Unnes Journal of Public Health 12 (1) (2023)

Unnes Journal of Public Health

http://journal.unnes.ac.id/sju/index.php/ujph

The Factors Affecting the Occurrence of Obesity in College Students

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Article Info

Article History:
Submitted April 2022
Accepted January 2023
Published January 2023

Keywords:
Obesity; College Students; High Snack Consumption; Inadequate Physical Activity; Smoking

DOI
https://doi.org/10.15294/ujph.v12i1.56013

Abstract

Obesity is a risk factor for many non-communicable diseases, a finding that provides insight into the preventable morbidity, disability, and death by reducing body mass index. The risk factors of non-communicable diseases attributable to obesity are diabetes (ca. 10%), hypertension (ca. 6%), heart disease (ca. 16%), cerebrovascular diseases (ca. 10%), and cancer (ca. 15%). College students are among the people with high risk of obesity. This review aims to identify and describe factors that can cause obesity and the increased risk of non-communicable diseases in college students. We first collected 608 studies associated with the review and then selected 9 studies that highly correlate to the specific purpose. We evaluated each selected study for its quality and risk of bias using STROBE. We then conducted data extraction of each study. It can be concluded from the results of data extraction that even though there are various factors contributing to the occurrence of obesity in college students, skipping breakfast and high snack consumption have a close relationship with the occurrence. In addition, inadequate physical activity and high calorie diet also contribute to its occurrence. Finally, smoking is also associated with the occurrence of obesity.

INTRODUCTION

Obesity is an increase and accumulation of fat cells in excess within the body. Obesity can be caused by an imbalance between the intake and use of energy, drugs, lifestyle, and environmental influences. Obesity is a condition that causes complications such as high blood pressure, atherosclerosis, heart disease, diabetes, high blood cholesterol, cancer and sleep disorders (Garaulet et al., 2006). The rate of obesity is increasing progressively during the the last several decades, and now obesity is one of the leading causes of death globally (Rakhra et al., 2020). Approximately 3.4 million adults die each year due to obesity or overweight history. An increase in body mass index can be a risk factor for non-communicable diseases (Kurdanti et al., 2015).

The data from the World Health Organization (WHO) show that in 2016, more than 1.9 billion adults aged 18 years and over were overweight. Among these numbers, more than 650 million adults were obese. Overal, in 2016 around 13% of the world's adult population was obese (WHO, 2021). Meanwhile, it is reported

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Open Access
pISSN 2252-6781
eISSN 2548-7604

that during four years of college in 2017 the percentage of students overweight or obese increased from 23% to 41% – a 78% increase (Pope, Hansen and Harvey, 2017). Center for Disease Control reported that the prevalence of obesity in the United States was 42.4% in 2017, increased from 30.5% in 1999. Obesity is reported to be a common, serious, and expensive chronic disease of adults that is increasing in the United States and affects overal health, the costs of health care, and productivity (CDC, 2021).

In Indonesia, the prevalence of obesity is increasing from year to year. Study in 12 districts in Indonesia showed a prevalence of obesity was 13.6 percent in adults (> 18 years) in 2018, higher than in 2013 (11.5%) and in 2007 (8.6%) (Badan Penelitian dan Pengembangan Kesehatan, 2019).

Sudikno et al. reported that according to WHO, the increase of body mass index (BMI) in obesity is in line with health risks: low risk (BMI <18.5 kg/m2), moderate risk (BMI 18.5-24.9 kg/m2), high risk (BMI 25.0-29.9 kg/m2), moderate severe risk (BMI 30.0-34.9 kg/m2), severe risk (BMI BMI 35.0-39.9 kg/m2), and very heavy risk (BMI 40 kg/m2 or more), and their study showed that gender and age group variables control the obesity in adults (Sudikno et al., 2020). Obesity was found to be a risk factor for the development of many non-communicable diseases such as type 2 diabetes, asthma, hypertension, stroke, coronary artery disease, cancer, sleep apnea, osteoarthritis, and gynecological complications (Riquelme et al., 2021)(Zato□ska et al., 2021). Furthermore, it is also reported that having obesity can put people at risk for severe illness from COVID-19 (CDC, 2021). The main risk factor of non-communicable diseases attributable to obesity is diabetes. Women with a BMI of 30 kg/m2 have a 28-fold greater risk of developing diabetes than do women of normal weight, The risk for BMI of 35 kg/m2 is 93-fold greater (Barnes and Coulter, 2011). The presence of diabetes can in turn increase the risk hypertension around 70%. Hypertension is confirmed as a major risk factor for cardiovascular disease, and the disease is the most prevalent cause of morbidity and mortality in diabetic patients (Naseri, Esmat and Bahee, 2022). In the Caribbean region, it is reported that obesity-related diseases are among the leading causes of death including diabetes (10%), hypertension (6%), heart disease (16%), cerebrovascular diseases (10%), and cancer (15%) (Wright et al., 2015).

Similarly, it has also been reported that heart disease mortality and morbidity have been shown to increase in overweight individuals, especially with central deposition of adipose tissue (Akil Luma, 2021). The Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration, which combines 97 studies with research locations throughout the world, also proves that obesity has a significant association with coronary heart disease. This study resulted in a pooled relative risk (RR) of 1.69 (95% confidence interval (CI) 1.58-1.81) (Ghani, Susilawati and Novriani, 2016). The young adult age group (18- to 35-year old) is a group that has largely been ignored as a group at high risk for obesity (Lanoye, Gorin and Larose, 2016). In young adulthood, there are a lot of college students whose lifestyle patterns have begun to be physically inactive (Wright et al., 2015).

College students have a high risk, around 41%, of becoming obese as reported by Journal of Nutrition Education and Behavior in 2017 (Pope, Hansen and Harvey, 2017). Campus or college life is generally associated with decreased physical activity, increased stress, and consuming unhealthy foods, such as soft drinks, sugary foods, fried foods, processed foods, and skipping breakfast. So, these are several factors that might support the increased fat in the body (Tapera et al., 2017).

There have been previous systematic studies that are similar to the current systematic study, but either they use different research subjects, i.e. teenagers aged 11-18 or the studies are limited in certain colleges/countries (Narciso et al., 2019). In this systematic study, we conducted a study on the factors affecting the occurrence of obesity in college students at broader scope across countries. By knowing the risk factors, the obesity in college students can be prevented in order to reduce the risk of obesity-related diseases in the future. This study will benefit the government, society, and specifically colleges that all are expected to participate in reducing the risk of obesity in college students by considering the relevant factors described in the results of this project, i.e. by setting-up healthy lifestyle in the campus, for example, controlling the food types sold in canteen and increasing physical activity inside the campus.

METHOD

The articles taken as references in this project are the recent literatures, mostly from 2015 to 2022, and only two are from the year before 2015. The studies in the articles were conducted in various countries: in Indonesia, Asia, Middle East, Africa, Europe, and America countries. The criteria of research in the literatures included in

this review are studies with college student participants aged ≥ 18-year old with obesity, with obesity diagnosed, with risk factors for obesity, and using cross-sectional study design.

We then reviewed the articles that have been selected. The data to be extracted from the literatures were author's name, title, year of publication, research location, type of study, number of participants, age, research subjects, prevalence of obesity in several colleges. To assure good quality of literatures, we used the 'Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)' guide which aims to provide guidance for author in assessing the quality of the literatures to be included and reported in a systematic review.

RESULT AND DISCUSION

There were 608 articles taken from the various recent literatures, mostly from 2015 to 2022, related to epidemiology. Several duplicate studies were excluded (n = 181). To select the relevant studies to be included in this review, a two-step process was used. The first step was filtering the information from the title and the abstract. The second step was assessing the abstract content of the chosen literatures.

Subsequently, the full text articles were evaluated based on the established criteria. We used the flow diagram of study in the systematic review phase by Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (Figure 1). First, the identification process was conducted and the duplicates were removed. Then, records were screened and the irrelevances were excluded. Next, the full text articles were assessed for eligibility and the irrelevant full text articles were removed. The final process was selection of studies to be included for review.

At the end of the selection process, 9 articles were selected to be put into the literature data extraction table (Table 1).

Obesity is one of the important public health concerns associated with numerous negative health consequences (Jakicic et al., 2018). Reviewing the studies that fulfil the established criteria by PRISMA and following literature data extraction, there are 6 important variables accounting for obesity and an increased risk of heart disease in college students, i.e. frequently skipping breakfast, snack consumption, lack of physical activity, family history, smoking status, and upper level in academic years at colleges.

Skipping breakfast is associated with an increased risk of overweight or obesity because passing breakfast will result in higher appetite

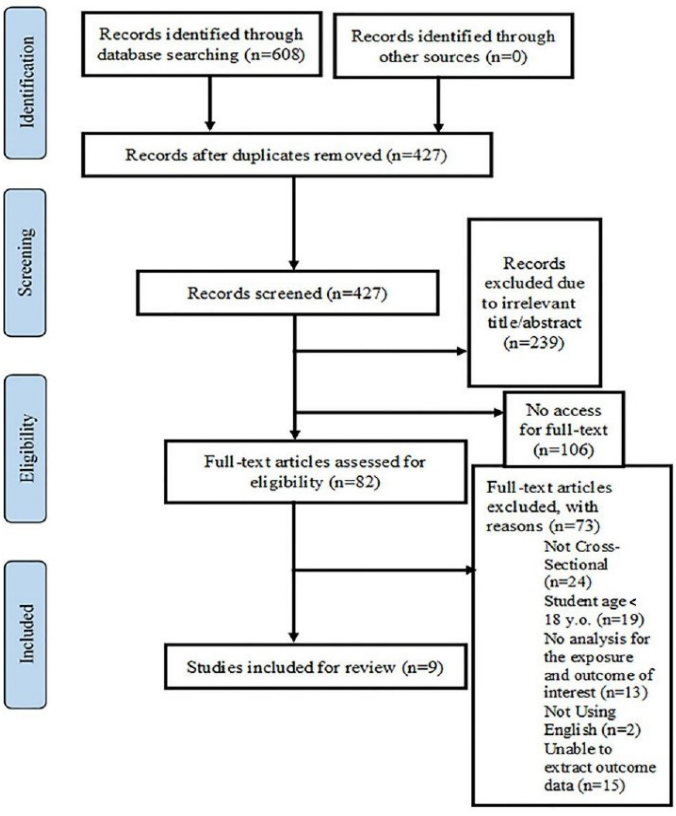

Figure 1. PRISMA flow diagram of study used in the selection process

Table 1. Extraction of Literature Data

Author	Location	Sample Size			Mean Age	Variables													
						Gender		Food Consumption				Physical Activity		Family History		Smoking Status		Year of Study	
		Female	Male	Total		% Female	% Male	Breakfast		Snacks									
								95% CI	p-value	95% CI	p-value	95% CI	p-value	95% CI	p-value	95% CI	p-value	95% CI	p-value
El- Kassas. et al, (2015)	Arab	252	245	497	21.5	17.1	36.3	0.55 (0.31, 0.96)	-	0.85 (0.56, 1.28)	-	0.84 (0.48, 1.47)	-	1.19 (0.69, 2.07)	-	1.58 (0.85, 2.95)	-	1.13 (0.10, 12.89)	-
C. Ruano. et al, (2018)	Ecuador	559	324	883	21.5	23.3	29.3	-	-	-	-	-	0.000	-	-	-	0.001	-	-
Olatona . et al, (2018)	Nigeria	275	228	503	21.5	3.3	3.0	-	0.927	-	0.52	-	-	-	0.127	-	-	-	-
Gaviria . et al, (2018)	Colombia	127	44	171	22.0	7.9	6.8	-	-	-	-	-	0.999	6.65 (2.33,	0.018	-	0.171	-	0.585
Jiang. et al, (2019)	China	692	528		22.0	2.2	5.3	-	-	2.02 (1.78, 5.46)	0.02	1.99 (1.26, 4.68)	0.040	-		-	-	1.61 (1.12, 2.27)	
Tapera. et al, (2017)	Africa	117	85	202	24.0	34.2	40.0	-	-	-	-	0.40 (0.39, 0.78)	0.019	1.50 (0.50, 3.32)	0.445	-	-	1.60 (1.09, 3.99)	
Damiri. et al, (2017)	Palestine	498	352	850	21.0	17.9	7.4	-	-	-	-	-	0.726	-	-	-	0.975	-	-
Rimarova. et al, (2018)	Slovakia	207	157	364	23.5	10.1	22.3	-	-	1.05 (0.58, 1.89)	n.s	1.56 (0.87, 2.77)	n.s	-	-	3.66 (1.80, 7.42)		-	-
Wright. et al, (2019)	United States of America (Grenada, Jamaica, Barbados)	211	89	300	24.0	12.8	10.2	1.07 (0.43, 2.64)	-	0.94	-	1.16 (0.89, 1.51)	-	-	-	-	-	1.45 (1.15, 1.84)	-
		534	167	701	24.0	9.85	5.4	1,31 (0.86, 1.98)	-	0.94	-	1.16 (0.89, 1.51)	-	-	-	-	-	1.45 (1.15, 1.84)	-
		247	330	577	24.0	18.3	12.5	2.65 (1.32, 5.30)	-	0.94	-	1.16 (0.89, 1.51)	-	-	-	-	-	1.45 (1.15, 1.84)	-

during the day. There will be high calorie intake as a compensation. A study at Tripoli campus in 2014 showed that there is a significant relationship (odds ratio (OR): 0.531, 95% CI: 0.299, 0.941) between breakfast consumption, healthy food choices, lifestyle and prevention of obesity in college students with a mean age of 20.1 ± 1.7 years. In addition, it was also reported that 26.6% of the college students were overweight or obese. Males (67.4%) were more obese than females (32.6%). More than three fourths of college students (76.8%) informed that they took meal irregularly and had unhealthy eating habits such as frequently eat fast food and low consumption of vegetables and fruits. Regular breakfast was reported as a protective factor against the progression of obesity in college students (El-Kassas, Itani, 2015).

The high snack consumption is closely related to obesity. Consuming snacks, especially those with high content of sugar and fat, is an important factor causing weight gain and obesity.

Rakhra et al. (2020) reported that although current information on lifestyle frequently emphasizes the importance of eating healthy foods, people continue to consume foods high in fat, sugar, and sodium as major components in the Western diet. This correlated with the constant increase in obesity. Hence, the management of obesity becomes an important issue with many people now acknowledging that modification of diet would have the biggest influence (Rakhra et al., 2020). The sugars and saturated fats consumed should only contribute lower than 10% of the daily calorie intake, meanwhile for daily sodium intake should be lower than 2.3 g (DeSalvo, Olson and Casavale, 2016). A healthy diet should contain vegetables, fruits, whole grains, and low-dairy-fat or fat-free dairy (Odphp, 2015). Eating healthy diet could result in weight loss and reduce the risk of cardiovascular diseases (Rakhra et al., 2020). The suggested daily intake of calories will depend on an individual age, gender, and level of physical activity. Weight gain in the form of adipose tissue deposition will take place when greater calories are consumed than the energy expended (Rakhra et al., 2020). However, some studies did not see a significant relationship between the frequency of eating snacks and the risk of obesity (El-Kassas, Itani, 2015)(Wright et al., 2015), because the provided information is uncertain, i.e. their questionnaires did not explain the type and quantity of snacks consumed.

Physical activity is a concerned lifestyle contributing to body weight regulation. It is believed that physical activity contributes to long-term weight loss when coupled with healthy diet, and it also prevents weight gain. It was reported in current evidence that moderate to active physical activity is connected to the body weight regulation (Jakicic et al., 2018), meanwhile low intensity physical activity does not appear to be connected with the decrease of BMI in obesity. Therefore, inadequate physical activity is associated with obesity. While the incidence of obesity and overweight may require effective treatments for weight loss, implementing strategy to prevent weight gain might be helpful to regulate BMI. Hence, the physical activity should be managed for the prevention as well as treatment of obesity and overweight (Jakicic et al., 2018). It was reported that the prevalence of inadequate physical activity among the college students studied in Beirut Arab University was 44%, in females are higher than in males (55% as compared to 32%). Someone whose life is less active (sedentary life) or someone who does not have a balanced physical activity and consumption of high-fat food, will tend to be obese and it is closely related to the risk of heart disease. Some authors did not find a clear relationship between physical activity and obesity (El-Kassas, Itani, 2015)(Damiri et al., 2018)(Rimárová et al., 2018)(Jiang et al., 2019). However, if the inadequate physical activity is accompanied with consumption of high calorie food, this condition is closely associated with the occurrence of obesity (Ruano et al., 2018). On the other hand, when sufficient physical activity is combined with dietary modification strategy that decreases calorie intake, it will result in greater weight loss than what can be achieved by dietary modification alone (Jakicic et al., 2018). Moreover, physical activity is reported to have a close relationship with the prevention of heart disease in obesity (Wright et al., 2015)(El-Kassas, Itani, 2015)(Damiri et al., 2018)(Jiang et al., 2019)(Rimárová et al., 2018)(Ruano et al., 2018).

Empirically, having a family history with obesity can be associated with a risk of obesity. People having a previous history of obesity among family members were comparatively more obese than those without such history. They were identified as possessing much closer association with increased levels of adipose tissue measured by various physical and physiological variables as well as pathological manifestation (Garg Mangla et al., 2019). In Iranian population, it was reported that an increase in BMI decreases the year of life for obese people without diabetes (Ramezankhani et al., 2022). Whereas in general, El-Kassas et al., (2015), Olatona et al., (2018), and Tapera et al., (2017) stated that family history does not have a significant relationship with the risk of obesity. The study from Alberto et al., (2018) reported that a family history with obesity is still related to the risk of obesity in college students.

Various findings showed the relationship between smoking and obesity however, their relationship is not compeletely comprehensible. Indonesia has the greatest burden of smoking in the world. The estimate prevalence of Indonesian adult male smokers is projected to increase from 56.2% in 2000 to 87.2% in 2025. This condition is worsened with the growing burden of obesity. Ministry of health of Republic Indonesia informed that 35.4% of Indonesian adults are overweight and obese according to the 2018 Indonesia National Health Survey (Badan Penelitian dan Pengembangan Kesehatan, 2019). In Indonesia, it was reported that heavy smokers possess a higher risk of obesity than mild smokers. Despite the increase of public awareness regarding the hazards of smoking, many smokers encounter difficulty in quitting smoking. Addiction is the

major problem for smokers failing to quit smoking. Moreover, in several communities smoking has become a part of social life (Dare, Mackay and Pell, 2015)(Nawawi et al., 2020). Smoking has been associated with obesity and specifically with the risk of cancer, coronary heart disease and other chronic non-communicable diseases, which contributes to greater than 7 millions deaths annually in the world (Di Angelantonio et al., 2016)(WHO, 2015). Cigarettes contain nicotine, carbon dioxide and other ingredients that can damage the walls of blood vessels, facilitate blood clotting so that they can damage peripheral blood vessels. Nicotine content can lead to insulin resistance and fat accumulation. There are 2 corresponding studies of Rimarova et al., (2018) and Alberto et al., (2017) which state that smoking is closely related to the occurrence of obesity. Two other studies from El-Kassas et al., (2015) and Damiri et al., (2017) explain that there is no significant relationship between smoking and the occurrence of obesity, however smoking has a strong relationship with the occurrence of heart disease.

Academic years at college is also associated with the increasing risk of developing obesity. It has a relationship with increased age. The obesity prevalence increases constantly among older age groups. The increase in age could be connected with an increase in abdominal obesity which is a major contribution to insulin resistance and the metabolic syndrome. Another important aspect is that with increasing age people have a tendency to become less active, which contributes to the decreased total energy expenditure and hence increases adipose tissue deposition (Jura and Kozak, 2016). It is stated that the prevalence of obesity in upper-level college students (levels 3 and 4) is higher than those at lower levels (levels 1 and 2) (Wright et al., 2015)(Tapera et al., 2017) (Jiang et al., 2019).

This systematic study will specifically benefit the students in the sense that they can participate in reducing the risk of obesity among them by considering the relevant factors described in the results of this project, i.e. by not skipping the breakfast, avoid consuming too many snacks, increasing physical activity, and avoid smoking.

CONCLUSION

This systematic review shows that the eating patterns, i.e. skipping breakfast and high snack consumption, have a close relationship with the risk of obesity in college students. In addition, inadequate physical activity (sedentary life) accompanied by high calorie diet, i.e. high-sugar and high-fat, has a significant relationship with the risk of obesity in college students and the risk of heart disease. Moreover, smoking is closely related to the risk of obesity and specifically the risk of heart disease. The academic year at college related with increasing age is also associated with the increased risk of obesity. Hence the colleges are expected to participate in reducing the risk of obesity in college students by taking into account the relevant factors described in the results of this study when setting-up healthy lifestyle in the campus.

ACKNOWLEDGEMENT

We acknowledge University of Surabaya (Ubaya), Surabaya, Indonesia for facilitating us to conduct this study. This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST

There is no conflict of interest to declare in this study.

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