REVIEW ARTICLE

Prevalence and factors of overweight and obese among adolescent in Asia: A scoping review

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Abstract:

This study aimed to estimate the prevalence or trends of overweight and obesity among adolescents in Asia countries and identify the associated risk factors between 2012 to 2020. The study design for this scoping review was carried out using SCOPUS, Web of Science and Google Scholar Databases for relevant studies in Asia countries. The inclusion criteria were Asian adolescents with ages ranging from 10 to 19 years old and geographical location. All studies on the prevalence and risk factors of overweight and obesity among adolescents in Asia countries were performed from September 2012 to the end of November 2020. Quality assessment and data extraction were based on The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Cross-sectional studies. Overweight and obesity were higher among boys than girls although some reviews did not discuss which sex had a higher proportion of prevalence. In addition, there was some evidence about potential contributors to childhood overweight and obesity in Asia countries. Due to differences in survey sampling methods, sample size and age range of subjects, the prevalence and the risk factor of overweight and obesity required careful interpretation.

Keywords: Adolescents, Asia, Risk factor, Obesity, Overweight

1. INTRODUCTION

Obesity and overweight are defined as abnormal or excessive fat accumulations that might be detrimental to one's health. According to the World Health Organization (WHO), the worldwide incidence of obesity almost quadrupled between 1975 and 2016. Concerns about utilising BMI for adults apply to adolescents as well. In addition to age, weight, and pubertal development, height and degree of sexual maturity have an impact on the association between BMI and body fat among adolescents. Obesity has been linked to a variety of risk factors, including genetics, lifestyle, specific illnesses, and drug use. Lifestyle factors, relatively higher consumption and limited physical exercise have been recognised as important contributors leading to obesity, especially in adolescents (Ahmad *et al.,* 2018). In addition, Various indicators with varied limits and strengths have been used to estimate overweight and obesity. Therefore, across all age categories, only the body mass index (BMI) is the most acceptable technique for assessing weight status (Motlagh *et al.,* 2018; Pawaskar *et al*., 2015). Body Mass Index (BMI) was estimated by dividing weight(kg) by height(m) squared (Hernández-Cordero *et al.,* 2017). However, there is very minimal research on the prevalence among adolescent settings in Asia.

Although the world's lowest rates of overweight and obesity are found in Southeast Asia, the growth rate has been significant during the last 10 to 15 years. Other than that, obesity in adolescents has been linked to the development of serious health issues such as type 2 diabetes, high blood pressure, asthma and other respiratory disorders, sleep disorders, and liver disease (WHO, 2014). In the global trend, the prevalence of childhood overweight and obesity grew by 10% (Elías-Boneta *et al.,* 2015; De Onis M *et al.,* 2010). Childhood obesity in the United States has more than doubled in the previous 30 years, and it has quadrupled among adolescents (Elías-Boneta *et al.,* 2015; Ogden CL *et al.,* 2014). In addition, the overall prevalence of obesity among adolescents at age 11 to 14 years old has been found (Dundar *et al.,* 2012; Archenti *et al.,* 2008). Based on surveys of children in the mainland United States and Puerto Rico, obesity rates among Puerto Rican adolescents in the U.S. and Puerto Rico are among the highest which result in 24-36% (Elías-Boneta *et al.,* 2015; Acosta-Pérez *et al.,* 2012). While other countries such as Mexico also point out that overweight and obesity have grown at the greatest rate among female adolescents during the previous 13 to 24 years. In all age categories except preschool children and those from urban regions, the growth in overweight and obesity has been more evident among children from the lowest socioeconomic level. Furthermore, overweight and obesity are highest in Mexican children even though compared in prevalence with other countries by using WHO classification

systems (Hernández-Cordero *et al.,* 2017). While in the Asia region, it shows that the prevalence of overweight and obesity is increasing day by day regardless of population areas. For example, the prevalence of overweight and obesity in China has shown significant increases among adolescents between 2011 and 2015. Given the high probability of BMI tracking from adolescence to adulthood, the rise and increased frequency of obesity in adolescents is worrying (Zhang *et al.,* 2018; Simmonds *et al.,* 2016).

Considering these, the main objective of this study was to review the percentage of prevalence of overweight and obesity and identify the associated risk factor which causes overweight and obesity among adolescents in Asia.

2. MATERIALS AND METHODS

This scoping review was reported according to the Preferred Reporting Items for scoping reviews and Meta-Analyses (PRISMA) Statement (Page *et al.,* 2021). A scoping review design was conducted to identify, assess, and summarize the available evidence on the prevalence of overweight and obesity with associated risk factors that causes overweight and obesity among adolescents in Asia. A combination of text words and MeSH terms and a Boolean search were used to search Web of Science, SCOPUS, and Google Scholar as the main worldwide electronic data sources to evaluate studies on obesity or overweight with associated risk factors in adolescents in Asia. In addition, websites of relevant agencies such as the International Obesity Task Force (IOTF), the Centre for Disease Control and Prevention (CDC), and the World Health Organization (WHO) were browsed. The data was managed by using the Endnote version 20 reference management system. However, a manual search for other articles and references to published articles were included. For inclusion criteria, the population comprised adolescents aged 10 to 19 years old in Asia countries such as India, Bangladesh, Pakistan, Nepal, Afghanistan, China, Malaysia, Thailand, Vietnam, Japan, Arab Saudi, Turkey, Indonesia, and Sri Lanka while for exclusion criteria, the papers of non-countries-based studies and duplicate citations were excluded.

The first researchers reviewed 536 titles. A total of 499 full-text papers were obtained and assessed against a set of inclusion criteria. Only 422 were eliminated based on the title and abstract. A total of 77 articles were sought for retrieval and only 23 articles were not retrieved. Meanwhile, 26 full-text articles were excluded due to issues relating to the mixed prevalence of overweight and obesity, not based on age range and review articles. Only 54 articles were assessed for eligibility and 28 articles were included in the review. The selection process was illustrated in Figure 1. The full-text articles were assessed by at least two reviewers. Data extracted included date of publication, study design and setting, age and sex, statistical method, prevalence, and risk factors associated with overweight and obesity. The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Cross-sectional studies was applied and used to determine the potential risk of bias.

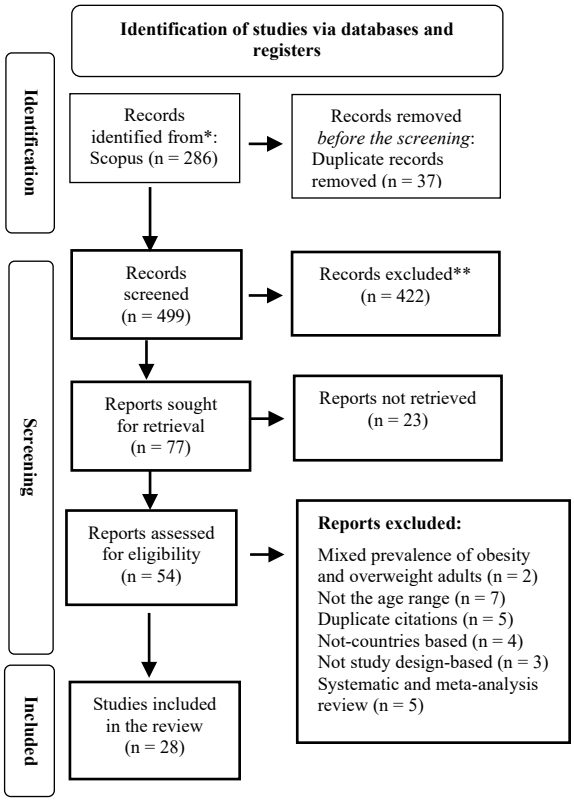

Figure 1 PRISMA Flow chart for the studies selection

3. RESULTS

3.1. Literature search

The search on the prevalence of overweight and obesity with a risk factor that can cause overweight and obesity among adolescents returned a total of 54 articles. By using JBI Critical Appraisal Checklist for Cross-Sectional Studies, 28 articles were reviewed for full-text articles according to inclusion criteria and 23 articles were eligible for general review. The majority of the studies were done in Arab countries(eight) followed by ASEAN countries(seven), followed by India(four), China(two) and Japan(one). The population consisted of adolescents from around age 10 until 19 years. Seven of the studies observed the prevalence of overweight and obesity based on age, sex, and country. The subjects were classified by sex female and male while the age ranges from 14-16, 12-15, 11-14, 14-19 and 11-18, respectively.

3.2. Prevalence of overweight and/ or obesity

The prevalence of overweight and/ or obesity from 18 countries were included in this study based on the classification method. About eight studies were using WHO guidelines while the other five studies were using IOTF guidelines and others combine with NHNS, CDC, and

NCHS guidelines. Based on the data given by using WHO guidelines, the highest overweight rate was in Ho Chi Minh, Vietnam at 19.6% and the lowest prevalence of overweight was in Chennai, India with 6.2% respectively. Meanwhile, obesity rates in Riyadh City, Saudi Arabia and Hanoi, Vietnam was higher (20.2% and 19.1% respectively) than in Changchun City, China with the lowest obesity rate among girls (3.1%).

Nguyen *et al.* conducted multistage cluster sampling and stated the prevalence of overweight and obesity by using three criteria; WHO shows 19.6% and 7.9%, IOTF shows 17.8% and 3.2% while CDC shows 14.1% and 3.2%, respectively. In addition, Phan *et al.* also conducted cluster sampling by using IOTF and WHO guidelines. The prevalence of overweight and obesity by using WHO and IOTF (17.4% and 17.1% respectively) and (8.6% and 5.4% respectively). While Pengpid *et al*. had taken a different approach by focusing on ASEAN countries. The prevalence of obesity was highest in Brunei and Malaysia (17.7% and 9.6% respectively) and the lowest was in Cambodia, Myanmar, and Vietnam (0.4%, 0.4% and 0.6% respectively). Meanwhile, the prevalence of overweight or obesity was also highest in Brunei (36.1%) and Malaysia (23.7%) and the lowest of overweight or obesity was in Cambodia (3.7%) and Myanmar (3.4%).

3.3. Risk factors associated with overweight and obesity

15 studies examined the association between lifestyle with overweight and obesity in adolescents. Only seven studies reported a significant association in lifestyles that involved risk factors overweight, and obesity. Four studies found that most adolescents were overweight or obese because of too spent over 2 hours or 4 hours of screen time per day. Other studies also showed a positive association between low physical activity with overweight or obesity.

The association between nutritional intake with overweight and obesity was assessed in ten studies. Most of the studies showed that a high intake of fast food, carbonated drinks and less consuming fruits and vegetables may be associated with overweight or obesity among them. In addition, two studies showed that irregular or skipped breakfast habits can also risk overweighting and obesity (Dundar *et al.,* 2012 and Al-Haifi *et al.,* 2013). All six studies also examined the association between consuming fruits or vegetables occasionally, increased consumption of energy-dense food intake, and having more fast food were positively related to the risk of overweight or obesity.

Nine studies examined the association between genetics, gender and environment with overweight and obesity. About five studies were positive and showed that male adolescents were high risk of overweight or obese than female adolescents. Other same studies also related parental BMI to overweight and obesity among adolescents. In addition, one study showed different results with overweight, or obesity can be related to not walking or biking among adolescents (Pengpid *et al.,* 2016). Meanwhile, six studies showed that families with high or middle socioeconomic status were at high risk of having overweight or obesity. One study that was conducted showed that adolescent girls from high-income families tend to get overweight or obese compared to adolescent boys (Noh *et al.,* 2014). Furthermore, other studies associated overweight or obesity with adolescents living in urban areas and who go to private schools tend to get overweight or obese more than in public schools (Dundar *et al.,* 2012).

4. DISCUSSION

This study aimed to review the prevalence of overweight and obesity among adolescents and the risk factors that were associated which causes overweight and/ or obesity among adolescents in Asia. It's worth mentioning that twenty-three of the twenty-eight studies carried out were of high-quality articles. In addition, according to the JBI Critical Appraisal Checklist for Cross-sectional Studies, four studies were considered to have a moderate risk of bias, while one study was classified as a high risk of bias. These studies could have lacked appropriate statistical methodology or design and were unclear of exposure measures and confounding variables. Both prevalence and risk factors that were associated with overweight and obesity among adolescents in Asia included in the studies range widely. As mentioned in the literature review, adolescents' obesity or being overweight had been increasing and may have serious health consequences that last into adulthood (Pengpid *et al.,* 2016; Reilly and Kelly *et al.,* 2011).

Regarding the previous article, when prevalence was analysed according to sex, about half of the countries that showed the prevalence of overweight, or obesity were higher among boys than girls. The other half only indicated that both boys and girls were higher in the prevalence of obesity and overweight. These results were reliable with the previous studies that stated a high prevalence of abdominal obesity among boys (Elías-Boneta *et al.,* 2015). Gender differences in the prevalence of overweight or obesity had been linked with lifestyle variables (Al-Hazzaa *et al.,* 2012; Duncan *et al.,* 2011 and Lazarou *et al.,* 2010). Ten articles compared data based on classification methods and pointed out that the World Health Organization (WHO) showed a higher prevalence of overweight and/ or obesity among adolescents in both sexes over this period.

Using the World Health Organization (WHO), about six articles based in Vietnam, India, Iran, China, and Malaysia countries showed that the prevalence of being overweight was higher among both sexes. Based on the region in that countries, Ho Chi Minh, Vietnam (19.6%), Kuala Terengganu and Besut, Malaysia (15.6%), and Tehran, Iran (14.4%) showed that higher prevalence of overweight than Nepal (12.2%) and Chennai, India (5.2%). Furthermore, three articles based on Vietnam, Saudi Arabia and China countries showed a higher prevalence of obesity among adolescents. The review also stated that the regions from

Hanoi, Vietnam and Riyadh City, Saudi Arabia showed (19.1%) and (20.2%) higher obesity prevalence (Pham et *al.,* 2019 and Al-Husaini *et al.,* 2019). Meanwhile, in Kajang, Malaysia showed a higher prevalence of both overweight and obesity among both sexes with only (19.5%) (Rezali *et al.,* 2012).

By using the International Obesity Task Force (IOTF) guidelines, 41.7% of urban boys in the Gujarat, India area were overweight and obese. This study confirms that the male gender and high socioeconomic status were associated with a significant risk of being both overweight and obese (Alok *et al.,* 2012). In comparison with the urban school in South India, 11% of boys were overweight and 5% of girls were obese. The most interesting finding was no difference between boys and girls for the prevalence of both overweight and obesity. Another important finding was based on Kuwaiti (50.5%) and Saudi Arabia cities (46.3%) were higher in both overweight and obesity for boys than girls in Kuwaiti (46.5%) and Saudi Arabia cities (34.8%).

In ASEAN countries, the prevalence of both overweight and obesity among adolescents increased in Brunei (36.1%) and Malaysia (23.7%) for both sexes. However, the other two countries showed the lowest prevalence of overweight and obesity among adolescents in Myanmar (3.4%) and Cambodia (3.7%) based on analyses in Global School-based Student Health Survey (GSHS) guidelines. Overall, there are no substantial differences between boys and girls. This could be due to a difference in puberty transition, with boys being more vulnerable to obesity than girls, as has been found in lower middle and upper middle-income nations (Pengpid *et al.,* 2016 and Poskitt *et al.,* 2014). Analyses of trends in overweight and obesity prevalence for the two National Centre for Health Statistics (NCHS) and Centre for Disease Control and Prevention (CDC) guidelines indicated that the higher prevalence of overweight (27.9%) and obesity (10.9%) among boys than girls at Samsun, Turkey (Dundar *et al.,* 2012). In Changchun City, China was in line with those of previous studies with the prevalence of overweight (17.4%) and obesity (8.8%) higher among boys than among girls. Meanwhile, the Islamic Republic of Iran only indicated the prevalence of overweight and obesity for both sexes (Motlagh *et al.*, 2018).

Although the prevalence of overweight and obesity is measured differently in different studies around the world, it was on the rise in most of them as a common factor. In the Global Burden of Disease Study's analyses, the global prevalence of overweight and obesity in children and adolescents was also estimated. Based in the previous year in 2013 reported that the prevalence of obesity among children and adolescents in developed countries was high which is approximately 24% of boys and 23% of girls were overweight or obese. In general, since 1980, the rate of overweight and obesity had steadily risen (Seidell *et al.,* 2015 and Ng *et al.,* 2013). There were significant differences in the prevalence of obesity or overweight in different parts of Asia, which could be due to cultural differences and socioeconomic reasons in different provinces. As a result of globalisation and rising urbanisation, many Asia countries were undergoing socioeconomic and lifestyle changes. In Singapore, Korea, Malaysia, Philippines, and Indonesia, more than 60% of the population lives in cities, compared to less than 30% that lives in China, Pakistan, India, and Thailand. Meanwhile, Bangladesh and Sri Lanka had poor urbanisation rates (Ramachandran *et al.,* 2012).

The studies showed that the lack of physical activity was the one key factor that was associated with overweight or obesity among adolescents. According to studies, children and adolescent populations in most regions were low levels of general physical activity, high levels of sedentary behaviour, and an increasing prevalence of obesity (Zhu *et al.,* 2019). Around 80% of adolescents (ages 13–15) worldwide do not fulfil recommended criteria, indicating they do not spend more than 60 minutes per day engaging in moderate-vigorous physical activity (MVPA), including vigorous activities on at least three days per week (Zhu *et al.,* 2019 and Hallal *et al.,* 2012). In many countries in the region, technological developments, and gadgets such as computers, online games and various widely available television channels seem to be resulting in long periods of inactivity at home for most adolescents. The most obvious finding to emerge from the results indicated that less frequently engaged in vigorous physical activity and long watching television for more than two hours per day were reported as a risk factors of childhood overweight and obesity. Long-term television viewing may lead to a desire for high-fat, high-sugar, and high-calorie snacks, resulting in increased energy intake from eating while watching and/or the effects of advertising, as well as a reduction in sleep. This finding supports evidence from laboratory-based experiments (Robinson *et al.,* 2017) that exposure to screen media resulted in increased energy consumption without increased appetite or compensatory decreased intake during the rest of the day.

Adolescents became more independent during this time and had more food options outside of those accessible at home (Al-Hazza *et al.,* 2021). These findings indicated that there was a global link between dietary intake and overweight and obesity, despite disparities in cultural and economic settings among Asia countries studied. Based on nine cross-sectional studies, the results indicated that high consumption of fast-food, sugar beverages, energy dense food, lower frequencies of vegetables and fruit intake and skipped breakfast tend to increase the risk of overweight and obesity among adolescents. Meanwhile, one unexpected finding confirmed that most students who consumed breakfast daily had the lowest prevalence of overweight and obesity. In addition, skipping breakfast was linked to changes in appetite and satiety, which can lead to overeating and poor insulin sensitivity (Robinson *et al.,* 2017). Other results also found that there was no statistically significant

link between fast food consumption and obesity. However, the portion size of fast foods, which was not considered in this study, could be a misleading factor in the relationship between fast food consumption and obesity (Al-Hazza *et al.,* 2012).

According to international data, obesity was more common in boys than girls around 5–19 years old in higher middle-income countries in the world (Shah *et al.,* 2020). The results of all studies indicated that male adolescents were higher in overweight and obesity than female adolescents. These results seem to be consistent with other research which found some studies that girls, particularly those in higher-income areas, choose diets that were low in energy and high in nutrients, such as fruits and vegetables, while boys consume more meat and calorie-dense foods. Moreover, in comparison to males, girls were more likely to have weight-related issues, such as a desire to lose weight, guilt over overeating, and low self-esteem (Shah *et al.,* 2020 and Wang *et al.,* 2018). As shown by other studies, family history of overweight and obesity among parents also tend to be associated with childhood obesity. By hereditary features or family living styles, the overweight or underweight status of parents may influence the overweight in children or adolescents (Noh *et al.,* 2014). However, because the overweight of parents was measured by adolescents, there was a chance that this measurement was biased. As a result, effective treatments to prevent the inheritance of obesity were required (Noh *et al.,* 2014).

Socioeconomic status (SES) was initially expected to be a significant risk factor for childhood obesity. Other well-known determinants of childhood overweight, such as parental weight status and physical inactivity were known to be influenced by socioeconomic status (SES) (Gätjens *et al.,* 2020). The finding indicated that adolescents with middle and higher SES were at risk of becoming overweight and obese. Following the present results, previous studies had demonstrated that there was a link between being overweight or obese and having a high income such as total family or daily pocket (Okour *et al.,* 2019). Children from higher-income status had a greater selection of eating options, including restaurant meals that were often higher in calories, fat, and salt.

5. LIMITATION

This study had several potentials limitations. Several populations had different ideal cut-off points in assessing overweight and obesity, hence overweight and obesity may be defined differently based on anthropometric measures in different countries. Due to differences in survey sampling methods, sample size, the age range of subjects, the prevalence and the risk factor of overweight and obesity required careful interpretation. Individual studies were also limited to selected locations, with participants consisting of adolescents attending schools, it was limiting the ability to produce a view that was representative of the different countries.

6. CONCLUSION

The findings of this study, the following conclusions may be drawn such as the prevalence of overweight and obesity among adolescents in Asia countries is still high but not consistently. Overweight and obesity higher among boys than girls although some reviews did not clearly mention which sex had a higher proportion of prevalence. With urbanisation, physical activity decreases, and the way people eat was changing dramatically, especially among adolescents. People in cities had easy access to a variety of diets that were high in refined carbohydrates, processed foods, saturated and total fat, and low in fibre (Ramachandran *et al.,* 2012). There was some evidence about potential contributors to childhood overweight and obesity in these countries, as discussed in the review, but a detailed knowledge of the associated cultural, social, and environmental factors, including dietary and behavioural factors, was required. In addition, there were some criteria to be used to classify adolescents as overweight or obese, such as World Health Organization (WHO), International Obesity Task Force (IOTF), Centre for Disease Control and Prevention (CDC), Japan National Health and Nutrition Survey (NHNS) and Global School-based Student Health Survey (GSHS) but most often used was the WHO and IOTF references.

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