Jurnal Gizi Indonesia
(The Indonesian Journal of Nutrition)

Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)
Vol. 8, No. 2, June 2020 (126-133)
Submitted: November 1, 2019, Accepted: May 6, 2020
Available online : https://ejournal.undip.ac.id/index.php/jgi/

Sugar-sweetened beverages as risk factor of central obesity among women in reproductive age

Nabila Rifka Annisa, Fillah Fithra Dieny*, Choirun Nissa, A. Fahmy Arif Tsani

ABSTRACT

Background: *Several risk factors for central obesity include high Sugar-sweetened Beverages (SSBs) intake, lack of physical activity, and lack of sleep duration. High fructose corn syrup, the sweetener used in SSBs, increase body weight because of the bad effect of insulin secretion and leptin release. The fructose from this beverage can increase visceral adiposity accumulation.*
Objectives: *This study aimed to analyze the intake of Sugar-sweetened Beverages (SSBs), physical activity, and sleep duration as risk factors for central obesity among women in the reproductive Age*
Methods: *This study used case-control design consists of 38Subjects in case and control groups. All women were in childbearing age (20-29 years) selected using a simple random sampling technique. The data taken were weight, height, waist circumference, and hip circumference. Food intake and sugar-sweetened beverage intake were obtained by using Semi-Quantitative Food Frequency (SQ-FFQ) questionnaire. Physical activity data were obtained using the International Physical Activity Questionnaire (IPAQ) questionnaire. Sleep duration data were obtained using the Pittsburgh Sleep Quality Index (PSQI). Chi-Square test and logistic regression were used to analyze the data.*
Results: *There were a significant relationship between Sugar Sweetened Beverages intake (p = 0.002, OR =5.926), energy intake of SSBs (p = 0.035, OR = 2.979) physical activity (p = 0.035, OR = 0.3111), duration of morning sleep / afternoon (p = 0.000; OR = 9.44) and sleep duration (p = 0.028, OR = 4.42) with central obesity. But there were no significant relationship between energy intake (p = 0.375), carbohydrates (p = 0.1), protein (p = 0.3), fat (p = 0.1) and fibers with central obesity.*
Conclusion: *High intake of sugar-sweetened beverages, short duration of night's sleep and the duration>2 hours/day of a long day sleep are risk factors for increasing the incidence of central obesity among Women in reproductive Age.*

Keyword: *sugar-sweetened beverages; physical activity; sleep duration; central obesity; reproductive age*

INTRODUCTION

Women of reproductive age (WRA) are women who are married or not married aged 15-49 years old. The peak of women's fertility is in the range of 20 – 29 years old. Womenofreproductive agewere categorized as early adults. In this age, women have 95% chance to be pregnant.[1] The frequent problem in reproductive women are POCS or polycysticovaries syndrome.[2] Endocrine disorder indicated with ovaries swelling with many cysts and irregular menstruation, infertilities, affect up to 18% of women in reproductive age. Central obesity increases the risk of polycysticovaries syndrome and contributes to anovulation through insulin resistance, hyperinsulinemia, and hyperadrogeremia.[3]

Obesity numbers in women tend to be higher than men.Indonesia's Riskesdas in 2013, state the prevalence of adult women (>18 years old) obese was 32,9% and adult men was 19,7% while central obesity was 26,6%. The prevalence of obesity in CentralJava's women was 21,7%.[4]Obesity that occurs during the planning stage of pregnancy disturbs metabolism and hormonal. The change can cause anovulation infertility and higher miscarriage risk.[5] Obesity on the woman in reproductive age can disturb pregnancy in the future, such as ovulation and placenta dysfunction. Obesity during pregnancy can cause various complications related to the metabolism disorder of glucose and lipid. Pregnant women with obesity tend to have a risk to have gestational diabetes and pre-eclampsia.[6]

Several risk factor which can cause central obesity on fertile women such as consuming sugar-sweetened beverages (SSBs)[7,8], lack of physical activity[9] and short duration of sleeping.[10] Female university students are a group of productive age categorizes as early adults. In their development, they need to balance nutrition intake to avoid various generative diseases impacted on productivity declining. In this phase women in fertile age can live independently, able to decide the food and beverage to consume. Universitystudent activities also affect physical activity and sleeping behavior. Beverage including SSBs is sweetening-added beverages such as soft drink, sports drink, fruit drink, energy drink, tea and coffee, milk, fruit juice, and isotonic beverage.[11,12] High fructose Corn syrup, the sweetener used in SSBs increases body weight because of the bad effect of insulin secretion and leptin release. The fructose from this beverage can increase adiposity visceral accumulation.[8]

Food overconsumption, if it is not compensated with physical activity can cause obesity. Lack of medium physical activity up to the heavy activity and sedentary behavior has proven to become an important risk factor of obesity. Lack of physical activity increases 1,2 times

Department of Nutrition Science, Faculty of Medicine, Universitas Diponegoro. Prof.Soedarto,SH.Street, Tembalang, Semarang, Jawa Tengah 50275, Indonesia.
* **Corresponding author** : E-mail: fillahdieny@gmail.com

e-ISSN : 2338-3119, p-ISSN: 1858-4942

of central obesity risk.[13] Regular physical activity or exercise decreases the fat in the body, even without decreasing body weight. This phenomenon happens because it can increase non-fat tissue mass.[14]

Several studies found that sleeping behavior has a contribution toward the increase of obesity prevalence particularly lack of sleep.[15] This is because the short duration of sleep leads to deficiency growth hormone-related to lipogenesis. Besides the short duration of sleeping also lead to an increase in food intake because of the lower increase of ghlerin level and decrease leptin level which stimulate hunger.[16] However, to the best of our knowledge, studies related to the risk factors of central obesity among women in reproductive age are still rare in Indonesia. This study aimed to analyze the intake of Sugar-sweetened Beverages (SSBs), physical activity, and sleep duration as risk factors for central obesity among women in the reproductive age.

MATERIALS AND METHODS

This study using a case-control design.It was conducted in March until May 2018 in 11 facultiesat Diponegoro University. The population target in this study was women aged 20-29 years old on Semarang; meanwhile, reached population was a Female University student aged 20-29 years old at Diponegoro University. The subject consists of 38 subjects in the case group and 38 in the control group. This study has been conducted based on Medical Research Ethics Commission of the Faculty of Medicine, Universitas Diponegoro and Kariadi General Hospital Number 137/EC/FK-RSDK/III/2018.

The subject was chosen from those who have central obesity for the case group and non-central obesity (normal) for the control group using simple random sampling. Screening conductedmeasurement of height by using microtoise with the accuracy of 0.1 cm, body weight was measured using a digital scale with the accuracy of 0.1 kg, and waist circumference was measured by using metlinribbon with the accuracy of 0.1 cm, the measurement of the hip circumference with the accuracy of 0.1cm. The inclusion criteria for both groups, including women aged 20-29 years old, had the willingness to contribute to this study by filling informed consent, did not smoke, did not consume alcohol. The case group had waist circumference ≥80 cm, WtHr ≥0.85, meanwhile, the control group had waistline <80 cm, WtHr<0.85.

The independent variable in this study was SSBs intake, physical activity, sleep duration, and the dependent variable is central obesity. Confounding variables in this study were energy, carbohydrate, fat, and protein, and fiber intake. SSBs and nutrition intake is the average daily intake from food and beverage using additional sugar (not packaged drink) and SSBs from packaged drink. Data SSBs was obtained through interview using Semi Quantitative-Food Frequency Questionnaire (SQ-FFQ). The result of SSBs intake express in gram and categorized as <50 gram/day and ≥50 gram/day[17]. Energy from SSBs intake categorized as high if it is ≥10% from total energy intake and normal if it is <10% from total energy intake.[18]Analysis of energy carbohydrate, fat, and protein intake using Nutrisurvey 2005 application. After being analyzed, compared to the need of each individual by using harris-benedict formula. Cut off point of fiber intake using fiber need based on energy need as 14 g/1000 kcal. Therefore the need for the subject was ± 28 g/day.[19] The level of macronutrient intake was divided into two categories those are over intake (>100 from individual need) and adequate (≤100% from individual need).[7] Meanwhile, the level of fiber intake was divided into two categories those were inadequate(<77% from the need) and normal (<77% from the need). Physical activity was obtained through an interview by using Long International Physical Activity Questionnaire (Long IPAQ) which was physical activity for the last seven days, including activity during working, transportation, family care, recreation, and physical exercise. Activity level was categorized base on IPAQ Scoring Protocol Long-form, in which physical activity score <900 MET-minute/week categorized as light physical activity, >900 MET -minute/week was categorized as adequate physical activity.[20] The sleeping duration was obtained by interview by using questioner PSQI (Pittsburgh Sleep Quality Index). The adequacy of the total duration of sleeping was categorized as low (<6 hours/day) and good (>6 hours/day).[10] Meanwhile, the adequacy of sleeping was categorized low if (<5 hours/day) and good (>5 hours/day).[21]

Bivariate analysis using chi-square test, and multivariate analysis using logistic regression test. Multivariate analysis was performed to determine the most significant risk of central obesity by using logistic regression.

RESULTS

Results of screening at 575 female university students aged 20-29 at Diponegoro University found that the prevalence of central obesity was 16%. After the inclusion criteria, a total of subjects involved up until the end of the study were 76 subjects consisting of 38 subjects in the case group and 38 subjects in the control group. The characteristics of research subjects can be seen in table 1.

Table 1. Subject Characteristics

Variable	Case			Control		
	Mean±SD	Minimum	Maximum	Mean±SD	Minimum	Maximum
Age (year)	20.6±0.1	20	22	20.7±0.1	20	22
Weight (kg)	65.4±2	47.3	107.3	47.5±0.5	43	57
BMI (kg/m^2)	27.1±0.8	20.8	43.8	20±0.1	18.6	22.3
Waist Circumference (cm)	89.9±1.3	80	116	70±0.63	59	79
Energy (kcal)	1900±78.6	1020	2804	1511±83.2	855	2706
Carbohydrate (g)	190.1±9.7	83.2	387.8	152.3±9.2	68.9	283.5
Fat (g)	88.5±10.6	46.4	447.8	65.3±3.8	31.1	119.6
Protein (g)	59.6±3.2	24.2	111.3	44.9±,27	15.7	92
Fiber (g)	8.8±0.5	2.8	18.1	6.5±0.5	2.5	14.4
SSBs* (g)	56.3±5.1	6.8	130.8	29.6±2.8	4.8	60.5
Energy SSBs(kcal)	225.2±20.6	27.1	525.3	119.9±11.3	19.3	244.7
Energy SSBs(%)	11.7±0.9	2	26	8.1±0.7	1	20
SSBs from Packaged drink(g)	34.6±3.6	1.9	95.3	13.86±1.6	1	37.6
SSBs from non packaged drink(g)	21.4±2.4	1	65.8	15±1.9	2.9	49.7
Physical activity (MetS)	1267.8±1.6	325	4200	1651.7±1.9	351	5316
Total sleep duration (hr/day)	6.8±0.2	3.5	9.29	7±0.2	4	10.3
Along day sleep duration (hr/day)	1.8±0.21	0	6	0.7±0.1	0	3.3
Night sleep duration (hr/day)	5.2±0.1	2.9	7.6	6.3	4	8

*Note: SSBs = *Sugar sweetened Beverages*

Table 2. Risk Factor of Central Obesity Among Women in Reproductive Age

Variable	Case		Control		*p*	OR (95%CI)
	n	%	n	%		
EnergyIntake						
Excessive	9	27.3	5	13.2	0.375^{ans}	0.488(0.147-1.624)
Adequate	29	76.3	33	86.8		
Carbohydrate Intake						
Excessive	1	2.6	0	0	0.1^{b,ns}	-
Adequate	37	97.4	38	100		
Fat Intake						
Excessive	27	71.1	19	50.0	0.1^{b,ns}	0.407(0.158-1.05)
Adequate	11	28.9	19	50.0		
Protein Intake						
Excessive	4	10.5	1	2.6	0.3^{b,ns}	0.23(0.024-2.158)
Adequate	34	89.5	37	97.4		
Fiber Intake						
Excessive	38	100	38	100	-	-
Adequate	0	0	0	0		
SSBs Intake(g)						
≥50g/day	20	52.6	6	15.8	0.002^{a,s}	5.926(2.013-17.44)
<50g/day	18	47.4	32	84.2		
EnergySSBs Intake(ccal)						
Execessive	22	57.9	12	31.6	0.038^{a,s}	2.979(1.164-7.622)
Normal	16	42.1	26	68.4		
Physical activity (METs)						
Inadequate	20	52.6	10	26.3	0.035^{a,s}	3.111(1.188-8.147)
Adequate	18	27.4	28	73.7		
Total sleep duration (hr)						
Inadequate	9	23.7	6	15.8	0.56^{a,ns}	1.525(0.525-5.221)
Adequate	29	76.3	32	84.2		
Along day sleep duration(hr)						
>2 hour	20	52.6	4	10.5	0.000^{a,s}	9.44(2.799-31.865)
<2 hour	18	47.4	34	89.5		
Night sleep duration (hr)						
Inadequate	13	34.2	4	10.5	0.028^{a,s}	4.42(1.287-15.181)
Adequate	25	65.8	34	89.5		

Note: [a]Continuity Correction ; [b]Fisher'sexaxt test[s]significant ; [ns]non significant

e-ISSN : 2338-3119, p-ISSN: 1858-4942

Table 1 shows the characteristics of the study subjects in both groups. The average BMI in the case group included the obesity type-I based on WHO. The average energy intake, protein, fat, carbohydrate, and fiber was higher in the case group compared to the control group. Fiber intake in both groups was lower than the recommendation that was 28 g / day. Fiber intake in the case and control group only fulfilled 31% and 23% of the requirement respectively. The average sugar-sweetened beverage intake was higher in the case group which was 56.3 g/day, which means it was ≥50g/day. Not only higher than normal limits, but the average percentage of intake of SSBs from total intake was> 10% total intake was also higher which was 11.7%. The maximum energy intake of SSBs in the case group was 525.3 kcal/day; it contributed to 23% of the total energy intake.

The average intake of SSBs packed and none packed was higher in the control group than in the case group. The mean physical activity was higher in the control group than in the case group. The mean total of sleep duration in both case and control groups ware good. However, the average night time sleeping duration in the case group was lower compared to the duration of the control group, while the mean duration napping was higher in the case group. This is because most subjects have short sleeping duration at night, and then continue to nap in the morning and afternoon.

Table 2 shows the results of the correlation analysis between variables with central obesity on women in fertile age. The percentage of categories of the adequacy of energy, carbohydrates, and protein intake in case and control groups were more in an adequate category. However, the category of adequate intake of fat in the control group as much as 71.1% of subjects was classified over intake, while in the control group as much as 50%. Category adequacy of fiber intake both case and control groups 100% of subjects were in the category of under the intake. The intake of SSBs in the 57.9% case group was high. The energy intake of SSBs was more than 52.6%. In the physical activity category in the case group as 52,6% subject had less physical activity. In the control group, the total sleeping duration was classified as low as 27.3%, while the duration of the night sleeping as 34.2%.

There were a significant correlation between SSBs intake (p = 0.002), energy intake of SSBs (p = 0.038), physical activity (p = 0.035), duration of napping/day (p = 0.000), night sleeping (p = 0.028) with obesity (≥10% of total energy intake) had a risk of central obesity of 2.979 times, while SSBs over the intake (> 50g/day) had a central factor of 5.926 times. The subjects who had lower physical activity and were napping > 2 hours had 3.111 risk and 9.44 times. The short duration of night sleeping was also a risk of increasing the prevalence of central obesity by 4.42 times. There were no correlation between energy, carbohydrates, protein, fat intake and total sleeping duration with central obesity in WRA.

Table 3. The Most Affecting Risk Factor to Central Obesity among Women in Reproductive Age

Variable	*p*	OR (95%CI)
SSBs intake	0.037	3.78 (1.08-13.21)
Energy SSBs intake	0.086	3.55 (0.83-15.13)
Physical activity	0.071	2.96 (0.91-9.64)
A long day sleep duration	0.002	8.88 (2.23-34.25)
Night sleep duration	0.017	5.71 (1.36-23.90)

Table 3 shows the results of multivariate analysis. The tested variable was only the variables with significant value p <0.05 on bivariate analysis. Factors were most affecting central obesity on women in reproductive age was SSBs intake (p = 0.037; OR = 3.78; 1.08 to 13.21) duration of napping/day (p = 0.002; OR = 8.88; 2.23-34.25) and night sleeping duration (p = 0.017; OR = 5.71; 1.36-23.90). Subjects who were consuming high SSBs were at risk 3.78 times. Whereas subjects who had a sleeping hour of hours > 2 hr / day were at risk of central obesity 8.88 times and subjects who had a short night sleeping duration) were approximately at risk of central obesity 5.71 times. WRA are likely to have central obesity if they consume high SSBs, SSBs energy, lack of physical activity, napping duration>2hr/day, and short night sleeping duration for 96%.

DISCUSSIONS

About 16% of female university students at Diponegoro University have central obesity based on waist circumference. This obesity prevalence is higher than the central obesity prevalence at UdayanaUniversity which is 14.5%[22], but it was lower than central obesity in Indonesia which is 26.6%.[4] Obesity occurs due to an imbalance of energy. Several factors cause central obesity, such as over intake of macronutrient and lack of intake of fiber, high intake of SSBs, lack of physical activity, and short duration of the night sleeping. In this study, the results show that there was a significant correlation between SSBs intake, physical activity, duration of night sleeping and napping with central obesity.

Average SSBs intake on the case group was 56,3 g/day, which was considered as high, in which packed SSBs intake is higher compare to non packed SSBs, which was 34.6 g/day. SSBs consumption was mostly from packed SSBs, tea, milk, fruit juice, coffee, isotonic, and soft drink, whichcontributes sugar as 18-46 g/ pack or equal to ±4 tablespoon of sugar. The high intake of packed SSBs is affected by several factors such as advertisement, distribution in the canteen or easily accessible minimarket and also the influence from peers.

There are certain effect from media toward food, such as food advertisement for instance discount, promo, and low price, buy one get one, discount for the credit card holder and give information/reference about new kind of food.[23,24]

However, a high intake of SSBs did not follow with a high carbohydrateintake of the subject, in which it was only found 2.6% of the subject has carbohydrate over intake. A subject who has adequate carbohydrate intake is mostly obtained from SSBs. Meanwhile, the suggested simple carbohydrate intake is limited to no more than 50 g/day or <10% of total energy intake. Energy intake from SSBs on the case group which is categorized as high (>10% of total energy intake) is 57.9%. Average SBBs intake on the case group contributes 11.7% of total energy. This is higher than survey data of NHCS on women aged 20-29 years old in the U.S. in 2011-2014 as 8.2% from total energy intake.[25]

A subject who has the SSBs intake and energy intake from SSBs categorized as high increase obesity prevalence 5.926 and 2.979 times. Energy comes from SSBs which is known in a form of liquid didn't give the feeling of being full compared to solid food, so that the individuals keep consuming a lot of food because they feel hungry which will lead someone to overeat.[26,27]The Excessive energy intake can increase body fat.[28] The increase in body fat can affect the increase of waist circumference. SSBs intake increases insulin concentration in circulation. High insulin postprandial level and also the lowest level of glycogen plasma will stimulate the intake of glucose into the cell and fatty acid decrease fat oxidation in muscle, adipose cell, and liver cell. It leads to the decrease of glucose and fatty acid in circulation ad stimulate the increase of hormone indicating hunger and make the consumer keep consuming food.[29] This phenomenon is following the study conducted in Iran in 2015 that high consumption of SSBs can increase central obesity risk as 35%.[8]

Physical inactivity is one of the factors of central obesity prevalence. 52,6% of subject of the case group was lacking physical activity. Physical activity in case group tends to be mild, it was because the habits of a subject which is lack of exercise, lack of walking, prefer to use a motor vehicle to go around even though the distance is not far. Modern life in the neighborhood, advance technology and various instant life styles lead to an inactive lifestyle, the energy which has to be allocated for physical activity is not needed anymore and will be stored as body fat which leads to obesity.[30]

Several studies started about the correlation between physical activity and central obesity. The study conducted in Iran and Padang.[31,32] Physical activity has a negative correlation with central obesity. The heavier the physical activity, the lower the risk of central obesity would be. In this case, it applied the energy balance concept. The excess energy is not used for an activity but will create stored body fat. Effective physical activity can reduce waist circumference, visceral fat, and subcutaneous fat.[33] Heavy physical activity leads to fat loss due to weight loss may lead to an increase in sympathetic tone, increasing lipolysis especially in abdominal fat. Lipolysis is a process in which chemical decomposition occurs and the removal of fat from fat tissue. When additional energy is required, lipolysis becomes an important process for the lypogenesis process resulting in significant fat loss, and associated with the removal of muscle mass.[34]

The lack of physical activity is also indirectly related to the duration of a lack of night's sleep. Those lacking in sports activities will trigger a person to be difficult to enter into the depths of deep sleep or sleep depth. Also, someone who used to exercise will be easier to sleep. This is also due to the fatigue that they usually feel after exercising.[35]The short night sleeping duration is also associated with an increased prevalence of central obesity. The increased prevalence of obesity in adults occurs along with a decrease in the average sleep duration of the population.

A total of 34.2% of subjects in the case group had a short duration of sleep. This is lower than studies conducted in Aceh that is like 55% of obese people experience a short duration of sleeping.[36] There is an inverse relationship between sleep duration and the measurement of central obesity. An increase in 1 hour of sleep duration was associated with a decrease of 1.24 cm in waist circumference. There was a significant relationship between the duration of night sleep and central obesity. This is in line with a study conducted on women in Iran[37]

Increased intake and decreased energy expenditure due to the short duration of night sleeping, related to changes in levels of various hormones, one of which is leptin. Leptin plays a role in the regulation of energy balance so that changes in leptin levels in the body affect intake and energy expenditure acutely. Increased energy intake due to the short duration of night sleeping can occur through several mechanisms. First, fewer sleep durations have implications for longer working hours. This increases a person's chance to eat food. In addition, a person's biological mechanism may change from having a short duration of sleep. Increased calorie intake and excessive appetite can be explained by an increase in ghrelin levels in blood plasma after a person passes through the insufficient duration of sleeping.[21,37]

If someone is usually active until late at night, they will tend to wake up later or not be able to wake up early.[35]In the case group the subject is classified by the duration of the morning/afternoon is more by 53.6%. According to the National Sleep Foundation in America, more than a third (36%) of young adults ages 18-29 reported having difficulty getting up early (compared to

e-ISSN : 2338-3119, p-ISSN: 1858-4942

20% at age 30-64 years and 9% over 65 years). Nearly a quarter of young adults (22%) are often late to class or work because of difficulty getting up (compared to 11% in workers aged 30-64 years and 5% over age 65). Forty percent of young adults also complain of drowsiness at work 2 days a week or more (compared to 23 percent at age 30-64 and 19 percent over age 65).[38]

The duration of a nap that is related to a sedentary lifestyle. Sedentary lifestyle is one of the activities of light physical activity, such as sleeping. Physical activity affects only one-third of a person's energy expenditure with normal weight, but for people who have overweight physical activity has a very important role. At the time of exercise, it burns calories. The more exercise, the more calories are lost to the body's metabolism and energy expenditure. Calories indirectly affect the basal metabolic system. People who sit all day will decrease in basal metabolism. This is due to a less mobile lifestyle that makes fat accumulation in the body and is not released as energy.[39]

The study also showed no significant correlation between energy intakes, carbohydrates, fat, fiber and the total duration of sleep with central obesity. The results of this study are not in line with a study conducted in Padang which states that energy intake, carbohydrates, proteins, and fats are associated with central obesity.[32]In the case and control subjects average macronutrient intake is not too different. This is due to a diet in both groups of subjects the same. Roommates, college friends, close friends, and classmates affect the choice of food intake.Students tend to eat foods that are easy to find around their environment so often they eat fried food or practical food on the sidelines of their activities. Habits such as leaving breakfast, the lack of frequent meals in a day, the lack of frequent eating vegetables and fruits and lack of energy intake in a day are still found in many students. This is in line with research on students in Europe and Bangladesh.[24]

Another cause is that most students live alone (live in boarding house). It is assumed that a person who lives in a board pursues his food, Mostly by buying at a food stall. This is different from those who stay at home because it is assumed that staying at home with family members. So the quality and quantity of intake more controlled, in variation and availability is also sufficient.[24]

While in fiber intake all subjects in both groups were less. This happens because almost all respondents consume fiberless than 28 grams per day. Therefore, the statistical test is not able to show a difference in the proportion of central obesity events in the group of respondents who consume fiber insufficient and sufficient. It was because central obese and non-obese groups have a low fiber intake. This is due to the lack of frequent eating of vegetables and fruits. When they consume vegetables they eat it in only a small portion.

CONCLUSION

The case group had an average variable of SSBs intake, sugar-sweetened beverage energy intake, napping duration was higher than the control group. Physical activity and sleeping duration were lower in the case group than in the control group.SSBs intake was ≥ 50 g/hr, SSBs energy intake was> 10% total energy intake, physical activity, more napping duration, and less nigh sleeping duration are risk factors for central obesity. The most significant risk factors for central obesity on the woman with reproductive ageare sleeping duration, napping duration, and SSBs intake.

The risk of central obesity among woman in reproductive age can be controlled by limiting the consumption of sugar intake from beverages and foods maximum of ≥ 50 g/hr, performing physical activity by routinely performing daily activities plus physical or sport activities at least 1 time a week for 1 hour or 3 times a week for 20-30 minutes of activity, as well as having enough sleeping time > 5 hours at night to lower the risk of central obesity.

ACKNOWLEDGMENTS

This research was funded by the Research and Development Grants from the Faculty of Medicine, Universitas Diponegoro, 2019.

REFERENCES

1. Brown JE, Issacs JS, Krinke UB, Lechtenberg E, Murtaugh MA, Sharbaugh C.,Wooldrodge NH. Nutrition Through The Life Cycle. Wadsworth Belmont; 2011.
2. Kulie T, Slattengren A, Redmer J, Counts H, Eglash A & Schrager S. Obesity and women's health: an evidence-based review. The Journal of the American Board of Family Medicine. 2011;24(1):75-85.
3. Messinis IE, Messini CI, Anifandis G & Dafopoulos K. Polycystic ovaries and obesity. Best Pract Res Clin Obstet Gynaecol. 2015;29(4):479-88.
4. Pusat Penelitian dan Pengembangan Kesehatan. Riset Kesehatan Dasar Tahun 2013. Jakarta: 2013
5. Best Start Resource Centre. Obesity in Preconception and Pregnancy. Canada; 2013. 12-4 p.
6. Galtier-Dereure F, Boegnera C, & Bringer J. Obesity and pregnancy: complications and cost. Am J Clin Nutr. 2007;71:1242-8.
7. Diana R, Yuliana I, Yasmin G & Hardinsyah. Risk factors of overweight among Indonesian women. Jurnal Gizi dan Pangan. 2013;8(1):1-8.
8. Mirmiran P, Ejtahed HS, Bahadoran Z, Bastan S & Azizi F. Sugar-sweetened beverage consumption and risk of general and abdominal obesity in iranian

adults: tehran lipid and glucose study. Iran J Public Health. 2015;44(11):1535-43.
9. Sudikno, Syarief H, Dwiriani CM & Riyadi H. Risk factors of central obesity in adults age 25-65 years in indonesia (basic health research data analysis 2013). Penelitian Gizi dan Makanan. 2015;38(2):111-20.
10. Theorell-Haglöw J, Berne C, Janson C, Sahlin C & Lindberg E. Associations between short sleep duration and central obesity in women. Sleep. 2010;33(5):593-8.
11. Centers for Disease Control and Prevention. The CDC Guide to Strategies for Reducing the Consumption of Sugar-Sweetened Beverages. 2010.
12. Malik VS, Schulze MB & Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr. 2006;84(2):274-88.
13. Sugianti E, Hardinsyah & Afriansyah N. Faktor risiko obesitas sentral pada orang dewasa di DKI Jakarta : analisis lanjut data RISKESDAS 2007. Gizi Indon. 2009;32(2):105-16.
14. Koh-Banerjee P, Chu, NF, Spiegelmen D, Rosner B, Colditz G, Willett W & Rimm E. Prospective study of the association of changes in dietary intake, physical activity, alcohol consumption, and smoking with 9-y gain in waist circumference among 16 587 US men. Am J Clin Nutr .2003;78(4):719-27.
15. Gradisar M, Gardner G & Dohnt H. Recent worldwide sleep patterns and problems during adolescence: A review and meta- analysis of age, region, and sleep. Sleep Med. 2011;12(2):110-8.
16. Morselli LL, Guyon A & Spiegel K. Sleep and metabolic function. Pflugers Arch. 2012;463(1):139-60.
17. Kementrian Kesehatan Republik Indonesia. Permenkes No. 30 Tahun 2013 Tentang pencantuman informasi kandungan gula garam dan lemak serta pesan kesehatan untuk pangan olahan dan pangan siap saji. Jakarta; 2013.
18. World Health Organisation. Guideline*:* Sugars Intake for adults and children. Geneva; 2015.
19. Nelms MN, Sucher K, Roth SL, Habash D, Nelms RG, Frazier CL, et al. Nutrition Therapy and Pathophysiology. California Wadsworth; 2011.
20. Cassidy S, Chau JY, Catt M, Bauman A & Trenell MI. Low physical activity, high television viewing and poor sleep duration cluster in overweight and obese adults; a cross-sectional study of 398,984 participants from the UK Biobank. Int J Behav Nutr Phys Act. 2017;14(57):1-10.
21. Safitri D& Sudiarti T. Perbedaan durasi tidur malam pada orang dewasa obesitas dan non obesitas : metaanalisis studi cross sectional 2005-2012. Penelitian Gizi dan Makanan. 2015;38(2):121-32.
22. Dini MAR, Widianti IGA & Wardana ING. Prevalensi obesitas dengan menggunakan metode waist-hip ratio pada mahasiswa program studi pendidikan dokter fakultas kedokteran universitas udayana angkatan 2014. Bali Anatomy Journal. 2018;1(1):9-11.
23. Bray GA & Bouchard C. Handbook of Obesity Epidemiology, Etiology, and Physiopthology (Vol. 1). USA: CRC Press. 2014.
24. Deliens T, Clarys P, De Bourdeaudhuij l & Deforche B. Determinants of eating behaviour in university students: a qualitative study using focus group discussions. BMC Public Health. 2014;14(53):9-11.
25. Rosinger A, Herrick K, Gahche J & Park S. Sugar-sweetened beverage consumption among U.S. adults, 2011–2014. NCHS Data Brief. 2017; 270:1-8.
26. Chan TF, Lin WT, Huang HL, Lee CY, Wu PW, Chiu YW, et al. Consumption of sugar-sweetened beverages is associated with components of the metabolic syndrome in adolescents Nutrients. 2014;6:2088-103.
27. Olsen NJ, Andersen LB, Wedderkopp N, Kristensen PL, Heitmann, BL. Intake of liquid and solid sucrose in relation to changes in body fatness over 6 years among 8- to 10-year-old children: the european youth heart study: the european youth heart study. Obesity Facts. 2012;5:506-12.
28. Pereira MA. Sugar-sweetened and artificially-sweetened beverages in relation to obesity risk. Adv Nutr. 2014; 5(6):797-803.
29. Mcmillan J & Brand-Miller JC. Low-glycaemic index diets and body weight regulation. International Journal Obesity. 2006;30:S40-6.
30. Deliens T, Deforche B, De Bourdeaudhuij I & Clarys P. Determinants of physical activity and sedentary behaviour in university students: a qualitative study using focus group discussions. BMC Public Health. 2015;15(201).
31. Hajian- Tilaki KO & Heidari B. Prevalence of obesity, central obesity and the associated factors in urban population aged 20-70 years, in the north of Iran: a population-based study and regression approach. Obes Rev. 2007;8(1):3-10.
32. Trisna I & Hamid S. Faktor-faktor yang berhubungan dengan obesitas sentral pada wanita dewasa (30-50 Tahun) di kecamatan Lubuk Sikaping tahun 2008. Andalas Journal of Public Health. 2009;3(2):68-71.
33. Ross R, Janssen I, Dawson J, Kungl AM, Kuk JL, Nguyen-Duy TB, et al. Exercise-induced reduction in obesity and insulin resistance in women: a randomized controlled trial. Obes Res. 2004;12(5):789-98.
34. Strasser B. Physical activity in obesity and metabolic syndrome. Ann N Y Acad Sci. 2013;1281(1);141-59.
35. Wunsch K, Kasten N & Fuchs R. The effect of physical activity on sleep quality, well-being, and

e-ISSN : 2338-3119, p-ISSN: 1858-4942

affect in academic stress periods. Nat Sci Sleep. 2017;9:117-26.
36. Ramadhaniah, Julia M & Huriyati E. Durasi tidur, asupan energi dan aktivitas fisik dengan kejadian obesitas pada tenaga kesehatan puskesmas. Jurnal Gizi Klinik Indonesia. 2014;11(2):85-96
37. Najafian J, Mohammadifard N, Siadat ZD, Sadri G, Ramazani M & Nouri F. Association between sleep duration and body mass index and waist circumference. Iran Journal Medical Science. 2010;35(2);140-44.
38. Gradisar M, Wolfson AR, Harvey AG, Hale L, Rosenberg R & Czeisler CA. The sleep and technology use of americans: findings from the national sleep foundation's 2011 sleep in America Poll. J Clin Sleep Med. 2013;9(12):1291-9.
39. Mandriyarini R, Sulchan M & Nissa C. Sedentary lifestyle sebagai faktor risiko kejadian obesitas pada remaja SMA stunted di Kota Semarang. Journal of Nutrition College. 2017;6(2):149-55.