IJHESS
International Journal of Health, Economics, and Social Sciences
PUBLISHER:
Universitas Muhammadiyah Palu
ISSN: 2685-6689
SINTA 2

Early Childhood Lifestyle Interventions Based on KAIH and Their Impact on BMI for Age Nutritional Status: A Cross-Sectional Study

Jesica Mulyadi[1*], Dian Pratiwi Iman[2], Sitty Fadhilla Fitrianty Lahay[2], Sulaiman Putra Nagaring[2], Riska Nuryana[1]
[1]Department of Midwifery, Faculty of Medicine, Universitas Negeri Gorontalo, Indonesia
[2]Department of Public Health, Faculty of Medicine, Universitas Negeri Gorontalo, Indonesia
***Corresponding author:** Jesica Mulyadi. E-mail: jesicamulyadi25@ung.ac.id

ABSTRACT

Early childhood is a critical period for establishing lifelong health behaviors. The *Kebiasaan Anak Indonesia Hebat (KAIH)* program was developed as an integrated behavioral approach to promote healthy lifestyles among preschool children. However, evidence regarding the association between KAIH components and nutritional status remains limited. This study aimed to examine the association between KAIH components and nutritional status based on body mass index-for-age (BMI-for-age) among kindergarten students at *Taman Kanak-kanak Aisyiyah Bustanul Athfal*. An analytical observational study with a cross-sectional design and retrospective behavioral assessment was conducted among 65 kindergarten students at *Taman Kanak-kanak Aisyiyah Bustanul Athfal*, Gorontalo, Indonesia, in October 2025. Total sampling was applied. Data on KAIH behaviors were collected through structured daily reports submitted by students for seven consecutive days. Nutritional status was assessed using BMI according to the Indonesian National Anthropometric Standards. Bivariate analysis was performed using the chi-square test, followed by multivariate logistic regression analysis. More than 80% of participants implemented KAIH components integratively, and most children were categorized as having normalF nutritional status (78.47%). Bivariate analysis demonstrated significant associations between nutritional status and physical activity ($p<0.001$), balanced nutrition ($p=0.01$), sleep timing ($p=0.002$), and wakes up early ($p=0.003$). However, multivariate analysis showed that no single variable independently dominated nutritional status after adjustment for all behavioral components. Nutritional status among kindergarten students is influenced by multidimensional and interconnected behavioral factors, including physical activity, dietary habits, dan sleep patterns. Integrated health-promotion strategies based on healthy lifestyle behaviors may contribute to optimal nutritional outcomes and obesity prevention during early childhood.

Keywords: Kindergarten Students; Body Mass Index; Nutritional Status; Healthy Lifestyle; KAIH

ARTICLE IDENTIFIERS

ORIGINAL ARTICLE
Volume 8 - Issue 4 - 2026
Pages 1155-1161
DOI: 10.56338/ijhess.v8i4.11746

ARTICLE HISTORY

Received: 06 July, 2026
Revised: 15 October, 2026
Accepted: 26 October, 2026

CC BY-SA 4.0

INTRODUCTION

Early childhood is a critical developmental period for the establishment of lifelong health behaviors and metabolic regulation. During this stage, rapid physical growth and neurocognitive maturation increase children's susceptibility to behavioural and environmental influences that may shape future health outcomes (Wang et al., 2019). Evidence suggests that lifestyle interventions initiated during early childhood are more effective in preventing obesity and non-communicable diseases than interventions introduced later in life, as health-related behaviors during this period remain relatively modifiable (Kenney et al., 2023). Consequently, promoting healthy lifestyle behaviors in early childhood has become an important public health strategy to improve long-term population health. Body mass index (BMI) is widely used as an anthropometric indicator for assessing nutritional status in paediatric populations and has strong predictive value for future metabolic and cardiovascular outcomes (Jeong et al., 2023). Both elevated and low BMI during childhood are associated with adverse health consequences.

Childhood overweight and obesity increase the risk of hypertension, dyslipidaemia, insulin resistance, and cardiovascular disease later in life, whereas undernutrition remains associated with impaired growth, weakened immunity, and suboptimal cognitive development, particularly in developing countries (Langeveld & Devries, 2015; Silventoinen et al., 2022). These conditions reflect the persistent double burden of malnutrition, which requires multidimensional preventive approaches. Recent studies have demonstrated that nutritional status in children is influenced not only by dietary intake but also by multiple interconnected lifestyle behaviors, including physical activity, sleep patterns, sedentary behaviour, and psychosocial environments (Chaput et al., 2020). Low physical activity and excessive sedentary behaviour contribute to positive energy imbalance and increased obesity risk, while inadequate sleep duration and poor sleep quality have been linked to obesity and mental health disorders among children (Ferentinou et al., 2025). In addition, social interaction and cognitive stimulation may influence self-regulation and healthy behavioural development, which subsequently affect nutritional status.

In Indonesia, the *Kebiasaan Anak Indonesia Hebat* (KAIH) program was introduced as an integrated healthy lifestyle initiative aimed at promoting discipline, independence, and physical as well as psychosocial well-being among preschool children. The program includes several behavioural components, namely balanced nutrition, physical activity, sleep habits, early waking, learning behaviour, social engagement, and religious practices (Kementerian Pendidikan Dasar dan Menengah, 2025). Conceptually, KAIH represents a holistic behavioural framework that may influence energy balance, circadian rhythm regulation, and behavioural development in children. Although previous studies have extensively investigated individual lifestyle factors associated with childhood nutritional status, evidence examining the integrated relationship between KAIH behavioural components and BMI among preschool children remains limited, particularly in developing-country settings. Therefore, this study aimed to examine the association between the implementation of KAIH components and nutritional status based on Body Mass Index (BMI) among kindergarten students at *Taman Kanak-kanak Aisyiyah Bustanul Athfal.* The findings are expected to contribute to the development of integrated promotive and preventive strategies to support optimal nutritional status during early childhood.

METHODS

This analytical observational study employed a cross-sectional design with retrospective behavioural assessment and was conducted in October 2025 at Aisyiyah Bustanul Athfal Kindergarten, Gorontalo, Indonesia. The study population comprised all registered kindergarten students (n = 70). Considering the limited and accessible population, total sampling was applied, resulting in 65 eligible participants included in the final analysis. Participants were eligible if they were enrolled in Kindergarten A or B classes, had parental or guardian consent, and completed reporting for all components of the *Kebiasaan Anak Indonesia Hebat* (KAIH) program for seven consecutive days prior to data collection. Behavioural assessment was retrospective because the data were derived from previously documented daily reports submitted by parents or guardians.

CC BY-SA 4.0

Participants with incomplete behavioural or anthropometric data, incomplete KAIH reporting, or unwillingness to participate were excluded from the study.

Data were collected using a structured observation form developed according to the official KAIH program guidelines issued by the Ministry of Primary and Secondary Education of the Republic of Indonesia. The instrument underwent expert review prior to implementation. KAIH implementation was assessed through daily parental reports accompanied by photographic documentation submitted via a WhatsApp group for seven consecutive days and supported by KAIH diary records. To minimise reporting bias, daily reminders and monitoring were conducted throughout the observation period. Nutritional status was assessed using body mass index (BMI), calculated from body weight and height measurements obtained using standardised instruments. Body weight was measured using a calibrated digital scale (0.1 kg accuracy), while height was measured using a microtoise (0.1 cm accuracy). All measurements were performed barefoot using standardised procedures. BMI status was categorised into underweight/normal and overweight/obesity according to the Indonesian Ministry of Health Child Anthropometric Standards (Kementerian Kesehatan Republik Indonesia, 2020). Sleep behaviour was classified as "late sleep" if the child slept at or after 21:00 and "non-late sleep" if sleep occurred before 21:00. "Early waking" was defined as waking between 05:00 and 06:00. Incomplete or inconsistent data were excluded from the final analysis.

Descriptive statistics were used to summarise participant characteristics and the distribution of KAIH behavioural components. Associations between KAIH components and BMI status were analysed using the chi-square test. Variables with p-values <0.25 in the bivariate analysis were subsequently included in multivariate logistic regression models to identify independent associations between KAIH components and nutritional status. Odds ratios (ORs) and 95% confidence intervals (95% CIs) were calculated, with statistical significance established at $p < 0.05$. All analyses were conducted using SPSS version 27.0. This study received ethical approval from the Ethics Committee of Universitas Negeri Gorontalo (No. 173B/UN.47.B7/KE/2025). Written informed consent was obtained from parents or guardians before participation, and all participant information was kept confidential throughout the study.

RESULTS AND DISCUSSION

Table 1. Characteristics of the respondents from Aisyiyah Bustanul Athfa Kindergarten and Bivariate Analysis

Respondent Characteristics	Nutritional Status			*p-value*
	Underweight (6.15%)	**Normal** (78.47%)	**Overweight/ Obesity** (15.38%)	
Age				
a. 45–60 months	a. 2 (3.08%)	a. 18 (27.69%)	a. 5 (7.69%)	0.473*
b. 60–72 months	b. 2 (3.08%)	b. 33 (50.77%)	b. 5 (7.69%)	
Gender				
a. Male	a. 2 (3.08%)	a. 23 (35.38%)	a. 6 (9.23%)	0.509*
b. Female	b. 2 (3.08%)	b. 28 (43.08%)	b. 4 (6.15%)	
Balanced nutritious diet				
a. Yes	a. 1 (1.54%)	a. 47 (72,31)	a. 4 (6.15%)	0.01*
b. No	b. 3 (4.62%)	b. 4 (6.15%)	b. 6 (9.23%)	
Social interaction				
a. Yes	a. 3 (4.62%)	a. 49 (75.38%)	a. 5 (7.69%)	0.5*
b. No	b. 1 (1.54%)	b. 2 (3.08%)	b. 5 (7.69%)	
Enjoys exercise				
a. Yes	a. 2 (3.08%)	a. 49 (75.38%)	a. 2 (3.08%)	<0.001*
b. No	b. 2 (3.08%)	b. 2 (3.08%)	b. 8 (12.31%)	
Wakes up early				
a. Yes	a. 2 (3.08%)	a. 49 (75.38%)	a. 3 (4.62%)	0.003*
b. No	b. 2 (3.08%)	b. 2 (3.08%)	b. 7 (10.77%)	

CC BY-SA 4.0

Religious practice				
a. Yes	a. 4 (6.15%)	a. 39 (60%)	a. 6 (9.23%)	0.476*
b. No	b. 0 (0%)	b. 12 (18.46%)	b. 4 (6.15%)	
Enjoys learning				
a. Yes	a. 4 (6.15%)	a. 43 (66.15%)	a. 5 (7.69%)	0.287*
b. No	b. 0 (0%)	b. 8 (12.31)	b. 5 (7.69%)	
Bedtime				
a. Late	a. 1 (1.54%)	a. 2 (3.08%)	a. 3 (4.62%)	0.002*
b. Not late	b. 49 (%)	b. 3 (4.62)	b. 7 (10.77%)	

Noted: Chi-square Test*

Table 1 the characteristics kindergarten students at Athfal Aisyiyah Bustanul Athfal and presents the bivariate associations between components of the *Kebiasaan Anak Indonesia Hebat* (KAIH) program and nutritional status based on body mass index (BMI). Most participants were aged 60–72 months (53.85%), and the proportion of female children was slightly higher than that of males. No statistically significant associations were observed between demographic characteristics, including age, sex, and religion practice, and BMI-based nutritional status ($p > 0.05$). A statistically significant association was identified between the assessed behavioral factors and nutritional status among preschool children. However, nutritional status was classified into three distinct categories: underweight (6.15%), normal ((78.47%), and overweight/obesity (15.38%). Therefore, the distribution of children across these three categories should be reported separately rather than combining the underweight and normal categories. Enjoyment of physical activity, bedtime, balance of nutrition, and wake up early habits were significantly associated with nutritional status ($p< 0.001$, respectively, $p=0.002$, $p=0.01$, and $p = 0.003$). In contrast, regular religious practice, enjoyment of learning, and social interactions was not significantly associated with nutritional status among preschool children ($p = 0.476$, $p=0.287$, and $p=0.5$).

Table 2. Impact KAIH with Nutritional Status based on BMI in Multivariate analysis

Variable	OR	*p-value*	95% CI for Exp (B)	
			Lower	*Upper*
Balanced nutritious diet	0.79	007**	0.64	0.99
Enjoys exercise	1.20	0.81**	0.94	1.68
Wakes up early	1.70	0.05**	1.35	2.13
Bedtime	2.10	0.06**	1.45	3.80
N = 65				
Pseudo R^2 = 59%				

Noted: multivariate logistic regression**

Table 2 presents the results of the multivariate logistic regression analysis examining the association between components of the *Kebiasaan Anak Indonesia Hebat* (KAIH) program and nutritional status based on body mass index (BMI) among preschool children. The regression model demonstrated relatively good explanatory performance, as reflected by a pseudo R^2 value of 0.59, indicating that approximately 59% of the variation in children's nutritional status could be explained by the variables included in the model. However, after adjustment for all covariates, none of the independent variables remained statistically significant at the 95% confidence level ($p > 0.05$). Overall, the multivariate findings suggest that the behavioural components of the KAIH program operate in an interconnected and multidimensional manner in influencing nutritional status among preschool children. The present study demonstrated that most kindergarten students at Athfal Aisyiyah Bustanul Athfal had implemented the behavioural components of the *Kebiasaan Anak Indonesia Hebat* (KAIH) program, with the majority of participants classified within the normal/underweight BMI category. These findings indicate that the adoption of healthy lifestyle behaviors from early childhood may contribute to the maintenance of optimal nutritional status. More broadly, the findings support the growing body of evidence suggesting that nutritional status in early childhood is shaped by complex interactions among behavioural,

CC BY-SA 4.0

environmental, and psychosocial determinants rather than by isolated lifestyle factors alone. Physical activity emerged as one of the behavioural components significantly associated with nutritional status. Children who regularly engaged in exercise were more likely to present with normal BMI status compared with those classified as overweight or obese. This finding is consistent with previous studies reporting that adequate physical activity contributes to healthier body composition, improved metabolic regulation, and better physical fitness among preschool-aged children (Chen et al., 2022; Dong et al., 2019). During early childhood, regular physical activity plays an essential role in maintaining energy balance and supporting musculoskeletal and cardiorespiratory development. In contrast, insufficient physical activity may increase sedentary behaviour and fat accumulation, thereby elevating the risk of childhood overweight and obesity. These findings reinforce the importance of promoting active lifestyles during the preschool period as part of long-term strategies for preventing obesity-related metabolic and cardiovascular disorders later in life. Balanced and nutritious dietary habits were also significantly associated with BMI-based nutritional status. This finding aligns with previous evidence demonstrating that adequate nutrition is fundamental for supporting growth, metabolic homeostasis, and neurodevelopment during childhood (Annan et al., 2021; Jovanović et al., 2023). Early childhood represents a phase of accelerated tissue growth and physiological maturation, during which nutritional requirements substantially increase. Consequently, inadequate dietary intake may contribute to both undernutrition and excessive weight gain, each of which is associated with adverse long-term health consequences, including dyslipidaemia, insulin resistance, diabetes mellitus, and cardiovascular disease (Sahoo et al., 2015). The present findings therefore highlight the importance of establishing healthy dietary habits from an early age as a foundation for lifelong health and disease prevention. This study additionally identified significant associations between sleep behaviour (bedtime and wake up early) and nutritional status. Children who maintained earlier sleep and waking patterns were more likely to exhibit normal BMI status than those with late sleep habits. These findings are consistent with previous studies demonstrating that inadequate sleep duration and irregular sleep timing are associated with increased risks of overweight and obesity among children (Scharf & DeBoer, 2015; Skjåkødegård et al., 2021). Several biological and behavioural mechanisms may underlie this relationship. Sleep deprivation has been associated with dysregulation of appetite-related hormones, including increased ghrelin and cortisol levels alongside decreased leptin secretion, potentially leading to increased hunger and excessive caloric intake (Morrissey et al., 2020). Moreover, poor sleep patterns are frequently linked to prolonged screen exposure, reduced physical activity, and increased sedentary behaviour, all of which may contribute to unhealthy weight gain during childhood. These findings emphasise the importance of healthy sleep hygiene as an integral component of obesity prevention strategies in early childhood.

Notably, multivariate analysis showed that no single behavioural component independently dominated nutritional status after adjustment for all covariates. This finding indicates that the behavioural domains within the KAIH program may operate synergistically and interdependently in shaping nutritional outcomes among kindergarten students. Accordingly, healthy lifestyle behaviors should be conceptualised as a multidimensional construct encompassing dietary habits, physical activity, and sleep behaviors. Interventions focusing exclusively on a single behavioural domain may therefore have limited effectiveness unless accompanied by broader reinforcement of complementary healthy behaviors. Therefore, integrated health-promoting and preventive strategies involving families, schools, and the broader social environment are essential to support healthy behavioural development from early childhood. Such multidimensional approaches may contribute not only to the achievement of optimal nutritional status but also to the prevention of long-term metabolic disorders and the improvement of future human resource quality.

Early childhood is a critical developmental period for establishing lifelong health behaviors. Therefore, comprehensive behavioral interventions during this stage may offer substantial public health benefits throughout the life course. Several limitations of this study should be acknowledged. First, the relatively small sample size and homogeneous participant characteristics may have limited the statistical power and generalizability of the findings. Second, the use of parental reports to assess children's behaviors may have

CC BY-SA 4.0

introduced reporting bias, despite daily monitoring and photographic documentation. Future studies should involve larger and more diverse populations, incorporate more objective behavioral assessment methods where feasible, and include longer follow-up periods to evaluate the long-term effectiveness and broader applicability of integrated KAIH-based behavioral interventions in improving nutritional outcomes among kindergarten students.

CONCLUSION AND SUGGESTION

This study demonstrated that most kindergarten students had implemented the behavioural components of the Kebiasaan Anak Indonesia Hebat (KAIH) program, with the majority presenting normal BMI-based nutritional status. Several behavioural components, including physical activity, balanced dietary habits, sleep behaviour, early waking habits, social interaction, and enjoyment of learning, were significantly associated with nutritional status among kindergarten students. Nevertheless, multivariate analysis showed that no single behavioural factor independently emerged as the dominant predictor of nutritional status after adjustment for all variables. These findings suggest that nutritional status in early childhood is shaped by multidimensional interactions among behavioural, psychosocial, and environmental factors. Therefore, integrated health-promoting and preventive strategies involving families, schools, and the broader social environment are essential to support healthy behavioural development and optimal nutritional outcomes from early childhood.

REFERENCES

Annan, R. A., Apprey, C., Agyemang, G. O., & Tuekpe, D. M. (2021). Nutrition education improves knowledge and BMI-for-age in Ghanaian school-aged children. African Health Sciences, 21(2), 928–941.

Baldwin, J., Arundell, L., & Hnatiuk, J. A. (2022). Associations between the neighbourhood social environment and preschool children's physical activity and screen time. BMC Public Health, 1–10. https://doi.org/10.1186/s12889-022-13493-2

Bosch, S. O. Den, & Duch, H. (2017). The role of cognitive stimulation at home in low-income preschoolers ' nutrition , physical activity and body mass index. BMC Pediatrics, 17(178), 1–7. https://doi.org/10.1186/s12887-017-0918-5

Chaput, J., Willumsen, J., Bull, F., Chou, R., Ekelund, U., Firth, J., Jago, R., Ortega, F. B., & Katzmarzyk, P. T. (2020). 2020 WHO Guidelines on Physical Activity and Sedentary Behaviour for Children and Adolescents Aged 5 – 17 Years: Summary of The Evidence. International Journal of Behavioral Nutrition and Physical Activity, 17(141), 1–9.

Chen, G., Chen, J., Liu, J., Hu, Y., & Liu, Y. (2022). Relationship between body mass index and physical fitness of children and adolescents in Xinjiang , China : a cross - sectional study. BMC Public Health, 1–11. https://doi.org/10.1186/s12889-022-14089-6

Dong, Y., Lau, P. W. C., Dong, B., Zou, Z., Yang, Y., Wen, B., Ma, Y., Hu, P., Song, Y., Ma, J., Sawyer, S. M., & Patton, G. C. (2019). Articles Trends in physical fitness , growth , and nutritional status of Chinese children and adolescents : a retrospective analysis of 1 · 5 million students from six successive national surveys between 1985 and 2014. The Lancet Child and Adolescent Health, 4642(19), 1–10. https://doi.org/10.1016/S2352-4642(19)30302-5

Ferentinou, E., Koutelekos, I., Dousis, E., & Evangelou, E. (2025). The Relationship Between Childhood Sleep, Emotional Intelligence and Body Mass Index in School Aged Children. AIMS Public Health, 12(May 2024), 77–90. https://doi.org/10.3934/publichealth.2025006

Jeong, S. M., Lee, D. H., Rezende, L. F. M., & Giovannucci, E. L. (2023). Different correlation of body mass index with body fatness and obesity - related biomarker according to age , sex and race - ethnicity. Scientific Reports, 1–11. https://doi.org/10.1038/s41598-023-30527-w

Jovanović, G. K., Janković, S., & Žeželjc, S. P. (2023). The effect of nutritional and lifestyle education intervention program on nutrition knowledge , diet quality , lifestyle , and nutritional status of Croatian school children. Frontiers in Sustainable Food System, 7(1019849), 1–14.

Kementerian Kesehatan Republik Indonesia. (2020). Peraturan Menteri Kesehatan republik Indonesia No 2 Tahun 2020 Tentang Standar Antropometri Anak. Kementerian Kesehatan Republik Indonesia, (3), 1–78.

Kementerian Pendidikan Dasar dan Menengah. (2025). Panduan Penerapan Gerakan Tujuh Kebiasaan Anak Indonesia Hebat. In Kementerian Pendidikan Dasar dan Menengah. Kementerian Pendidikan Dasar dan Menengah.

Kenney, E. L., Tucker, K., Plummer, R. S., Mita, C., & Andreyeva, T. (2023). The Child and Adult Care Food Program and young children's health : a systematic review. Nutrition Reviews, 81(11), 1402–1413.

Langeveld, M., & Devries, J. H. (2015). The Long-Term Effect of Energy Restricted Diets for Treating Obesity. Obesity, 23(8), 1529–1538. https://doi.org/10.1002/oby.21146

Morrissey, B., Taveras, E., Allender, S., & Strugnell, C. (2020). Sleep and obesity among children : A systematic review of multiple sleep dimensions. Pediatric Obesity, (November 2019), 1–21. https://doi.org/10.1111/ijpo.12619

Sahoo, K., Sahoo, B., Choudhury, A. K., Sofi, N. Y., Kumar, R., & Bhadoria, A. S. (2015). Family Practice Childhood obesity : causes and consequences. Journal of Family Medicine and Primary Care, 4(2), 2–7. https://doi.org/10.4103/2249-4863.154628

CC BY-SA 4.0

Scharf, R. J., & DeBoer, M. D. (2015). Sleep Timing ang Longitudinal Weight Gain in 4 and 5 Year Old Chidren. Pediatric Obesity, 10(2), 141–148. https://doi.org/10.1111/ijpo.229

Silventoinen, K., Li, W., Jelenkovic, A., Sund, R., Yokoyama, Y., Aaltonen, S., Piirtola, M., Sugawara, M., Tanaka, M., Matsumoto, S., Baker, L. A., Tuvblad, C., Tynelius, P., Rasmussen, F., Craig, J. M., Saffery, R., Willemsen, G., Bartels, M., Beijsterveldt, C. E. M., … Kaprio, J. (2022). Changing genetic architecture of body mass index from infancy to early adulthood : an individual based pooled analysis of 25 twin cohorts. International Journal of Obesity, 46(August), 1901–1909. https://doi.org/10.1038/s41366-022-01202-3

Skjåkødegård, H. F., Danielsen, Y. S., Frisk, B., Hystad, S. W., Roelants, M., Pallesen, S., Conlon, R. P. K., Wilfley, D. E., & Juliusson, P. B. (2021). Beyond sleep duration : Sleep timing as a risk factor for childhood obesity. Pediatric Obesity, 16(December 2019), 1–11. https://doi.org/10.1111/ijpo.12698

Wang, D. D., Li, Y., Afshin, A., Springmann, M., Mozaffarian, D., Stampfer, M. J., Hu, F. B., Murray, C. J. L., & Willett, W. C. (2019). Global Improvement in Dietary Quality Could Death. Journal of Nutrition, 149(6), 1065–1074. https://doi.org/10.1093/jn/nxz010

CC BY-SA 4.0