Factors Associated with Obesity in Adults in South East Asia

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Abstract: *Obesity is defined as an abnormal condition with excess fat which is a risk to health. There is a risk of diseases caused by obesity such as type 2 diabetes for adolescents, coronary heart disease, stroke, myocardial infarction, cancer, and even failure to breathe normally while sleeping. The purpose of this research literature is to find factors that are strongly associated with obesity in adults in south east Asia. The literature search strategy identified 647 articles. The PRISMA strategy was used to identify various articles through a database of publications: Scopus, Direct Science, ProQuest, and Springer link. Search keywords used were "Obesity" and "Adult", and articles had to focus on "East Asia" according to the inclusion criteria. Inclusion criteria are 5-year journal limits (2015-2020), document type articles, English language, journals that allow full-text form to be retrieved. Rough calculation of the prevalence of obesity in adults aged 18 years and over in ASEAN countries shows the following levels: Indonesia 28%, Cambodia 50.20%, Laos 20.9% Class I or Class II Obesity, Malaysia 15.4%, Myanmar 8.4%, Singapore 44.1%, Thailand 12.7%, Vietnam 2.53%, Brunei Darussalam 29.5%. In all ASEAN countries rates of obesity are more prevalent in women. Obesity is a health problem in Southeast Asia which can be seen from the increasing prevalence of obesity from year to year in Southeast Asia. In general, the factors that can cause obesity are, sex, age, level of education, physical activity, marital status, history of obesity during childhood, genetics, stress, alcohol consumption and smoking habits, consumption patterns, residence, economic status, sleep habits, culture, social media, and influence of friends.*

Keywords --- *Obesity, adults, Southeast Asia, risk of obesity*

I. INTRODUCTION

Non-communicable diseases (NCD) are problems that threaten global health and a country's development. The prevalence of obesity around the world has almost tripled in the last four decades. As a result, obesity is becoming a global epidemic projected to be a public health problem throughout the world and it is becoming a serious problem in developing countries and increasing in developed countries [1]. The World Health Organization (WHO) Specialist Consultation on Obesity provides a warning about the prevalence of obesity in developing countries. Previous WHO reports on Diet, Nutrition, and Prevention of Chronic Disease mentioned obesity as a major risk factor for all non-communicable diseases [2]. BMI categories are calculated according to WHO guidelines: underweight (<18.5 kg / m²), normal weight ($18.5–24.9$ kg / m²), overweight ($25– 29.9$ kg / m²) and obesity (≥ 30 kg / m²) [1]. Obesity causes health problems including hypertension, diabetes mellitus and especially arteriosclerosis. In most cases, arteriosclerosis is a result of obesity, especially from complications of diabetes mellitus. In addition, obesity can cause arteriosclerosis from multifactorial components associated with metabolic syndrome [3], [4].

Diet and food intake are some of the main factors in obesity. Excessive eating patterns without offset activity is one of the factors causing obesity. In developing countries, people are more likely to consume cheap food. In research, obesity in Malaysia states that the source of funds has the highest impact on the intake of unhealthy foods and the lowest impact on the intake of healthy food [5]. Monotonous work and recreational activities or minimal body movements can also be a trigger for obesity [6]. Thus, the purpose of this systematic review is to integrate and understand what factors

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influence obesity in adults in Southeast Asia. This systematic review discusses systematic reporting and meta-analysis (PRISMA) due to systematic and transparent renewal.

II METHOD
Search Strategy

The systematic search was first carried out using the following databases: Scopus, PubMed, Sage Journal, Science Direct, Springer Link and Cambridge using the strategy described in Figure 1. Studies had to be published in English in the last 5 years (2015 to 2020). A search was conducted in December 2019, to ensure that every article published after the initial search was included. Appropriate medical subject titles (MeSH) were used in conjunction with searches and phrases of text words. Keywords with Boolean operators that were searched for in each database included (Obesity) OR (Body Weight) OR (Body Mass Index ≥ 30) AND (Teenagers) OR (Teenagers) OR (Adults) AND (Obesity in Southeast Asia) OR (Obesity in Indonesia) OR (Obesity in Cambodia) OR (Obesity in Laos) OR (Obesity in Malaysia) OR (Obesity in Myanmar) OR (Obesity in Singapore) OR (Obesity in Thailand) OR (Obesity in Vietnam) OR (Obesity in Myanmar) OR (Obesity in Singapore) OR (Obesity in Thailand) OR (Obesity in Vietnam) OR (Obesity in Myanmar) OR (Obesity in Singapore) Vietnam) OR (Obesity in Brunei Darussalam)

The literature search strategy including the keywords obese adults found 647 articles, Scopus = 60 ProQuest = 210, Sage Journal = 6, Science Direct = 255, Cambridge = 38 and Springer link = 78, sorted according to inclusion criteria so that 10 articles were included in this review. Ten articles were judged to have quality, data extraction, and synthesis required.

Inclusion Criteria

We included all English language studies that considered obesity in adults in Southeast Asia published between 2015 and 2020. Research was considered to be eligible if it was explicitly:

1. Targeted at the age group of adults aged 18 years and over
2. The study was conducted on adults in the Southeast Asian Region with a BMI (≥ 30 kg / m²).

Figure 1. PRISMA Flow Diagram from Moher 2009 [7]

III. RESULTS

From the literature review results obtained, obesity in adults in the Southeast Asian region can be seen in Table 1. The levels were as follow: Indonesia 28% [8], Cambodia 50.20% [9], Laos 20.9%[10] Class I or Class II Obesity, Malaysia 15.4% [11], Myanmar 8.4%[12], Singapore 44.1%[13], Thailand 12.7% [3], Vietnam 2.53% [14], Brunei Darussalam 29.5% [15]. In all ASEAN countries women were more likely to be obese. Energy expenditure in women is lower than in men due to lack of physical activity, so fat storage tends to be higher in women [16].

Table 1. Rough Prevalence of Obesity by Gender in Adults in ASEAN

Articles (authors, year)	Country	Obesity Gender	
		Male	Female
Harbuwono, Dante et al., 2018	Indonesia	16.9%	28.6%
Sim Samphors and Wongsa Laohasiriwong, 2019	Cambodia	49.80%	50.20%
Supa Pengpid et al., 2018	Laos	17.9%	20.9%
Christopher Pell et al., 2016	Malaysia	11.1%	15.4%
Shekhar Grover et al., 2018	Myanmar	2.6%	8.4%
Low, serena et al., 2019	Singapura	55.9%	44.1%
Zaher Khazaei, et al., 2020	Thailand	7 %	12.7%
Tran Quoc Cuong, et al., 2019	Vietnam	1.92%	2.53%
Ong Sok King et al., 2017	Brunei	26.9%	29.5%

Besides being influenced by gender factors, there were also other factors that influence obesity, namely age, level of education, physical activity, marital status, history of obesity during childhood, genetics, stress, alcohol consumption and smoking habits, consumption patterns, residence, economic status, sleep habits, culture, social media, and peer influence.

IV DISCUSSION

Global prevalence of obesity has increased dramatically in most Southeast Asian countries over recent years. A person with a BMI of 30 or more is generally considered obese [1]. Obesity in adults is very risky for health so that it can cause chronic diseases such as asthma, sleep apnea, bone, and joint problems, type 2 diabetes, hypertension and the risk of heart disease. In modern society, energy intake and output depend on several factors.

1. Gender

The risk of obesity seems to be more common in women than in men. The main female hormone estrogen is an important factor in maintaining ideal body weight. Energy expenditure in women is lower than men due to a lack of physical activity [16].

2. Age

In general, obesity increases with age. In one study it was noted that people of 50-59 years of age has a high obesity prevalence (58.2%) compared to people aged 20-49 years (45.6%) [17]. This is supported by research conducted by Hong et al. (2018) which states that among the age groups with a higher obesity rate 30-49 years is notable (around 50%), whereas the age group 18-29 years had a body weight and BMI below the normal limit (20.2%) [18].

3. Education Level

The level of education is related to the occurrence of obesity. Respondents who have poor diets who often eat snacks and lack physical activity are those who really have good knowledge about ideal eating patterns and balanced nutrition [19].

4. Physical Activity

Physical activity that is not too demanding on physical strength has been alleviated by the use of robots and computer technology or sports during active days impacting on obesity [20].

5. Marital Status

Through Pujilestari's research (2017), it was found that marital status has a significant relationship to the prevalence of obesity in adults. Someone who already has a partner tends to be obese (33.1%) compared to someone who is single. This is common in social settings. In addition, the household's wealth of food is also considered. The type and form of food consumed by married couples varies [21].

6. History of Obesity during Childhood

Someone who has been obese during childhood tends to be obese as an adult. Research conducted by Shi et al. (2014) shows that a history of childhood obesity between the ages of 5 to 12 years is significantly related to the prevalence of obesity in adulthood (32.4%) compared to those in childhood who have a normal weight (20.2%) [2].

7. Genetic

A person's vulnerability in suffering from obesity can be seen from the type of genotype that is owned. Genetic factors are associated with weight gain, BMI, and waist circumference. If the father or mother suffers from being overweight then the chances of the child being overweight are 40-50%. If both parents suffer from obesity the likelihood of their child becoming obese is 70-80% 15. [22]. These findings indicate that adults in Indonesia with the AT / AA FTO genotype rs9939609 have a higher risk of obesity and a preference for higher fat food intake compared to those who have the TT genotype [23].

8. Stress

Regional Canada found a significant relationship between obesity and stressful work. Obese workers can result from high work pressure due to work stress. Stress can support obesity caused by behavior and metabolism and is an adverse psychosocial environmental impact [24].

9. Consumption Patterns

Increased consumption of processed foods that are easily consumed (ready-to-eat foods) and have a higher energy density than home-cooked foods cause passive energy consumption [25]. Self-cooked foods at home are healthier and proportional than buying outside the home [2]. Expressive consumption of sugar, eating large portions, and consumption of fast food cause obesity because one extra spoonful of sugar consumed each day increases the risk of obesity by around 14% [26], [16].

10. Smoking and Alcohol Consumption

Respondents who smoke every day are 1.73 times more likely to be obese than non-smokers [2]. Exposure to cigarette smoke has been shown to increase insulin resistance and is associated with central fat accumulation [27]. Alcohol drinkers get an additional calorie intake from alcohol and sugar contained in these drinks. Alcohol can increase triglyceride levels in the body. Alcohol drinkers get additional calorie intake from alcohol and sugar contained in these drinks [28].

11. Residence

The relationship between the living environment and obesity is estimated to vary between countries due to different cultures and socioeconomic environments [29]. The prevalence of obesity is higher in urban subjects (51%) compared to rural subjects (23%) [22]. This is caused by lifestyle factors and the availability of food in the city so that it affects excessive food intake [30]. The availability of more food choices in the city increases the desire to eat higher [30].

12. Economic Status

Based on Myanmar, 58.7% of respondents who were obese, the majority of respondents (19.2%) were rich in economic status [31]. Economic transition causes a transition of nutrition, namely by changing the diet from traditional staple foods to high-energy foods [21].

13. Sleeping Habits

Sleep duration contributes to the problem of obesity for master's students in Malaysia [25]. With the increase in the hormone ghrelin in individuals with short sleep duration, there will be an increase in appetite [32]. Poor sleep can cause an increase in the production of the hormone cortisol and increase insulin secretion. This mechanism can increase body fat and cause obesity [33].

14. Culture

In certain societies, looking fat is considered proof of family well-being and as such, has become a local culture. Also it is important not to overlook superstitions about food that must be consumed and should not be consumed in certain situations and conditions without regard to one's nutritional levels and caloric needs [34].

15. Social Media

The rise of food advertising or promotion circulating through electronic media shows the highest weight contribution to the problem of overweight and obesity for Malaysian students [25].

16. Influence of Friends

Changes in eating patterns and physical activity in adults are inseparable from associations or social relations. Both diet and lifestyle will change very easily to maintain relationships and social relations. This is supported by research from Bruening (2015) stating that food intake patterns can also be influenced by external factors such as the influence of peer group members [35].

In this study, there are several weaknesses that cause bias. The systematic review retrieved data that were not purely related to an examination of the prevalence of obesity in adults in Southeast Asia. Researchers also took data on the amount of obesity from studies of obesity risk factors studies of diseases caused by obesity.

V. CONCLUSION

Obesity is a health problem in Southeast Asia which can be seen from the increasing prevalence of obesity from year to year in several countries in Southeast Asia. Prevention efforts can be undertaken by providing socialization about the importance of physical activity in an effort to prevent obesity.

CONFLICT OF IINTEREST

There is no conflict of interest in this systematic review.

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VI. APPENDIX

Table 2. Summary of obesity findings in South East Asia

Title, Author and Year	Country	Methodology	Result
Obesity and central obesity in Indonesia:	Indonesia	A cross-sectional study based on the National Basic Health	Obesity is defined as body mass index ≥25 according to the Asia-

Title, Author and Year	Country	Methodology	Result
Evidence from a national health survey (Harbuwono et al., 2018)		Survey 2007 using total sampling method from 33 provinces.	Pacific standard for obesity. Central obesity is defined as waist circumference >90 cm for men and > 80 cm for women according to the Asia-Pacific standard for central obesity.
Fast Food Consumption, Overweight and Obesity among Working Age Persons in Cambodia (Sim and Wong, 2019)	Cambodia	A cross-sectional study among 749 working persons aged 18-59 years who were selected from 12 communes from 5 districts in Phnom Penh, Cambodia by multistage random sampling. Using questionnaire interview and anthropometric measurement.	50.20% respondents were female with a mean age of 32.26±11.12 years. As high as 62.75%; 95% CI: (59.28%-66.22%) consumed fast food during the past one month. The prevalence of overweight and obese population was 38.72% (95% CI: 35.22%-42.21%). Fast food consumption was significantly associated with overweight and obesity (OR adj.=2.00; 95% CI: 1.39-2.88; p<0.001).
The prevalence of underweight and overweight/obesity and its correlates among adults in Laos: a cross-sectional national population based survey, 2013 (Supa et al., 2018)	Laos	A national cross-sectional study based on stratified cluster random sampling. The total sample was 2,531 individuals aged 18-64 years (female = 59.3%; mean age 38.7 years, SD = 12.8) from Laos. Questionnaire interviews, blood pressure, and anthropometric measurements, and biochemical tests were carried out and analysis was undertaken using multinomial logistic regression	Using Asian criteria for BMI classification, 9.7% of the population was underweight (BMI <18.5, kg / m2), 47.5% was normal weight (BMI 18.5–22.9 kg / m2), overweight 17.5% (23.0–24.9 kg / m2), 19.6% had grade I obesity (BMI 25.0-29.9 kg / m2), and 5.6% had grade II obesity (BMI ≥ 30.0 kg / m2) (or obesity 42.8%, obesity class I or class II).
Coming of age, becoming obese: a cross-sectional analysis of obesity among adolescents and young adults in Malaysia (Christopher et al., 2016)	Malaysia	Data were collected at the Southeast Asia Community Observatory (SEACO) in the Segamat District, Johor. In this dynamic cohort of about 40,000 people, there were 5,475 aged 16-35 in 2013-2014. Data were collected through health profiles (body mass index [BMI] measurements at home) and self-report questionnaires.	Age and ethnicity were associated with being overweight (BMI 25.0-29.9Kg / m2) and obesity (BMI≥30Kg / m2). The prevalence of being overweight was 12.8% at age 16-20 and 28.4% at age 31-35; obesity was 7.9% and 20.9% in the same age groups.
The changing face of risk factors for non-communicable disease in Myanmar: Findings from the 2009 and 2014 WHO STEP Survey (Shekhar et al., 2018)	Myanmar	The proportion of individuals with major NCD risk factors such as current tobacco and alcohol consumption, <5 fruit/vegetable servings, physical activity, raised blood pressure (BP) and overweight and obesity from the year 2009 (n = 6414) and year 2014 (n = 8757) WHO STEP surveys were compared for the age group 25–64 and relative changes (RC) calculated	The percentage of overweight individuals decreased significantly over the years of the surveys (−18% RC) (P < 0.01) with an exception of the 55–64 age group. This decline was marked in males (−23.3% RC) (P < 0.01) but not in females (−6.7% RC). Similarly, the percentage of obese individuals also declined significantly over the years (−27.6% RC) (P < 0.01). This decrease was prominent among males (−42.2% RC) (P < 0.01).
The prevalence of sarcopenic obesity and its association with cognitive performance in type 2 diabetes in Singapore (Low et al., 2019)	Singapore	This was a cross-sectional study of 1235 patients with a mean age of 61.4 ± 8.0 years and primary and secondary T2D care attending diabetes care in Singapore. Body composition	Distribution of body composition based on FM / FFM ratio were: Group 1, 20.2%; Group 2, 60.5%; and Group 3, 19.4%. SO (Group 3) was significantly

Title, Author and Year	Country	Methodology	Result
		was assessed using a tetrapolar multi-frequency BIA device analysis. Cognition was assessed using Repeated Batteries for Assessment of Neuropsychological Status (RBANS) and Mini-Mental Status Examinations (MMSE)	associated with a decrease in total RBANS score with b-1.44 (95% CI -2.82 to 0.060.06; p 41 0.041) in multivariable linear regression adjusted for demographics, education, depressive symptoms and clinical covariates.
Body mass index and type 2 diabetes in Thai adults: Defining risk thresholds and population impacts (Papier et al., 2017)	Thailand	Participants were those from the Thai Cohort Study who were free of diabetes in 2005 and followed up in 2009 and 2013 (n = 39,021). Multivariable logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CIs) for the BMI-T2DM association. Non-linear associations were modelled using finite cubic splines.	Non-linear modeling shows the inflection points at which the BMI-T2DM association becomes statistically significant compared to the reference 20.00 kg / m2 is 21.60 (OR = 1.27, 95% CI 1.00-1.61) and 20.03 (OR = 1.02, 95% CI 1.02-1.03) for men and women, respectively.
Associated Factors of Hypertension in Women and Men in Vietnam: A Cross-Sectional Study (Tran et al., 2019)	Vietnam	A cross-sectional study was conducted from January to February 2019 on 2203 community-dwelling women and men aged 18 years or above. Participants' characteristics, comorbidity, behaviors, and physical measures were evaluated. Hypertension was classified as systolic/diastolic blood pressure≥140/90 mmHg or using antihypertensive medication. Data were analyzed using logistic regression model	The prevalence of hypertension was 24.3% (20.9% in women, 29.1% in men). For women, older age (odds ratio, OR, 6.80-12.41; p <0.001), overweight / obesity (OR, 1.64; p = 0.005), abdominal obesity (OR, 2, 07; p <0.001) was associated with hypertension. For men, older age (OR, 2.67-5.92; p <0.001), and overweight / obesity (OR, 2.18; p <0.001) were associated with hypertension.
Cross-sectional STEPwise Approach to Surveillance (STEPS) Population Survey of Noncommunicable Diseases (NCDs) and Risk Factors in Brunei Darussalam 2016 (Ong Sok King et al., 2017)	Brunei Darussalam	Weighted cross-sectional measurements of non-communicable diseases (NCD) and the prevalence of risk factors among the adult population of Brunei using WHO STEPS. Two-step random sampling was conducted from August 2015 to April 2016. Three-step surveillance included (1) interviews using a standard questionnaire, (2) blood pressure and anthropometric measurements, and (3) biochemical tests. Data weighting applied. A total of 3808 adults aged 18 to 69 years participated in step 1; 2082 completed steps 2 and 3 measurements.	Prevalence of obesity was 28.2% among those aged 40 to 69 years, 8.9% had a 10-year risk of cardiovascular disease (CVD) ≥30%, or with an existing CVD. Population strategies and target group interventions were needed to control risk factors and NCD morbidity.
Relation between obesity prevalence and the human development index and its components: An updated	Asia	This is an ecological study. The data required were the HDI and the prevalence of obesity (BMI≥30) in adults > 18 years of age, obtained from the World	Between 2000 and 2016, the highest prevalence of obesity was found in men and women> 18 years who lived in America and the lowest was found in Southeast Asia.

Title, Author and Year	Country	Methodology	Result
study on the Asian population (Zaher Khazaei et al., 2020)		Bank (https://data.worldbank.org/). Two-way correlation and analysis of variance were used at a significance level < 0.05, and the analyses were performed using Stata-14 software.	The results showed that there was a positive and significant correlation between the prevalence of obesity in men (r = 0.486, P <0.001) and women (r = 0.360, P <0.001) with HDI.