JIKM. 2025; 17 (3): 162-178
DOI: 10.52022/jikm.v17i3.704
p-ISSN: 2085-4366, e-ISSN: 2684-950X

Jurnal Ilmiah Kesehatan Masyarakat:
Media Komunikasi Komunitas Kesehatan Masyarakat

The Relationship between Sleep Duration and Sedentary Behavior with the Incidence of Obesity in School-Age Children: A Literature Review

Nessa Ishmah Munyati, Chandra Tri Wahyudi*

Department of Nursing, Faculty of Health Sciences, Universitas Pembangunan Nasional "Veteran" Jakarta, Depok, Postal Code 16515, West Java, Indonesia

Abstract

***Background**: Obesity is a growing public health issue among school-age children. Children with obesity are characterized by excessive accumulation of body fat. Various factors, for instance, lifestyle changes and sleep duration, can potentially increase the risk of obesity. This literature review aimed to identify the relationship between sleep duration, sedentary behavior, and obesity in school-age children.*

***Method:** In this review, journal articles published in the last five years were included. All relevant articles were obtained from several databases, including NCBI, ScienceDirect, PubMed and Google Scholar. The search strategy utilized the following keywords: "obesity", "school age-children", "sedentary", and "sleep duration".*

***Results**: A total of 255 articles were found in the initial search. These articles were subsequently screened using the PICOS framework. No more than 30 articles were eligible for inclusion.*

***Conclusion**: The results of the analysis show that sleep duration and sedentary behavior are factors that influence the incidence of obesity in school-age children.*

***Keywords**: Obesity, School children, Sedentary, Sleep duration.*

INTRODUCTION

Obesity is one of the health problems that has become a global concern and must be addressed. The prevalence of obesity increases every year, along with the shift in lifestyle and diet among residents living in urban areas. School-age children have a high risk of obesity because they are still in a dynamic growth phase, where height and weight continue to change.[1] However, if weight gain is not balanced with height gain, children are at risk of being overweight or obese. In 2016, the number of children and adolescents in the world suffering from obesity with an age range of 5—19 years old reached more than 340 million people. In the United States, the prevalence of adolescents aged 6—19 years old who have obesity reaches at least 1 in 5 children.[2] In several developing countries, approximately 35 million school-age children were diagnosed with obesity.[3] In Asia Pacific countries, 38% of children aged 5 years old or younger are overweight.[4] According to the Basic Health Research Agency in 2018, in Indonesia, the prevalence of obesity in children (5–12 years old) was recorded at 9.2%, while in adolescents (13–15 years old), it was 4.8%.

Obesity does not cause death directly, but it can be a risk factor for several diseases, such as cardiovascular disease, hypertension, diabetes mellitus, and gallstones.[5] Obesity can cause an increase in body mass index, which can lead to the risk of cancer and heart disease, especially in children.[6] In addition, obesity can cause psychological problems for children, as children with obesity will have lower self-esteem, and obesity experienced by children can inhibit growth and development due to high levels of fat in the body.[7] The risk of obesity is influenced by both modifiable and non-modifiable risk factors.[8] Non-modifiable factors include genetics, puberty, individual development, and ethnicity or race. Other risk factors, such as lifestyle, physical activity, and sleep patterns, are classified as modifiable factors.

Research involving elementary school students in Makassar reported that more than 75% of students with sedentary behavior were obese.[4] Sedentary behavior can be observed in school-age

Correspondence*: Chandra Tri Wahyudi
E-mail: chandratriwahyudi@upnvj.ac.id

Received: May 09, 2024
Accepted: August 08, 2025
Published: August 26, 2025

children because their parents provide them with electronic gadgets for use during their leisure time. Sedentary behavior is related to low levels of physical activity and is characterized by energy expenditure of 1.5 Metabolic Equivalent of Task (MET) or less in a sitting or reclining position.[9] Watching television, reading, playing on computers and playing video games are examples of sedentary behaviors.[10] Sedentary behavior consists of two categories, namely high and low. If the aforementioned activities last for five hours or longer per day, they are considered high sedentary behavior. However, if the activities last less than five hours a day, they are classified as low sedentary behavior.

Another risk factor for childhood obesity is the duration of sleep. The National Sleep Foundation revealed that sleep deprivation could result in decreased physical activity, which leads to an increased risk of obesity. A study in Australia found that sleeping for less than 10 hours could increase the risk of obesity by 2.6 times. Short sleep duration could reduce the secretion of hormones leptin and ghrelin, which regulate hunger and satiety.[11] Such metabolic alterations increase the risk of obesity.[1] Taking these previous findings into account, this study aimed to review the relationship between sleep duration, sedentary behavior, and the incidence of obesity in school-age children.[12]

The gender-specific findings from Cao et al. may reflect physiological and behavioral differences between boys and girls. Hormonal fluctuations, earlier pubertal onset, and greater psychosocial stress among girls may contribute to higher susceptibility to sleep-related metabolic changes. Moreover, differences in parental expectations and study-related pressures in Chinese culture could also influence bedtime routines and sleep duration, particularly among school-aged girls.[13]

Several studies have reported that short sleep duration may contribute to the increased risk of obesity among school-age children. A comprehensive review highlighted that most longitudinal studies support an inverse relationship between sleep duration and obesity among children and adolescents, although some studies found no significant associations after adjusting for confounding factors.[14] These findings suggest that insufficient sleep may have both direct and indirect effects on body weight regulation through behavioral and hormonal pathways.

METHOD

In this study, the researchers utilized journal articles that discussed similar topics to the research objectives as supporting data (secondary data). Literature search was conducted through reputable databases, including PubMed, ScienceDirect, NCBI, and Google Scholar. The Population, Intervention, Comparators, Outcome, and Study Types (PICOS) framework was applied in the literature search, combined with "AND" and "OR" as conjunctions. Keywords were structured with boolean combinations, such as ("school age children" OR "school child" OR "children") AND ("sleep duration and sedentary behavior" OR "time to retire and sedentary activity" OR "time for bed and sedentary") AND ("obesity" OR "overweight" OR "fatness") to identify relevant publications. After that, the research process continued by filtering the literature based on predetermined inclusion and exclusion criteria. The inclusion criteria included articles with subjects aged 6—12 years, using study designs such as cross-sectional, RCTs, or systematic reviews, and coming from English-language journals published between 2015 and 2020. Meanwhile, studies with child subjects who had congenital diseases, including asthma and heart disorders, or who were undergoing special diets, were excluded. The research screening flow is as follows to the Figure 1.

RESULT

The findings showed a total of 30 journals met the inclusion and exclusion criteria of the research. General characteristics of the selected scientific articles are presented in Table 1. The analysis revealed that articles published in 2015 contribute the highest proportion of all selected articles, with 30%. In contrast, only 3.3% articles were published in 2020. Regarding research design, the majority of the articles (76.7%) utilized a cross-sectional design, while cohort studies were the least represented (3.3%).

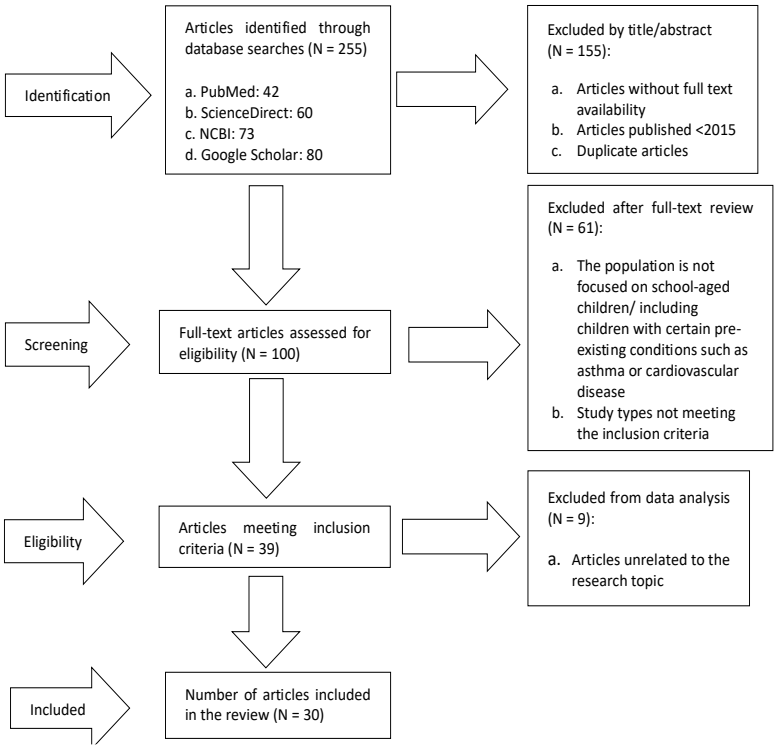

Figure 1. ***PRISMA Flowchart***

The results show that most studies found a significant association between short sleep duration and high sedentary behavior with an increased risk of obesity in school-age children. These studies revealed that children who slept less than 9 hours per night or had excessive screen time tended to have a higher body mass index. In addition, some studies highlighted other factors that strengthen these relationships as well, including lack of physical activity, unhealthy diets, and access to electronic devices in the bedroom. These findings indicate that children's daily habits, particularly related to sleep and sedentary activities, play an important role in influencing nutritional status and obesity risk from an early age. The findings showed that a total of 14 scientific articles discussed related to sleep duration factors that can affect the incidence of obesity, while a total of 16 journals discussed related to sedentary behavioral factors that can affect the incidence of obesity.

Table 1. General Characteristics of Research Articles

Category	Frequency (n)	Percentage (%)
Year of Publication		
2015	9	30%
2016	3	10%
2017	5	16.7%
2018	4	13.3%
2019	8	26.7%
2020	1	3.3%
Total	30	100%
Research Design		
Cross Sectional	23	76.7%
Cohort Study	1	3.3%
Systematic Review	4	13.3%
Case control	2	6.7%
Total	30	100%

DISCUSSION

Sleep Duration and Incidence of Obesity in School-Age Children

The normal sleep duration for school-age children (6—13 years old) is 9—11 hours per day.[15] There are three categories of sleep duration, namely long sleep duration (more than 9 hours per day), middle sleep duration (7 to 9 hours per day), and short sleep duration (less than 7 hours per day).[16] In relation to the incidence of obesity among school-age children, sleep is categorized into four dimensions, including duration, time, efficiency, and sleep quality.[17] Of the 103 studies discussing sleep duration, 86 (83%) reported a significant association between short sleep duration and weight gain. The amount of time spent on homework, extracurricular activities, and social activities, as well as the lack of parental supervision on children's bedtime, led to sleep deprivation among children.[18] Of the 103 studies discussing sleep duration, 86 (83%) reported a significant association between short sleep duration and weight gain, which aligns with findings from a meta-analysis, demonstrating a consistent longitudinal relationship between insufficient sleep and increased obesity risk in children.[19]

Consequently, insufficient sleep triggers hormonal changes that disrupt appetite regulation, influencing hunger and satiety. Reduced leptin levels and elevated ghrelin levels increase hunger and stimulate appetite in children. Therefore, parental awareness in determining adequate sleep time and maintaining a healthy diet would be beneficial in reducing the risk of obesity in children. Similar metabolic mechanisms have been observed in adults, where short sleep duration has been linked to central adiposity through disruptions in appetite-regulating hormones and energy metabolism. These findings support the hypothesis that inadequate sleep may promote fat accumulation in the abdominal region, potentially predisposing children to future metabolic disorders. Therefore, parental awareness in determining adequate sleep time and maintaining a healthy diet would be beneficial in reducing the risk of obesity in children.[20]

Epidemiological evidence supports a link between short sleep duration and childhood obesity. Findings from 13 studies show that children with shorter sleep durations are twice as likely to develop obesity compared to those with longer sleep.[21] Limited sleep reduces energy expenditure and stamina while providing more time for food intake, thereby disrupting thermoregulation. These changes will affect hormones and energy imbalances, which can further lead to being overweight or obese. One possible mechanism underlying this association is an increased desire to eat. Restriction in sleep time triggers the loss or reduced inhibition of original activity in the hypothalamus region, which can reduce appetite regulation and lead to heightened hunger. This increased hunger not only promotes short-term weight gain, but will also cause obesity in the long term if left unaddressed.[22]

A study conducted in Jakarta found that 22 out of 107 primary school students were obese.[23] Among those students, 67 suffered sleep disorders related to sleep duration, frequency, and time of awakening at night. Most cases of sleep disturbance, such as snoring, were associated with insufficient nighttime sleep for their age; 61.7% of the children slept less than nine hours.[24] This was largely attributed to difficulty falling asleep, staying up late, spending more than two hours watching television or using the computer, and school-related fatigue that delayed bedtime without altering waking time. Consequently, many children attempted to compensate for sleep loss during school days by extending their sleep on weekends.[25] This pattern is consistent with research showing that about 40% of 10-year-olds report sleep deprivation due to excessive screen time, school fatigue, and irregular sleep–wake schedules between weekdays and weekends.[26] Insufficient sleep during school days not only increases weekend lethargy but also reduces motivation for physical activity, even though weekends provide an ideal opportunity for exercise and fat burning to prevent excess weight gain and obesity.[27,28]

Furthermore, the findings revealed that short sleep duration is an independent risk factor for obesity. Of the 8,760 children, 8.4% were found to be obese in Urban, China with more males being obese than females.[29] More than half of the 6-year-olds in the study did not get sufficient sleep duration of 9 hours/night. As children age, they have less sleep duration a trend supported by national sleep recommendations and population studies.[15] This is because short sleep duration causes stress reactions. As a trigger, sleep habits with a continuous short sleep duration will activate oxidative stress and systemic inflammation [30] and can trigger the appearance of chronic metabolic diseases. The imbalance in energy intake and energy expenditure that occurs is considered the most plausible reason for the increased risk of obesity from short sleep duration in children.[31] Therefore, adequate sleep duration is critical for children's long-term health. Adequate sleep duration plays an important role that greatly

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
1.	Bridget Morrissey Mary Malakellis, Jill Whelan, Lynne Millar, Boyd Swinburn, Steven Allender and Claudia Strugnell, 2016.[12]	Australia / Victoria	Sleep duration and risk of obesity among a sample of Victorian school children	To examine the effect of sleep duration on obesity risk in children	Cross-sectional; anthropometry, interviews, accelerometer; Chi-square, t-test, logistic regression	School-aged children	n = 289	Children sleeping <10 hours/day were more likely to be overweight or obese than those with sufficient sleep
2.	Satoko Nakano, Chiaki Hirano, Kazushi Hotta, Yoshihiko Fujita, and Hisako Yanagi, 2019. [32]	Japan	Factors associated with overweight status, obesity, and sedentary behavior in elementary and junior high school students	To identify lifestyle-related risk factors for obesity in children	Cross-sectional; anthropometry, questionnaire; linear regression	Elementary & junior high students	n = 107	Sedentary behavior time (337.2 ± 122.5 minutes/day) and HDL-C were independent risk factors for overweight
3.	Yijuan Qiao, Tao Zhang, Hongyan Liu, Peter T. Katzmarzyk, Jean-Philippe Chaput, Mikael Fogelholm, William D. Johnson, Rebecca Kuriyan, Anura Kurpad, Estelle V. Lambert, Carol Maher, Jose A.R. Maia, 2017. [33]	Global (12 countries)	Joint Association of Birth Weight and Physical Activity/ Sedentary Behavior with Obesity in Children Ages 9-11 Years from 12 Countries	To examine the combined effects of birth weight and activity levels on obesity	Cross-sectional; questionnaire, accelerometer; multilevel logistic regression	Children aged 9–11	n = 5,088	Children with high birth weight and low physical activity had 4.48–5.18 times higher obesity risk
4.	Allana G. L, Peter T. K, Tiago V. B, Stephanie T. B, Jean-Philippe Chaput, Timothy S. C, Mikael F, Deirdre M. H, Gang Hu, Rebecca K, Anura K, Estelle V. L,	Global	Correlates of Total Sedentary Time and Screen Time in 9–11 Year-Old Children around the World: The International Study of	To analyze the factors related to sedentary time and screen use	Cross-sectional; questionnaire, accelerometer; multivariate analysis	Children aged 9–11	n = 5,844	Sedentary time averaged 8.6 hours/day; boys had higher screen time and BMI; girls had more sedentary time

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
	Carol M, José Maia, Victor M, Timothy O, Vincent O, Olga L. Sarmiento, Martyn S, Catrine Tudor-Locke, Pei Zhao, Mark S. Tremblay, ISCOLE Research Group, 2015.[34]		Childhood Obesity, Lifestyle and the Environment					
5.	Bridget Morrissey, Elsie Taveras, Steven Allender and Claudia Strugnell, 2019.[17]	Global	Sleep and obesity among children: A systematic review of multiple sleep dimensions	To explore associations between various sleep dimensions and obesity	Systematic review; questionnaire, accelerometer; PRISMA	Primary school-aged children	n = 295,834 (112 studies)	98 out of 112 studies found significant association between sleep duration and weight gain
6.	Yanhui Wua, Qinghai Gongb, Zhuquan Zouc, Hui Lib,Xiaohong Zhangca, 2016.[35]	Global	Short sleep duration and obesity amongchildren: A systematic review andmeta-analysis of prospective studies	To evaluate the association between sleep duration and obesity	Systematic review & meta-analysis; questionnaire, BMI; PRISMA	Children	n = 35,540	Short sleep duration was consistently associated with higher obesity risk, affected by geography
7.	Daly CM, Foote SJ, Wadsworth DD, 2017.[36]	USA	Physical Activity, Sedentary Behavior, Fruit and Vegetable Consumption and Access: What Influences Obesity in Rural Children?	To examine how behavior and diet relate to obesity in rural children	Cross-sectional; accelerometers, questionnaires; ANOVA, regression	Rural school-aged children	n = 153	6th graders had higher sedentary time; sedentary behavior was significantly linked to obesity
8.	Muqing Cao, Yanna Zhu, Baoting He, Wenhan Yang, Yajun Chen, Jun Ma and Jin Jing, 2015.[16]	China	Association between sleep duration and obesity is age- and gender-dependent in Chinese urban	To determine the relationship between sleep and obesity	Cross-sectional; questionnaire, anthropometry; ANOVA, regression	Urban school children	n = 8,760	Children sleeping <9 hours had higher obesity prevalence (8.4%); boys more affected than girls

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
			children aged 6–18 years: a cross-sectional study					
9.	Konstantinos D. Tambalis, Demosthenes B. Panagiotakos, Glyceria Psarra, Labros S. Sidossis, 2018.[37]	Greece	Insufficient Sleep Duration Is Associated With Dietary Habits, Screen Time, and Obesity in Children	To assess sleep and lifestyle influences on obesity	Cross-sectional; questionnaire, anthropometry; logistic regression	School children	n = 177,091	42.5% of boys and 37.3% of girls had insufficient sleep; linked to dietary habits and obesity
10.	Theodosia Adom, Anniza De Villiers, Thandi Puoane and André Pascal Kengne, 2019.[38]	Ghana	Prevalence and correlates of overweight and obesity among school children in an urban district in Ghana	To identify prevalence and correlates of obesity	Cross-sectional; interview, questionnaire, anthropometry; logistic regression	Urban school children	n = 453	Watching TV >2 hours/day and attending private schools significantly related to overweight/obesity
11.	Jean-Philippe Chaput, Joel D. Barnes, Mark S. Tremblay, Mikael Fogelholm, Gang Hu, Estelle V. Lambert5, Carol Maher, Jose Maia, Timothy Olds, Vincent O, Olga L. S, Martyn S, Catrine Tudor-L and Peter T. Katzmarzyk, 2018.[18]	Global (12 countries)	Inequality n Physical Activity, Sedentary Behavior, Sleep Duration, and Risk of Obesity in Children: A 12-Country Study	To explore behavior patterns and obesity risk across countries	Cross-sectional; self-report, accelerometer; Pearson correlation	School-aged children	n = 6,128	China had the highest obesity prevalence (24.5%) and highest sedentary time (9.5 hrs/day); sedentary behavior significantly associated with obesity
12.	Haji Chomba , Haikael D. Martin, and Judith Kimywe, 2019.[39]	Tanzania / Arusha	Prevalence and Predictors of Obesity among 7- to 17-Year-Old School	To examine obesity prevalence and contributing factors	Cross-sectional; questionnaire; logistic regression	Schoolchildren aged 7–17	n = 451	Children with low physical activity and sedentary behavior had higher rates of overweight and obesity

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
			children in Urban Arusha, Tanzania					
13.	Pernilla Garmy, Eva K. Clausson , Per Nyberg and Ulf Jakobsson, 2017.[26]	Sweden	Insufficient Sleep Is Associated with Obesity and Excessive Screen Time Amongst Ten-Year-Old Children in Sweden	To determine effects of sleep and screen time on obesity	Cross-sectional; questionnaire; Chi-square, logistic regression	10-year-old children	n = 1,260	Children sleeping <9 hours/day and with ≥2 hours screen time were more likely to be overweight
14.	Jinwen Zhang, Xingming Jin, Chonghuai Yan, Fang Jiang, Xiaoming Shen and Shenghui Li, 2015.[21]	China	Short sleep duration as a risk factor for childhood overweight/obesity: a large multicentric epidemiologic study in China	To assess how sleep affects weight status in schoolchildren	Cross-sectional; questionnaire; logistic regression	Schoolchildren	n = 17,696	Children sleeping <9 hours/day had higher risk of being overweight or obese (10.7%)
15.	Eimear Keane, Xia Li, Janas M Harrington, Anthony P Fitzgerald, Ivan J Perry and Patricia M Kearney, 2017.[40]	Ireland	Physical Activity, Sedentary Behaviour and Risk of Obesity	To explore relationships between activity, sedentary time and weight	Cross-sectional; accelerometer, questionnaire; regression analysis	School-aged children	n = 826	23.7% were overweight / obese; 61.3% engaged in sedentary behavior linked to higher obesity risk
16.	John Kuumuori Ganle, Priscilla Pokuaa Boakye and Leonard Baatiema, 2019.[41]	Ghana	Childhood obesity in urban Ghana: evidence from a cross-sectional survey of in-school children aged 5–16 years	To assess the prevalence of obesity in schoolchildren	Cross-sectional; questionnaire; logistic regression	Urban in-school children aged 5–16	n = 285	46% were overweight, 21.2% obese; private school students had higher obesity prevalencev
17.	Jing Fan, Caicui Ding, Weiyan Gong , Fan Yuan, Yan Zhang, Ganyu Feng, Chao Song and Ailing Liu, 2020. [42]	China	Association of Sleep Duration and Overweight/Obesity among Children in China	To investigate sleep duration as a predictor of obesity	Cross-sectional; questionnaire; ANOVA, logistic regression	Chinese children	n = 35,414	Shorter sleep duration significantly associated with increased risk of overweight and obesity

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
18.	Jenny Vilchis-Gil, Marcia Galván-Portillo, Miguel Klünder-Klünder, Miguel Cruz and Samuel Flores-Huerta, 2015.[43]	Mexico	Food habits, physical activities and sedentary lifestyles of eutrophic and obese school children: a case–control study	To compare behaviors of eutrophic vs. obese children	Case-control; anthropometry, questionnaire; logistic regression	Schoolchildren	n = 402	Obese children had less physical activity, more sedentary behavior due to screen exposure and vehicle use
19.	Muqing Cao, Yanna Zhu, Xiuhong Li, Yajun Chen, Jun Ma, and Jin Jing, 2018.[13]	China	Gender-dependent association between sleep duration and overweight incidence in CHINESE school children: a national follow-up study	To analyze gender-based patterns in sleep and obesity	Cross-sectional; questionnaire; regression analysis	Chinese school children	n = 14,089	Girls aged 6–10 with <9 hours of sleep were more likely to be overweight compared to those sleeping >9 hrs
20.	Jing Chen, Chaoying Hu Guozhang Zeng, Chao Xu, Lijun Xu, Junxia Shi, Conway Niu and Liangwen Zhang, 2019.[20]	China / Xiamen	Trends and Prevalence of Overweight and Obesity among Children Aged 2–7 Years from 2011 to 2017 in Xiamen, China	To identify lifestyle and diet factors in obesity trends	Cross-sectional; anthropometry, questionnaire; logistic regression	Children aged 2–7	n = 56,738	High intake of fast food and sedentary behavior (TV, games) linked to increased obesity risk
21.	Indrani Godakanda, Krishanta Abesena and Ayesha Lokubalasuriya, 2018.[44]	Sri Lanka	Sedentary behavior during leisure time, physical activity and dietary habits as risk factors of overweight among school children aged 14–15 years: case control study	To examine sedentary behavior and its relation to overweight	Case-control; interviews, questionnaire; logistic regression	Schoolchildren aged 14–15	n = 880	Watching TV/DVD ≥2 hours/day and ≥4 hours sedentary time significantly increased the risk of overweight

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
22.	Sook Hyun Seo & Young Suk Shim, 2019.[22]	South Korea	Association of Sleep Duration with Obesity and Cardiometabolic Risk Factors in Children and Adolescents: A Population-Based Study	To assess sleep and cardiometabolic risk in children	Quantitative, cross-sectional; questionnaire, anthropometry; ANOVA, chi-square	Children and adolescents	n = 6,048	Children with shorter sleep had higher risk of overweight/obesity compared to recommended sleep group
23.	Y. Fatima, S. A. R. and A. A. Mamun, 2015.[19]	Global	Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis	To evaluate the long-term effect of sleep duration on obesity	Systematic review and meta-analysis; PRISMA; questionnaire	Children and adolescents	n = 24,821	Short sleep duration doubled the risk of overweight/obesity over time
24.	Peter T. K, Tiago V. B, Stephanie T. B, Catherine M. C, Jean-P C, Mikael F, Gang Hu, William D. J, Rebecca K, Anura K, Estelle V. L, Carol M, Jose M, Victor M, Timothy O, Vincent O, Olga L. Sarmiento, Martyn S, Mark S. T, Catrine T, Pei Z, and Timothy S. C, 2015.[45]	Global (12 Countries)	Relationship Between Lifestyle Behaviors and Obesity in Children Ages 9–11: Results from a 12-Country Study	To analyze global predictors of obesity in children	Quantitative, cross-sectional; accelerometer, questionnaire; regression	Children aged 9–11	n = 6,025	Watching TV and short sleep duration were significantly related to obesity and cardiometabolic risk
25.	Mohammad K.A. Khan, Yen Li Chu, Sara F.L.	Canada	Are sleep duration and sleep quality associated with diet	To examine sleep patterns in relation to body weight	Quantitative, cross-sectional; questionnaire,	Canadian children	n = 5,560	Short sleep duration, snoring, and daytime

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
	Kirk, Paul J. Veugelers, 2015.[24]		quality, physical activity, and body weight status? A population-based study of Canadian children		interviews; logistic regression			sleepiness associated with higher obesity risk
26.	Shoo Thien Lee , Jyh Eiin Wong, Safii Nik Shanita, Mohd Noor Ismail, Paul Deurenberg and Bee Koon Poh, 2015.[46]	Malaysia	Daily Physical Activity and Screen Time, but Not Other Sedentary Activities, Are Associated with Measures of Obesity during Childhood	To evaluate physical activity and screen time in relation to obesity	Quantitative, cross-sectional; questionnaire; t-test, logistic regression	School-aged children	n = 1,736	Obese children had less physical activity; screen time also contributed to obesity
27.	Herpreet Thind, Susan L. Davies, Terri Lewis, Dorothy Pekmezi, Retta Evans, and Monica L. Baskin, 2015.[14]	USA	Does Short Sleep Lead to Obesity Among Children and Adolescents? Current Understanding and Implications	To evaluate links between short sleep and weight gain	Systematic review; PRISMA; questionnaire, accelerometer	Children and adolescents	n = 52,400	Short sleep was significantly associated with obesity, particularly in younger children
28.	Sara Jalali-Farahani, Parisa Amiri and Yit Siew Chin, 2016.[47]	Iran	Are physical activity, sedentary behaviors and sleep duration associated with body mass index-for-age and health-related quality of life among high school boys and girls?	To explore factors influencing BMI and quality of life	Quantitative, cross-sectional; questionnaire; t-test	High school students	n = 465	38.5% were overweight/obese; boys had more screen and sedentary time than girls

Table 2. List of Search Results Journals

No	Author/ Year	Country/ City	Title	Objective	Design Study and Method	Population	Subject of Study (Sample size)	Result
29.	Jing Zhang, Yunting Zhang, Yanrui Jiang, Wanqi Sun, Qi Zhu, Patrick Ip, Donglan Zhang,Shijian Liu, Chang Chen, Jie Chen, Lei Zhang, Hao Zhang, Mingyu Tang, Wenfang Dong, Yufengwu, Yong Yin and Fan Jiang, 2017.[48]	China	Effect of Sleep Duration, Diet, and Physical Activity on Obesity and Overweight Elementary School Students in Shanghai	To analyze associations between lifestyle and obesity	Quantitative, cross-sectional; questionnaire; ANOVA, logistic regression	Elementary school students	n = 13,001	31.3% of boys and 23.4% of girls were overweight/obese; sleep duration and diet were key factors
30.	Eimear Keane, Xia Li, Janas M Harrington, Anthony P Fitzgerald, Ivan J Perry and Patricia M Kearney, 2017.[49]	Ireland	Physical Activity, Sedentary Behaviour and the Risk of Overweight and Obesity in School Aged Children	To examine the relationship between physical activity, sedentary behavior, and overweight/obesity in children	Quantitative, cross-sectional; questionnaire; Regretion analysis	School-aged children	n = 826	A total of 23.7% of children were overweight or obese, with 61.3% spending time in sedentary behavior. Total sedentary time was significantly associated with the risk of overweight and obesity.

Table 3. Factors Affecting the Incidence of Obesity

Influencing Factors	Empirical Source (Reference Number)
The incidence of sleep duration affects the incidence of obesity	13-20, 29-32
Sedentary behavior affects the incidence of obesity	21-26, 33-37, 39-45

affects hormones and metabolism in Greek children and adolescents.[50] They found that 42.5% of males and 37.3% of females had insufficient sleep duration, where overweight and obese females had less sleep time compared to females with a normal weight. Likewise, males with normal weight had sufficient or even more sleep time compared to males who were overweight and obese. This suggests that sex differences represent another factor requiring attention. The determination of normal sleep duration may vary between boys and girls due to differences in hormonal levels and physiological variations.[51]

Research involving Victorian Primary School students in 2016 reported that televisions or electronic game devices in children's bedrooms emerged as a confounding variable disrupting their sleep duration.[12] This is because it provides a two times greater chance that children will spend their time watching television or playing games compared to getting enough sleep. However, another study reported that excessive sleep duration (more than 10 hours per day) is associated with a higher risk of overweight and obesity.[17] Prolonged sleep may contribute to sleep disturbances that disrupt energy balance, promote weight gain, and impair glucose elimination through reduced systemic insulin activity.[43]

Based on the reviewed studies, researchers suggest that short sleep duration exerts a stronger influence on the incidence of obesity in children compared to prolonged sleep. Within the normal age-specific range, longer sleep duration is generally associated with a reduced risk of overweight and obesity.[42] Other research findings also revealed that children and adolescents who do not get enough sleep based on the normal sleep time range at their age have the potential to develop diabetes, obesity, poor mental health, injuries, behavioral problems, and poor academic achievement.[52] Therefore, the Institute of Medicine has recently recommended health promotion regarding the duration of sleep appropriate to the child's age as an early prevention of childhood obesity.[14]

Sedentary Behavior and Incidence of Obesity in School-Age Children

A sedentary lifestyle refers to patterns of behavior characterized by prolonged sitting or reclining with minimal energy expenditure. Sedentary behavior is typically assessed by measuring the amount of time spent in physical activity versus sedentary activities.[53] A study in Ghana defined high sedentary behavior as ≥4 hours per day.[54] Across different countries, sedentary time has been positively associated with higher body fat percentage, reduced physical activity, limited time spent outdoors after school, and the presence of a television or computer in a child's bedroom.[43] Among males, higher sedentary behavior was linked to greater body fat, lower activity levels, less outdoor time, and increased likelihood of having electronic devices in their rooms compared to peers without such access, regardless of diet quality. Additional findings revealed that males spent more time than females using computers, playing video and console games, and engaging in mobile gaming.[47] Researchers argue that this pattern may reflect males' stronger interest in gaming compared to females, contributing to their higher levels of sedentary activity.

A study stated that more than 50% of children are overweight and obese, and the prevalence tends to increase with age. Children aged 5—10 years old are more likely to have well-regulated food choices compared to children aged 11—16 years old.[41] For example, children aged 5—10 years tend to bring lunch to school rather than children aged 11–16 old. The older ones prefer to purchase snacks available at school. However, these foods are considered unhealthy and cause weight gain. Moreover, lifestyle patterns may also vary between different age groups. Children aged 5—10 years have more regulated sleep time and leisure time, which they spend by watching television or playing computer games. While in school, they are more active in outdoor play and recreational activities at school, while the older children frequently spend their time in classrooms.

It was found that the average length of time children spend in sedentary behavior in this study is approximately 17.5 hours per day, including sleep hours. In China, the average sedentary time is the highest, which is 9.5 hours/day.[18] In fact, it is explained in the current international recommendation

for sedentary behavior that children should not spend more than two hours per day in screen-based sedentary behavior because this has been shown to increase the risk of childhood obesity.[45] Overall, the study found that children living in rural areas with low socioeconomic status, limited physical activity, and high sedentary behavior showed a significant correlation with weight status.[36] Other research also indicates that children from lower socioeconomic backgrounds are more likely to spend their time at home in sedentary activities—such as sitting, writing, drawing, or lying down while listening to music—compared to children from higher socioeconomic groups. This pattern may be attributed to the lack of parental support and encouragement for engaging in structured or supervised physical activities among children with lower socioeconomic status. They are less likely to see their parents as role models in doing physical activity, and consider physical activity to be less important.[55] Therefore, the authors argue that it is necessary to educate the lower middle class about clean and healthy living behaviors by performing physical activity for at least 1 hour/day.

Another factor related to sedentary behavior and obesity is birth weight, which reflects the growth of the fetus.[33] Some studies suggest that high birth weight is associated with higher levels of weight gain or obesity in childhood. Normal birth weight ranges from 2,500—3,000 grams and the high birth weight in question is 3,500 grams or more.[56] In the study, it was found that children with high birth weight and prolonged sedentary behavior had a higher chance of experiencing obesity than children with normal birth weight and having a small duration of time in sedentary behavior. Other findings suggest that sedentary behavior and HDL-C are independent factors that can increase weight in children.[48] The most common sedentary activities among children were found to be watching television, playing games, and using cellphones.

Currently, the availability of school facilities – such as canteens, sports equipment, and playgrounds – can influence the incidence of obesity among school-age children. For instance, the presence of canteens offering numerous snacks, sweets, and unhealthy foods and beverages may contribute to excessive dietary intake. Children who frequently consume fast food, prefer oily foods, spend long periods watching television, and show little interest in physical activity are at a substantially higher risk of developing obesity.[20] A proper field, supplemented with various sets of sports equipment, could encourage children to exercise and engage in physical activities. Some schools have implemented programs to prevent obesity in school-age children, such as limiting fat content in foods.[57] Furthermore, schools are required to develop policies that oversee snacks and foods sold in their canteens to ensure they meet nutritional intake criteria for students. *The Planet Health* program can serve as a model for implementing obesity prevention among school-age children by promoting reduced consumption of fatty foods, increasing fruit and vegetable intake, encouraging regular physical activity, and limiting screen time.[58] Physical education in schools also plays a vital role in preventing childhood obesity. Evidence shows that children who engage in less physical activity, exhibit higher levels of sedentary behavior, and participate in school sports fewer than two days per week are at greater risk of becoming overweight or obese.[39] Conversely, children who engage in regular exercise, light physical activity, and extracurricular activities that promote energy expenditure demonstrate better physical fitness and a lower risk of obesity.51

According to Jean Watson's theory, there are ten factors that relate to the individual and are integral to nursing practice. Within this framework, nurses, in their role as educators, aim to prevent disease and promote health by providing guidance to school children and parents. Through health education, they encourage increased physical activity and adequate rest, thereby supporting the fulfillment of psychophysical and holistic needs in alignment with Watson's theory.[59] Therefore, the authors argue that the need for adequate sleep or rest, eating and drinking and physical activity are some of the basic human needs that must be met, especially in children of their age who are experiencing growth and development. Consequently, children can achieve a healthy body state and lifestyle as well as avoid obesity risk factors.

CONCLUSION

From this review, a total of 14 articles demonstrate an association between sleep duration and the incidence of obesity. In addition, 16 articles reported the impact of sedentary behavior on obesity. These findings confirm that sleep duration and sedentary behavior influence the incidence of obesity in school-age children. Thus, it is believed that the findings of this study will serve as a cornerstone to

broaden the understanding of nursing professionals on how to apply management interventions, such as health counseling, to lower the risk of obesity.

REFERENCES

1. Septiana P, Irwanto I. The Relationship between Sleep Duration and the Incidence of Obesity in Children Aged 3–8 Years. Global Medical & Health Communication. 2018;6:63–7.
2. Ogden CL, Carroll MD, Lawman HG, Fryar CD, Kruszon-Moran D, Kit BK. Trends in obesity prevalence among children and adolescents in the United States, 1988-1994 through 2013-2014. JAMA - Journal of the American Medical Association. 2016;315(21):2292–9.
3. Rizky Putri V, Angkasa D, Nuzrina R. Consumption of Fast Food, Soft Drinks, Physical Activity, and the Incidence of Overweight of Elementary School Students in Jakarta. Indonesian Journal of Human Nutrition. 2017;4(1):47–57.
4. Silwanah AS, Amaliah A, Studi P, Masyarakat K, Tinggi S, Kesehatan I. Association of Sedentary Activity With Obesity Occurrence on Elementary School-Aged Children in Sd Thamrin Makassar. 2019;9(2):122–7.
5. Jannah M, Utami TN. Factors Affecting the Occurrence of Obesity in School Children at SDN 1 Sigli, Pidie Regency. J Glob Health. 2018;1(3):110.
6. Marcdante KJ, Kliegmen RM. Nelsons Essential of Pediatrics Seventh Edition. Elsevier. 2015;
7. Ortega Becerra MA, Muros JJ, Palomares Cuadros J, Martín Sánchez JA, Cepero González M. Influence of BMI on self-esteem of children aged 12–14 years. Anales de Pediatría (English Edition). 2015;83(5):311–7.
8. Chi DL, Luu M, Chu F. A scoping review of epidemiologic risk factors for pediatric obesity : Implications for future childhood obesity and dental caries prevention research. 2017;(2).
9. Ministry of Health of the Republic of Indonesia. Limit Sedentary Activities. 2018.
10. Sedentary Behavior Research Network (SBRN). What is Sedentary Behaviour? 2017.
11. Marfuah D, Hadi H, Huriyati E. Duration and quality of sleep in relation to obesity in elementary school children in Yogyakarta City and Bantul Regency. 2013;
12. Morrissey B, Malakellis M, Whelan J, Millar L, Swinburn B, Allender S. Sleep duration and risk of obesity among a sample of Victorian school children. BMC Public Health. 2016;16(1):1–8.
13. Cao M, Zhu Y, Li X, Chen Y, Ma J, Jing J. Gender-dependent association between sleep duration and overweight incidence in CHINESE school children: A national follow-up study. BMC Public Health. 2018;18(1).
14. Thind H, Davies SL, Lewis T, Pekmezi D, Evans R, Baskin ML. Does Short Sleep Lead to Obesity Among Children and Adolescents? Current Understanding and Implications. Vol. 9, American Journal of Lifestyle Medicine. Am J Lifestyle Med. 2015;9:428–37.
15. National Sleep Foundation. Sleep Time Recommendations. 2020.
16. Cao M, Zhu Y, He B, Yang W, Chen Y, Ma J. Association between sleep duration and obesity is age-and gender-dependent in Chinese urban children aged 6-18 years: A cross-sectional study. BMC Public Health. 2015;15(1).
17. Morrissey B, Taveras E, Allender S, Strugnell C. Sleep and obesity among children: A systematic review of multiple sleep dimensions. Pediatr Obes. 2020;15.
18. Chaput JP, Barnes JD, Tremblay MS, Fogelholm M, Hu G, Lambert E V. Inequality in physical activity, sedentary behaviour, sleep duration and risk of obesity in children: a 12-country study. Obes Sci Pract. 2018;4(3):229–37.
19. Fatima Y, Doi SAR, Mamun AA. Longitudinal impact of sleep on overweight and obesity in children and adolescents: A systematic review and bias-adjusted meta-analysis. Obesity Reviews. 2015;16(2):137–49.
20. Chen J, Hu C, Zeng G, Xu C, Xu L, Shi J. Trends and Prevalence of Overweight and Obesity among Children Aged 2-7 Years from 2011 to 2017 in Xiamen, China. Obes Facts. 2019;12(4):467–88.
21. Zhang J, Jin X, Yan C, Jiang F, Shen X, Li S. Short sleep duration as a risk factor for childhood overweight/obesity: A large multicentric epidemiologic study in China. Sleep Health. 2015;1(3):184–90.

22. Seo SH, Shim YS. Association of Sleep Duration with Obesity and Cardiometabolic Risk Factors in Children and Adolescents: A Population-Based Study. Sci Rep. 2019;9(1).
23. Melinda TF, Sekartini R. Association between obesity and sleep disorders in primary school children: A cross-sectional study. Medical Journal of Indonesia. 2019;28(2):167–73.
24. Khan MKA, Chu YL, Kirk SFL, Veugelers PJ. Are sleep duration and sleep quality associated with diet quality, physical activity, and body weight status? A population-based study of Canadian children. Canadian Journal of Public Health. 2015;106(5):277–82.
25. Chaput JP, Dutil C. Lack of sleep as a contributor to obesity in adolescents: impacts on eating and activity behaviors. Int J Behav Nutr Phys Act. 2016;13(1):103.
26. Garmy P, Clausson EK, Nyberg P, Jakobsson U. Insufficient Sleep Is Associated with Obesity and Excessive Screen Time Amongst Ten-Year-Old Children in Sweden. J Pediatr Nurs. 2018;39:1–5.
27. Chen IH, Lin YC, Chen YH. Association between screen time and sleep duration among children and adolescents: A cross-sectional study. BMC Pediatr. 2020;20(1):306.
28. Hysing M, Pallesen S, Stormark KM, Jakobsen R, Lundervold AJ, Sivertsen B. Sleep and use of electronic devices in adolescence: results from a large population-based study. BMJ Open. 2015 Jan 2;5(1):e006748.
29. Kim SY, Oh YJ, Lim MH, Youn HS, Jung HW, Kim HS. ssociation between sleep duration and childhood obesity: The Korea National Health and Nutrition Examination Survey 2008–2011. BMC Public Health. 2015;15(1):1044.
30. Besedovsky L, Lange T, Born J. Sleep and immune function. Pflugers Arch. 2012 Jan 10;463(1):121–37.
31. Spiegel K, Tasali E, Penev P, Cauter E Van. Brief Communication: Sleep Curtailment in Healthy Young Men Is Associated with Decreased Leptin Levels, Elevated Ghrelin Levels, and Increased Hunger and Appetite. Ann Intern Med. 2004 Dec 7;141(11):846–50.
32. Nakano S, Hirano C, Hotta K, Fujita Y, Yanagi H. Factors associated with overweight status, obesity, and sedentary behavior in elementary and junior high school students. Phys Ther Res. 2019;20(2):66–72.
33. Qiao Y, Zhang T, Liu H, Katzmarzyk PT, Chaput JP, Fogelholm M. Joint association of birth weight and physical activity/sedentary behavior with obesity in children ages 9-11 years from 12 countries. Obesity. 2017;25(6):1091–7.
34. LeBlanc AG, Katzmarzyk PT, Barreira T V., Broyles ST, Chaput JP, Church TS. Correlates of total sedentary time and screen time in 9-11 year-old children around the world: The international study of childhood obesity, lifestyle and the environment. PLoS One. 2015;10(6).
35. Wu Y, Gong Q, Zou Z, Li H, Zhang X. Short sleep duration and obesity among children: A systematic review and meta-analysis of prospective studies. Obes Res Clin Pract. 2017 Mar;11(2):140–50.
36. Daly CM, Foote SJ, Wadsworth DD. Physical Activity, Sedentary Behavior, Fruit and Vegetable Consumption and Access: What Influences Obesity in Rural Children? J Community Health. 2017;42(5):968–73.
37. Tambalis KD, Panagiotakos DB, Psarra G, Sidossis LS. Insufficient sleep duration is associated with dietary habits, screen time, and obesity in children. Journal of Clinical Sleep Medicine. 2018;14(10):1689–96.
38. Adom T, De Villiers A, Puoane T, Kengne AP. Prevalence and correlates of overweight and obesity among school children in an urban district in Ghana. BMC Obes. 2019;6(1).
39. Chomba H, Martin HD, Kimywe J. Prevalence and Predictors of Obesity among 7-to 17-Year-Old Schoolchildren in Urban Arusha, Tanzania. J Nutr Metab. 2019;
40. Keane E, Li X, Harrington JM, Fitzgerald AP, Perry IJ, Kearney PM. Physical activity, sedentary behavior and the risk of overweight and obesity in school-aged children. Pediatr Exerc Sci. 2017;29(3):408–18.
41. Ganle JK, Boakye PP, Baatiema L. Childhood obesity in urban Ghana: evidence from a cross-sectional survey of in-school children aged 5–16 years. BMC Public Health. 2019 Dec 26;19(1):1561.
42. Fan J, Ding C, Gong W, Liu A, Yuan F, Zhang Y. Association of sleep duration and overweight/obesity among children in China. Int J Environ Res Public Health. 2020;17(6).

43. Vilchis-Gil J, Galván-Portillo M, Klünder-Klünder M, Cruz M, Flores-Huerta S. Food habits, physical activities and sedentary lifestyles of eutrophic and obese school children: A case-control study. BMC Public Health. 2015;15(1).
44. Godakanda I, Abeysena C, Lokubalasooriya A. Sedentary behavior during leisure time, physical activity and dietary habits as risk factors of overweight among school children aged 14-15 years: Case control study. BMC Res Notes. 2018;11(1).
45. Katzmarzyk PT, Barreira T V., Broyles ST, Champagne CM, Chaput JP, Fogelholm M. Relationship between lifestyle behaviors and obesity in children ages 9-11: Results from a 12-country study. Obesity. 2015;23(8):1696–702.
46. Lee ST, Wong JE, Shanita SN, Ismail MN, Deurenberg P, Poh BK. Daily physical activity and screen time, but not other sedentary activities, are associated with measures of obesity during childhood. Int J Environ Res Public Health. 2015;12(1):146–61.
47. Jalali-Farahani S, Amiri P, Chin YS. Are physical activity, sedentary behaviors and sleep duration associated with body mass index-for-age and health-related quality of life among high school boys and girls? Health Qual Life Outcomes. 2016;14(1).
48. Zhang J, Zhang YT, Jiang YR, Sun WQ, Zhu Q, Ip P. Effect of Sleep Duration, Diet, and Physical Activity on Obesity and Overweight Elementary School Students in Shanghai. Journal of School Health. 2018;88(2):112–21.
49. Keane E, Li X, Harrington JM, Fitzgerald AP, Perry IJ, Kearney PM. Physical Activity, Sedentary Behavior and the Risk of Overweight and Obesity in School-Aged Children. Pediatr Exerc Sci. 2017 Aug;29(3):408–18.
50. Tambalis KD, Panagiotakos DB, Sidossis LS, Kavouras SA, Tokmakidis SP. Correlates of sleep duration in Greek children and adolescents. Sleep Med. 2011;12(5):510–6.
51. Short MA, Gradisar M, Lack LC, Wright HR, Dohnt H. The sleep patterns and well-being of Australian children. J Paediatr Child Health. 2011;47(1–2):25–30.
52. Wheaton AG, Jones SE, Cooper AC, Croft JB. hort Sleep Duration Among Middle School and High School Students — United States 2015. 2018;67(3).
53. Kurdaningsih S, Sudargo T, Lusmilasari L, Sv K. physical activity and seedentaary lifestyle towards teenagers overweight/obesity status. 2016;
54. Asare M, Danquah S. The relationship between phyical activity, sedentary behaviour and mental health in Ghanaian adolecents. 2015;
55. Lampinen EK, Eloranta AM, Haapala EA, Lindi V, Väistö J, Lintu N. Physical activity, sedentary behaviour, and socioeconomic status among Finnish girls and boys aged 6–8 years. Eur J Sport Sci. 2017;17(4):462–72.
56. Qiao Y, Ma J, Wang Y, Li W, Katzmarzyk PT, Chaput JP. Birth weight and childhood obesity : a 12-country study. 2015;74–9.
57. Suiraoka IP. PREVENTION AND CONTROL OF OBESITY IN SCHOOL CHILDREN. 2015;
58. Indrawati F. School-Based Exercise Approach in Overcoming Obesity in Children. 2015;5.
59. Ibrahim BI. The Relationship of Physical Activity and the Incidence of Obesity in Adolescents at SMAN 1 Gamping Sleman Yogyakarta Manuscript. 2018;33(1):37–49.