filling out questionnaires related to the menstrual cycle, and measuring body fat using skinfold in female athletes in Jakarta State University hockey associations and Hockey at Indonesian College of Economics. The results of body fat data percentage obtained by measurements using skinfold caliper on the triceps, biceps, subscapular, and suprailiac sections were then calculated using the Lohman formula. Furthermore, it is categorized into two. First was Risk, if percent body fat ≤22%, and second is not at risk, if body fat percent> 22%(Stokic & Scrdic, 2014). Meanwhile, the results of the intake data were calculated using the Indonesian Food Composition Table. Furthermore, it is categorized into two: Less (if fat intake is <60% compared to total energy requirements) and Normal (if fat intake is 90%-110% compared to total energy requirements). The results of the menstrual cycle data were obtained through the date of the first day of the last menstrual cycle and the date of the first day of the last two menstrual cycles. Then, the distance between menstrual cycles was calculated and categorized into two: the duration of the menstrual cycle disorder (if polymenorrhea (menstrual cycle <21 days), Oligomenorrhea (menstrual cycle>35 days) and Normal (menstrual cycle 21-35 days) (Kusmiran, 2012).

Bivariate analysis of data was done and the chi-squared test of significance was done where appropriate. Logistic regression analysis was performed to investigate factors associated with menstrual disorders.

3 RESULTS

The research found that some subjects were included in the category of body fat risk percentage (70.0%) with the average body fat percentage of was 20.40%, and the body fat percentage of subjects was between 5.62% and 47.33%. Also, some of the subjects' fat intakes are included in the category of less fat intake (57.5%) and 62.5% of subjects experienced menstrual cycle disorders, that was oligomenorrhea (Table 1).

Table 1: Body fat, fat intake, and abnormal menstrual period.

Variable	n	%
Body Fat		
At Risk	28	70.0
Not at Risk	12	30.0
Fat Intake		
Less	23	57.5
Normal	17	42.5
Abnormal Menstrual Period		
Polymenorrhea	1	2.5
Oligomenorrhea	25	62.5
Normal	14	35.0

Table 2 shows that menstrual cycle disorders occur more in subjects who have body fat risk percentage 78.6% compared to subjects who have body fat percentage of not being at risk (33.3%). This shows that there is a tendency for body fat percentage to be at risk with menstrual cycle disorders. The lower the percentage of body fat, the more the subject is at risk of experiencing menstrual cycle disorders. The results of the statistical tests performed showed a p-value of 0.011. It means that there was a relation between body fat percentage and menstrual cycle disorders. Subjects who experienced menstrual cycle disorders 2,357 times were more at risk compared to those who were not at risk. This research is in accordance with the research conducted by Wahyuningsih (2014), mentioning that body fat percentage is associated with abnormal menstrual period, in which 66.7% of athletes have less body fat percentage and experience abnormal menstrual period.

Abnormal menstrual period occurs more in subjects with less fat intake (69.6%) compared to subjects with normal fat intake (58.5%). It shows that there was a tendency for less fat intake with menstrual cycle disorders. The less fat intake, the more the subject is at risk of menstrual cycle disorders. There was no relation between fat intake and cycle disturbances (p>0.05). This happens because not only

fat intake, but also energy, carbohydrate, and protein intake can affect the composition of body fat, which will result in menstrual cycle disruption.

Table 2: Associations of Body Fat and Fat Intake with Menstrual Period.

Variables	Menstrual Period		PR	*p*-value
	Abnormal	**Normal**		
	n (%)	**n (%)**		
Body Fat				
At Risk	22 (78,6)	6 (28,4)	2,36	0,011*
Not at Risk	4 (33,3)	8 (66,7)		
Fat Intake				
Less	16 (69,6)	7 (30,4)	1,18	0,481
Normal	10 (58,8)	7 (41,2)		

*) *Fisher Exact*

4 DISCUSSION

A person's body fat level is mostly related to the level of activity and food intake, one of which is energy intake (Wiarto, 2013). Energy is the result of the metabolism of carbohydrates, proteins, and fats contained in foods that a person takes. Energy functions as energy for metabolism, growth, temperature regulation, and physical activity. Thus, energy intake that exceeds the needs will be stored as energy reserves in the form of body fat (Thompson, D., Karpe, F., Lafontan, M., Frayn, 2012)

In sports activities, such as hockey, which is carried out with high intensity and requires fast power such as when running to catch a ball. When hitting the ball hard, the body's energy metabolism will run anaerobically through energy sources obtained from PCr and glycogen deposits. Whereas, when doing low intensity, the energy source is obtained from carbohydrate, fat and protein deposits. Then when exercising, body energy savings, carbohydrate deposits (blood glucose, muscle, and liver glycogen) and fat deposits in the form of triglycerides will contribute to the rate of energy production aerobically in the body. Among the three deposits of nutrients that become the main energy source when exercising are carbohydrates and fats (Kemenkes, 2014).

In athletes, there are several metabolic and morphological changes if the exercise is carried out for several days or weeks. Metabolic changes that occur depend on the type of exercise with the use of aerobic or anaerobic energy system (Wilmore, Jack H. Costill, 2008). Then, in athletes, there will be a maximum burning of calories and fat. Although the athlete's intake is high, burning in her body will also remain high and will lessen the body fat percentage. In this research, it was found that the food intake of respondents had not reached optimal or less. The lack of food intake with high exercise intensity and metabolic adaptation will result in high-fat burning, causing no fat deposits in the body, causing the body fat percentage of respondents to be low.

The minimum body fat percentage needed to achieve menarche is 17% (Stokic & Scrdic, 2014)while the minimum body fat percentage required to maintain menstrual cycle regularity is 22%. In this study, it was found that 70% of subjects had a risk of body fat percent, which is <22% with an average body fat percentage of 20.40% and the body fat percentage of subjects is between 5.62% and 47.33%. This indicates that most of the subjects' body fat is below 22% which can be at risk of experiencing menstrual cycle disorders. Thus, female athletes should pay more attention to optimal intake and composition of body fat so that they are not at risk of suffering abnormal menstrual period and have long-term effects, such as infertility, cancer of reproductive organs and other problems (Mellion, Morris B., 2009).

Body fat is one of the factors that play an important role in maintaining the regularity of the menstrual cycle. Fat tissue in the body is needed to synthesize female reproductive hormones. All sex hormones are steroids that are converted from precursor molecules through cholesterol to their final form. Cholesterol as a precursor steroid is stored in large quantities in theca cells. Follicle maturation is regulated by GnRH. Thus, low fat in the body can interfere with GnRH secretion in female athletes and then interfere with GnRH secretion, causing athletes to experience menstrual irregularities (Paath et al., 2005).

In this research, it was found that 69.6% of subjects had less fat intake. This can be because when the data were collected, some respondents claimed to be on a diet by limiting their food intake to reduce weight for excellent performance during a match. Besides, most respondents said they were experiencing stress so that their appetite was reduced. The diet of female hockey athletes is still not appropriate, such as eating only twice a day.

Also, some respondents did not eat breakfast and practiced hockey for 4 hours. Some athletes pay little attention to what foods are consumed, such as frequent consumption of instant noodles, and other snacks. However, some other respondents ate food with more carbohydrates and vegetables than protein

and others. It can cause less fat intake. Meanwhile, Wahyuningsih (2013) stated that eating patterns for an athlete can be fulfilled in three meals (morning, afternoon and night) and by paying attention to the addition of certain types of food to provide energy during training and matches. Thus, hockey athletes in the research have not paid attention to the quality of food that must be chosen. Besides, they did not consider the fat intake needs. In fact, fat is also beneficial for athletes who need long-running activities, such as hockey.

Intake of nutrients consumed by athletes will produce energy and fat which are useful as building materials and regulators in the body. This nutrient is needed by athletes in fulfilling daily nutritional needs that will be used in carrying out daily tasks, exercises, and physical activities that will support athletic physical fitness (Maulana & Sulistyarto, 2016).

Fat intake related to the menstrual cycle is equal to a percentage of body fat, but the latter is the most influential. It happens because the percentage of body fat is fat deposits in the long term, while fat intake can change. If the energy savings are too much, it will be stored in the form of fat in the body. Food consumption affects the percentage of body fat. Also, the excess energy from food fat intake is easily stored as body fat compared to excess energy from carbohydrates (Heriyanto, 2012). Also, to convert excess carbohydrates into body fat, it takes 23% of the calories digested. Meanwhile, to turn excess fat into body fat, only 3% of calories are ingested. It is consistent with the research conducted in Switzerland, in that of the 2000 calorie carbohydrates consumed by one group, only 40 calories from excess carbohydrates are converted into body fat. This is because the body is more efficient at converting fat into body fat, compared to turning carbohydrates into body fat (Clark, 1996).

Fat is undoubtedly influential at the level of secretion and balance of reproductive hormones that regulate menstruation in the body because adipose tissue is significant in forming, converting, and storing reproductive hormones in regulating the menstrual cycle. Low levels of body fat can result in low estrogen levels associated with infertility. Meanwhile, the amount of increased body fat will increase the amount of estrogen in the blood so that the menstrual cycle becomes longer. Excess body fat can also cause blood vessel hyperplasia which is the pressure of blood vessels by fat tissue. If this happens to the female reproductive organs, the blood that should flow during the menstrual process is disrupted, resulting in longer menstruation and irregular menstrual cycles (Rakhmawati A and Dieny FF., 2013).

5. CONCLUSION

The majority of female hockey athletes in East Jakarta are at risk of body fat and less fat intake. There is a relation between body fat percentage and menstrual cycle disorders of female hockey athletes in East Jakarta region. There was no relation between fat intake and menstrual cycle disruption of female hockey athletes in East Jakarta.

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