Obesogenic behaviour in school-age children: A cross-sectional study

Akifa Syahrir[1, 2] iD
Akbar Harisa[2] iD
Nur Fadilah[2] iD
Yodang Yodang[3*] iD

[1] Department of Nursing, Politeknik Kesehatan Kemenkes Gorontalo, Gorontalo, Indonesia
[2] Department of Nursing, Universitas Hasanuddin, Makassar, Indonesia
[3] School of Nursing, Faculty of Science and Technology, Universitas Sembilanbelas November Kolaka, Sulawesi Tenggara, Indonesia

*Correspondence:
Yodang Yodang
School of Nursing, Faculty of Science and Technology, Universitas Sembilanbelas November Kolaka, Indonesia, Jln Pemuda No. 339 Tahoa, Kolaka, Sulawesi Tenggara, Phone +6282291410745, Postal code 93517
Email: yodang.usnkolaka@gmail.com

ABSTRACT

Background: Obesogenic behaviour, characterized by a lack of physical activity, extended periods of watching television, and insufficient consumption of nutritious food, significantly contributes to the risk of obesity in children. The highlights the importance of addressing these behavioural risk factors to combat the growing trend of childhood obesity.

Objective: To determine the characteristics of obesogenic behaviour in school-age children in Makassar City.

Methods: This study used quantitative research with a cross-sectional design. This research was conducted from July to September 2021 in three elementary schools located in Makassar. The research used purposive sampling for participant selection, and data collection was carried out using questionnaires completed by the respondents. For data analysis, the study applied spearman correlation and chi-square tests.

Results: In this study involving 209 students, predominantly male (50.7%), 11 years old (46.4%), living in urban areas (56%), and overweight (54.1%), the spearman correlation test revealed a strong correlation between BMI (p=0.005) and obesogenic behaviour. Additionally, the chi-square test indicated significant associations of gender (p=0.027) and living region (p=0.012) with obesogenic behaviour.

Conclusion: The study found a significant relationship between gender, domicile, BMI, and nutritional status, and their impact on children's obesogenic behaviour. These findings underline the importance of further research with a larger sample size of elementary school students to explore additional characteristics influencing obesogenic behaviours.

Keywords: elementary school; child-obesity; obesogenic behaviours

INTRODUCTION

School-age children, defined as those aged 6-12 years, experience school as a fundamental aspect of life. This period allows them to acquire essential knowledge and adapt to life as future adults (Hockenberry & Wilson 2015). At the end of 2019, a virus outbreak, later declared a pandemic, significantly impacted health, social, and economic sectors (Pietrobelli et al., 2020). Following the discovery of COVID-19 in Indonesia and

Nursing and Healthcare Practices

- *This research emphasises the importance of providing information regarding the obesogenic behaviour of children, particularly in suburban and urban areas.*
- *Families and caregivers can improve and maintain children's eating behaviour by actively seeking and exploring information about the importance of maintaining healthy eating in children.*
- *Nurses play a crucial role in the early detection of obesogenic behaviour by conducting interviews and collecting family health history during examinations at each child's hospital visit.*

its escalation to a pandemic, the government implemented various policies like lockdowns, self-isolation, remote work, online schooling, and large-scale social restrictions. These measures necessitated adaptations to new habits, including virtual activities for all age groups, especially school-age children (Kristiyanto et al., 2020).

During the COVID-19 pandemic, children were confined to their homes, transitioning to online classes and forgoing regular physical activities, sports, and peer interactions (Nicodemo et al., 2021). The lockdown restrictions limited physical movement, leading to reduced physical activity and an increase in sedentary behavior among children (Stavridou et al., 2021). This shift towards more sedentary lifestyles and increased screen time, coupled with reduced physical activity, has been linked to an elevated risk of obesity (Mattioli et al., 2020).

Obesogenic behavior, which increases the risk of obesity in childhood, includes lack of physical activity, high screen time, and skipping breakfast (Schröder et al., 2018). Changes in the food environment and eating habits further heighten this risk (Howard et al., 2017). Data from the Centers for Disease Control and Prevention (CDC) (2021) highlight that child obesity remains a critical issue. In 2017-2018, the prevalence of obesity in US children aged 6-11 years was 20.3%, and 21.2% in those aged 12-19 years (World Obesity Federation, 2021).

In 2016, approximately 340 million children and adolescents were afflicted with excess nutrition, manifesting as excessive body weight and obesity. The prevalence of overweight and obesity has been on a rising trajectory. In 1975, the incidence among children aged 5-19 years was approximately 4%, which escalated to 18% by 2016 (World Health Organization, 2022). The World Obesity Federation projects a stark increase in obesity amongst children and adolescents (aged 5-19 years), forecasting a rise to 206 million by 2025 and further to 254 million by 2030. Projections for 2030 indicate the highest numbers of obese children and adolescents in the following countries: China with an anticipated 61,987,920; India with 27,481,141; the USA with 16,986,603; and Indonesia ranking fourth, expecting around 9,076,416 cases of obesity (Lobstein & Brinsden, 2019). The Health Research of Indonesia report highlighted data from South Sulawesi, revealing an obesity prevalence of 6.54% and 7.83% in children aged 5-12 years. The highest prevalence rates were recorded in Makassar City (11.82%), the Selayar Islands (11.67%), and Sidenreng Rappang (8.83%) (South Sulawesi Province Riskesdas Report, 2018).

One approach to understanding the risk of childhood obesity during the COVID-19 pandemic involves examining children's obesogenic behaviours, as noted by Burkart et al. (2022) Contemporary children increasingly exhibit obesogenic behaviours such as excessive screen time, consumption of foods and beverages high in glucose, and insufficient sleep (Schröder et al., 2018). The focus of this study is to analyse the determinants of these obesogenic behaviours in primary school-aged children during the COVID-19 pandemic.

METHODS

Design

This study applied a quantitative approach with a cross-sectional design. The cross-sectional design of the study means that the data is gathered at a specific point in time, providing a snapshot of the situation as it exists currently, rather than observing changes over an extended period as in longitudinal studies.

Sample and Setting

In this study, the targeted population consisted of primary school students studying in the Makassar City area. The participants recruited were students residing in both urban and semi-urban localities. Selection of participants was conducted using the census method. A total of 209 students participated in this research. The inclusion criteria encompassed pupils in Years 4, 5, and 6 who had experienced weight gain during the pandemic and were willing to participate as respondents. Conversely, the exclusion criteria applied to students who were unwell or had lost weight prior to the commencement of data collection.

Variable

The dependent variable in this study was obesogenic behaviour, while the independent variables were age, gender, region of living, and Body Mass Index (BMI).

Instruments

The research instrument employed in this study is a questionnaire, which is divided into two main sections: socio-demographics and eating behaviour. The socio-demographic section of the questionnaire gathers information on age, gender, class/grade, and region of residence. The eating behaviour or obesogenic behaviour is measured using a modified version of the Child Eating Behaviour Questionnaire (CEBQ). This questionnaire comprises 35 items, utilising a 5-point Likert scale ranging from 'never' to 'always' (Purwaningrum et al, 2020). The

questionnaire, which has undergone validity and reliability testing, boasts a Cronbach's Alpha value of 0.957. It encompasses aspects such as physical activity, sedentary lifestyle, diet, and sleep patterns. To assess the students' body weight, observation sheets will be used in conjunction with anthropometric measuring tools. These include equipment to measure height in meters and weight scales. Subsequently, the anthropometric data collected will be converted using the BMI tool.

Data Collection

The questionnaires were provided in paper-based. All students participating in this study were required to sign an informed consent form prior to answering and completing the questionnaires. Teachers, acting as proxies for the students, provided support and assistance to the pupils throughout the data collection process. Due to the COVID-19 all researchers who collected the data had followed the COVID-19 protocol such as wore face-mask, washed the hand, and kept the physical distance between each student.

Data Analysis

This study aimed to identify obesogenic behaviour in children during the COVID-19 pandemic, employing a research questionnaire comprising 19 statements specifically related to obesogenic behaviour. These statements had undergone validity testing, achieving an r table value above 0.361 when assessed using the pearson product moment method. Additionally, reliability testing was conducted, with the

Table 1. Characteristics Respondents of School Age Children.

Characteristics	Category	n	%
Age	8	2	1.0
	9	35	16.7
	10	61	29.2
	11	97	46.4
	12	11	5.3
	13	3	1.4
Gender	Male	106	50.7
	Female	103	49.3
Region of living	Urban	117	56.0
	Semi-urban	92	44.0
Body mass index	Underweight	32	15.3
	Normal	64	30.6
	Overweight	113	54.1

Syahrir, A., Harisa, A., Fadilah, N., & Yodang, Y. (2024). Obesogenic behaviour in school-age children: A cross-sectional study. *The Journal of Palembang Nursing Studies. 3*(1), 14-21. http://dx.doi.org/10.55048/jpns108

Table 2. Relationship between respondent characteristics and obesogenic behaviour of school-age children in Makassar City.

Variable	Obesogenic Behaviour	
	Correlation (r)	p-value
Age (in years)	0.136	0.050
Height (cm)	0.087	0.212
Weight (kg)	0.095	0.170
Arm circumference	-0.064	0.359
Body mass index	0.195	0.005
Nutritional status	0.566	0.042

Table 3. Relationship between respondent characteristics based on gender and domicile and obesogenic behaviour of school-age children in Makassar City

Variable	Obesogenic Behaviour			p-value
	Good	Medium	Low	
	n (%)	n (%)	n (%)	
Gender				
Male	12 (11.32)	62 (58.49)	32 (30.19)	0.027
Female	14 (13.59)	68 (66.02)	21 (20.39)	
Region of living				
Urban	3 (2.56)	78 (66.67)	41 (35.04)	0.012
Semi-urban	5 (5.43)	62 (67.39)	25 (27.17)	

questionnaire achieving a cronbach's alpha of 0.8. For statistical analysis, the study utilised the chi-square test and spearman correlation test to test the hypothesis. The results of the research were presented in both univariate and bivariate forms. The objective of this presentation format was to comprehensively understand obesogenic behaviour in children during the COVID-19 pandemic.

Ethical Consideration

This research received approval from the Hasanuddin University Ethics Committee, under the reference number 6972/UN.414.1/TP.01.02/2021. This approval was granted with due consideration to each principle outlined in the research implementation protocol.

RESULTS

A total of 209 students voluntarily participated in this study. The characteristics of the participants were categorised into gender, age in years, region of residence, and BMI (Table 1). The majority of the participants were male (50.7%), aged eleven years (46.4%), resided in urban areas (56%), and were classified as overweight according to their BMI (54%).

Table 2 illustrates that there is a significant correlation in obesogenic behaviour, particularly with BMI, indicated by values (p < 0.05). Regarding the relationship between the classification of obesogenic behaviour and gender, the correlation strength (r) is identified as 0.195, suggesting that the correlation is weak.

Table 3 presents the results of the chi-square test. The p-values observed in the study indicate significant relationships in two key areas: the relationship between obesogenic behaviour and the child's gender, with a p-value of 0.027, and the relationship between obesogenic behaviour and the child's domicile, with a p-value of 0.012. Based on these findings, it can be concluded that there is a statistically significant relationship between both gender and domicile and obesogenic behaviour in children.

DISCUSSION

The relationship between gender and obesogenic behaviour

This study found a significant association between gender and obesogenic behaviour in children ($p < 0.05$), aligning with the findings of (Noh & Min, 2020). Their research highlighted a higher prevalence of obesogenic behaviour among boys, consistent with several previous studies focused on children and adolescents aged 7 to 18 years in primary schooling in China.

Song et al. (2016) suggest that the differences in overweight rates between girls and boys may stem from biological, cultural, and societal factors. Boys and girls differ in body composition, patterns of weight gain, hormone biology, and their susceptibility to various social, ethnic, genetic, and environmental factors. Gender differences in the prevalence of childhood obesity have been observed in numerous countries. Studies have reported varying prevalence rates, with some indicating a higher incidence of overweight and obesity in girls than boys, and others showing the opposite. Recent research has also pointed out gender differences in behavioral determinants of overweight, including caloric intake and physical activity.

Furthermore, the prevalence of obesity in children aged 5-12 years in South Sulawesi, as highlighted in the 2018 Riskesdas report, also reflects these gender disparities. The report noted that the majority of obese children were male (7.74%), while the majority of overweight children were female (8.40%) (Report of South Sulawesi Province Riskesdas, 2018).

The relationship between domicile and obesogenic behaviour

One key factor influencing children's eating habits is the home environment, which also affects their physical activity and sedentary lifestyle patterns (Mihrshahi et al., 2018). This encompasses the availability of sweetened foods and soft drinks, as well as the tendency of children to consume readily available snacks at home. Nurwanti et al. (2019) noted that urban areas provide greater access to a variety of processed, soft foods and drinks high in sugar and fat compared to rural areas. Moreover, the prevalence of advertisements for unhealthy food and beverages in urban media further encourages unhealthy eating behaviours in children. In contrast, children in rural areas exhibit lower consumption of fast food, attributed to the greater distance from fast food providers (Brazendale et al., 2021).

A diet low in healthy foods, coupled with excessive intake of processed foods, is linked to adverse health outcomes in children, including overweight, impaired insulin and lipid profiles, reduced HDL, and elevated triglycerides (Schröder et al., 2018). Concurrently, parental feeding practices significantly impact children's eating behaviour. In urban areas, some mothers face time constraints, hindering their ability to prepare meals. This limitation often leads to a reliance on ready-to-eat foods such as sausages, nuggets, or bread, rather than traditional dishes (Mihrshahi et al., 2018).

The relationship between BMI and obesogenic behavior

This study indicates that BMI is weakly correlated with obesogenic behaviour in children during the COVID-19 pandemic. This correlation is linked to specific behaviours, such as a lack of physical activity, unhealthy eating patterns, excessive consumption of sweet foods and drinks, and frequent snacking habits (Mihrshahi et al., 2018). Such unhealthy obesogenic behaviours have led to obesity in children becoming a significant public health concern, as evidenced by the increasing trend in BMI over recent years (Report of South Sulawesi Province Riskesdas, 2018).

Obesogenic behaviour generally causes an imbalance between food consumption and energy expenditure, contributing to the incidence of obesity. High caloric intake coupled with a sedentary lifestyle results in excessive fat accumulation in the body, consequently increasing body weight and BMI (Zhang et al., 2018). While many factors contribute to rising BMI in children, a sedentary lifestyle is considered one of the most influential factors in the incidence of obesity during the COVID-19 pandemic (Browne et al., 2021).

Pandemic-related restrictions have also limited children's access to outdoor play with peers, leading them to spend more time indoors engaged in activities such as playing video games, watching television, and blogging. These activities, which involve minimal physical movement, are often accompanied by the consumption of unhealthy drinks and snacks, thereby contributing to an increase in BMI.

Noh & Min (2020) suggest that the incidence of obesity in children can be mitigated by encouraging physical activity at school, for example, by increasing opportunities for extracurricular activities, physical education, and play. However, the closure of schools and public facilities due to the pandemic has led to a decrease in physical activity opportunities. Despite some cities keeping play facilities open during the pandemic, concerns about maintaining hygiene in these open environments and difficulties in enforcing social distancing among children have led to underutilisation of these spaces. Additionally, to reduce trips outside the home, parents have tended to stock up on longer-lasting foods such as flour, noodles, chips, drinks, and snacks, which are often nutritionally poor processed foods, leading to a diet high in calories that supports an increase in BMI (Rezaeipour, 2021). Thus, it can be inferred that parents play an indirect but significant role in the risk of obesity in children.

Analysis of the relationship of nutritional status to obesogenic behavior

Based on the results of the study, it was shown that body weight did not correlate with obesogenic behaviour in school-age children during the COVID-19 pandemic. This is in contrast to the research conducted by Vogel et al. (2021), who stated that children and adolescents experienced a significant increase in body weight during the COVID-19 pandemic due to the rapid changes in their daily routines. For many people, these changes have made their daily routines less structured and have also posed a risk for obesogenic behaviour (Burkart et al. 2021).

A study indicates that approximately 42% of children have developed the habit of eating more food during a pandemic and consuming an additional meal per day. Moreover, children are also consuming more sweet foods, drinks, and red meat. Apart from the COVID-19 restrictions that have been imposed, which have disrupted children's daily routines, school closures and a lack of children's play activities are also considered triggering factors for changes in eating behaviour. It is suspected that these restrictions cause stress and feelings of boredom in children (Dunton, Do & Wang 2020).

The limitations on children's play activities have led them to spend more time playing at home. However, screen time activities may be an option for school-age children during this time. This is consistent with the research conducted by Dunton, Do & Wang (2020), which indicates that children spend approximately 90 minutes on study-related activities but contribute 8 hours to internet use or simply hanging out with family. All of these activities do not encourage much physical movement. However, this also affects adults who are under social restrictions, such as isolation, which has been shown to increase the risk of sedentary behaviour associated with unhealthy behaviour and poor outcomes. This sedentary behaviour is primarily a result of social isolation, which creates a barrier for mature individuals to engage in physical activity.

CONCLUSION

The results of the analysis that has been carried out regarding children's obesogenic behaviour during the COVID-19 pandemic can be concluded that there is a significant relationship between gender, region of living and BMI in children on children's obesogenic behaviour. Suggestions from the research are that it is necessary to periodically monitor the increase in children's weight during the pandemic and expand other factors that can cause an increase in children's weight during the COVID-19 pandemic in Makassar City for research. It is hoped that this research can become input and new references in the development of research related to weight gain during the pandemic, especially in school-age children.

Data Availability

Authors can be contacted to access datasets created for and/or used in this study.

REFERENCES

Brazendale, K., Rayan, S., & Eisenstein, D. (2021). Obesogenic behaviors of rural children on school and nonschool days. *Childhood Obesity, 17*(7), 483-492. https://doi.org/10.1089/chi.2021.0084

Browne, T. B., Snethen, J. A., Greenberg, C. S., Frenn, M., Kilanowski, J. F., Cleveland, B. G., Burke, P. J., & Lewandowski, L. (2021) When pandemics collide: The impact of COVID-19 on childhood obesity. *Journal of Pediatric Nursing, 56*, 90. https://doi.org/10.1016/j.pedn.2020.11.004

Burkart, S., Parker, H., Weaver, R. G., Beets, M. W., Jones, A., Adams, E. L., Chaput, J. P., & Armstrong, B. (2022). Impact of the COVID-19 pandemic on elementary schoolers' physical activity, sleep, screen time and diet: A quasi-experimental interrupted time series study. *Pediatric Obesity, 17*(1), 1–11. https://doi.org/10.1111/ijpo.12846

Centers for Disease Control and Prevention (CDC). (2021). *Childhood Obesity Facts*. Prevalence of Childhood Obesity in the United States.

Dunton, G. F., Do, B., & Wang, S. D. (2020). Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the US. *BMC public health, 20*(1), 1-13. https://doi.org/10.1186/s12889-020-09429-3

Hockenberry;, M. J., & Wilson, D. (2015). *Wong's Nursing Care of Infants and Children* (10th edition). Elseiver.

Howard, J. B., Skinner, A. C., Ravanbakht, S. N., Brown, J. D., Perrin, A. J., Steiner, M. J., & Perrin, E. M. (2017). Obesogenic behavior and weight-based stigma in popular children's movies, 2012 to 2015. *Pediatrics, 140*(6). https://doi.org/10.1542/peds.2017-2126

Badan Penelitian dan Pengembangan Kesehatan. (2019). *Laporan Provinsi Sulawesi Selatan Riskesdas 2018*. Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan. Jakarta.

Kristiyanto, R. Y., Chandra, L., Hanjaya, H., Hakim, M. S., & Nurputra, D. K. (2020). School reopening: Evidence-based recommendations during COVID-19 pandemic in Indonesia. *Journal of Community Empowerment for Health, 4*(1), 1–14. https://doi.org/10.22146/jcoemph.57524

Mattioli, A. V., Pinti, M., Farinetti, A., & Nasi, M. (2020). Obesity Risk During Collective Quaranrine for The COVID-19 Epidemic. *Obesity Medicine, 20*. https://doi.org/10.1016/j.obmed.2020.100263

Mihrshahi, S., Drayton, B. A., Bauman, A. E., & Hardy, L. L. (2018). Associations between childhood overweight, obesity, abdominal obesity and obesogenic behaviors and practices in Australian homes. *BMC Public Health, 18*(1), 1–10. https://doi.org/10.1186/s12889-017-4595-y

Nicodemo, M., Spreghini, M. R., Manco, M., Sforza, R. W., & Morino, G. (2021). Childhood obesity and COVID-19 lockdown: Remarks on eating habits of patients enrolled in a food-education program. *Nutrients, 13*(2), 1–11. https://doi.org/10.3390/nu13020383

Nurwanti, E., Hadi, H., Chang, J.-S., Paramashati, B. A., & Gittelson, J. (2019). Rural–urban differences in dietary behavior and obesity: Result of the Riskesdas study in 10-18 year old Indonesian children and adolescent. *Nutrients, 11*(2813), 1–14.

Noh, K., & Min, J. J. (2020). Understanding school-aged childhood obesity of body mass index: Application of the social-ecological framework. *Children, 7*(9), 134. https://doi.org/10.3390/children7090134

Pietrobelli, A., Pecoraro, L., Ferruzzi, A., Heo, M., Faith, M., Zoller, T., Antoniazzi, F., Piacentini, G., Fearnbach, S. N., & Heymsfield, S. B. (2020). Effects of COVID-19 lockdown on lifestyle behaviors in children with obesity living in Verona, Italy: A longitudinal study. *Obesity, 28*(8), 1382–1385. https://doi.org/10.1002/oby.22861

Purwaningrum, D. N., Arcot, J., Hadi, H., Hasnawati, R. A., Rahmita, R. S., & Jayasuriya, R. (2020). A cultural adaptation and validation of a child eating behaviour measure in a low-and middle-income country. *Public Health Nutrition, 23*(11), 1931-1938. https://doi.org/10.1017/S136898001900510X

Rezaeipour, M. (2021). Effects of two water-based exercise programs on body weight and blood lipid parameters in elderly obese males with a sedentary lifestyle. *Diabetes & Metabolic Syndrome: Clinical*

Research & Reviews, 15(4). https://doi.org/10.1016/j.dsx.2021.102194

Schröder, H., Bawaked, R. A., Ribas-Barba, L., Izquierdo-Pulido, M., Roman-Viñas, B., Fíto, M., & Serra-Majem, L. (2018). Cumulative effect of obesogenic behaviours on adiposity in Spanish Children and Adolescents. *Obesity Facts, 10*(6), 584–596. https://doi.org/10.1159/000480403

Song, Y., Wang, H.-J., Dong, B., Ma, J., Wang, Z., & Agardh, A. (2016). 25-year trends in gender disparity for obesity and overweight by using WHO and IOTF definitions among Chinese school-aged children: a multiple cross-sectional study. BMJ Open, 6(9). https://doi.org/10.1136/bmjopen-2016-011904

Stavridou, A., Kapsali, E., Panagouli, E., Thirios, A., Polychronis, K., Bacopoulou, F., Psaltopoulou, T., Tsolia, M., Sergentanis, T. N., & Tsitsika, A. (2021). Obesity in children and adolescents during COVID-19 pandemic. *Children, 8*(2), 1–16. https://doi.org/10.3390/children8020135

Vogel, M., Meigen, C., Sobek, C., Ober, P., Igel, U., Körner, A., ... & Poulain, T. (2021). Well-being and COVID-19 related worries of German children and adolescents: A longitudinal study from pre-COVID to the end of lockdown in Spring 2020. *JCPP advances, 1*(1). https://doi.org/10.1111/jcv2.12004

World Obesity Federation. (2019). Atlas of Childhood Obesity. *World Obesity Federation, 211.*

Zhang, J., Zhai, Y., Feng, X. Q., Li, W. R., Lyu, Y. Bin, Astell-Burt, T., Zhao, P. Y., & Shi, X. M. (2018). Gender differences in the prevalence of overweight and obesity, associated behaviors, and weight-related perceptions in a national survey of primary school children in China. *Biomedical and Environmental Sciences, 31*(1), 1–11. https://doi.org/10.3967/bes2018.001