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ORIGINAL RESEARCH

Health Asset Profile and Health Literacy Among Elementary School-Aged Children

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Abstract

Background: Mental health issues, nutritional status, physical activity, and smoking behavior are among the most serious health problems among school-aged children, and they are closely linked to health-related behaviors. Literacy skills significantly influence these behaviors at this age; however, health literacy often receives insufficient attention from the government for this age group.
Purpose: The purpose of this study was to provide a comprehensive overview of health asset profiles and health literacy among elementary school-aged children.
Methods: This cross-sectional study involved 431 sixth-grade students from the Sumedang district, recruited through a cluster sampling method. Various research instruments were employed, including the Family Affluence Scale (FAS III), Rosenberg Self-Esteem Scale (RSES), Health Behaviours in School-Aged Children (HBSC), European Health Literacy Scale (HLS-EU), and the Newest Vital Sign (NVS) survey. Data were self-reported by participants, and BMI measurements were also collected. The Chi-square test was employed for statistical analysis.
Results: The results revealed notable variations across the assessed health asset profile sub-variables. Functional health literacy was significantly associated with self-esteem (p<0.001), student behavior (p=0.010), wake-up time (p<0.001), and smoking habit (p<0.001). In contrast, no significant associations were found with family affluence (p=0.868), BMI (p=0.809), physical activity (p=0.087), or bedtime (p=0.092). Gender-based comparisons revealed significant differences between boys and girls in self-esteem (p=0.042), BMI (p<0.001), physical activity (p<0.001), bedtime (p=0.004), wake-up time (p=0.005), and smoking behavior (p=0.001).
Conclusion: This study provides a comprehensive overview of health literacy in school-aged children, highlighting variations across health-related behaviors and asset profiles. Significant gender disparities were found in self-esteem, nutritional status, physical activity, bedtime, wake-up time, and smoking behavior. These findings highlight the importance of developing gender-sensitive health promotion strategies to enhance health literacy and promote healthy behaviors from early ages.

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1. Introduction

In 2023, school-aged children in Indonesia accounted for 11.2% (30.799.344 individuals) of the total population. Apart from being a relatively large number, this age population is also a key target for health development efforts, which serve as an important indicator of a country's health status (Ministry of Health Republic of Indonesia, 2024). After years of not being prioritized in health development targets, the health of school-age children is now receiving special attention as a priority for health services, with a focus on the main health issues experienced by teenagers, namely traffic accidents, violence, mental health problems, drug and alcohol abuse, smoking, HIV/AIDS, early pregnancy and childbirth, nutritional deficiencies, malnutrition, obesity, and low physical activity (World Health Organization [WHO], 2019). Most of these health problems are caused by poor health behaviors and environmental issues surrounding them, which will significantly affect their lives and health status in the future, as this period marks a transition to the next stage of life (Delbosq et al., 2022). These health problems cannot be separated from one's level of health literacy, which plays a vital role in shaping individual health behaviors, especially

those related to violent behaviors, mental health, drug abuse, smoking, and low physical activity (Parandeh et al., 2020; Tavousi et al., 2022).

Health literacy refers to the ability to understand and use health information and services effectively. It refers to the personal characteristics and social resources that individuals and communities need to access, understand, assess, and use information and services to make informed health decisions or take actions with health implications (Dodson et al., 2015). Health literacy varies among individuals, depending on their access to information, environmental contexts, health resources, and support systems, as well as their ability to maintain and improve health while reducing inequalities in access to healthcare. This broader concept is known as health assets (Paakkari et al., 2019). Health assets are defined as factors or resources that enhance the ability of individuals, groups, communities, populations, social systems, or institutions to maintain health and well-being and to help reduce health inequalities (Bambra et al., 2010; Van Bortel et al., 2019). Previous research has shown that health assets encompass broad components, which is why studies often focus on selected parts of the overall framework. Health asset components include internal factors, such as physical health, psychological well-being, and health behaviors, and external factors, including the social environment and family financial status (Paakkari et al., 2019; Prihanto et al., 2021; Vasli et al., 2024).

Health literacy among school-aged children, as measured by the Newest Vital Sign (NVS) scale, has been shown to improve at higher school levels (Linnebur & Linnebur, 2018). Differences in health literacy are also noted between children with stable versus unstable emotions, likely influenced by social context, with children in developed countries typically demonstrating better literacy than those in developing countries (Chu-Ko et al., 2021; Loer et al., 2022). Children who participate in structured physical activity programs as part of their school's health promotion efforts tend to exhibit higher levels of health literacy. These levels are categorized based on the scores obtained, namely excellent, problematic, or inadequate (Chu-Ko et al., 2021; Knisel et al., 2020). The health status of school-age children is also closely related to their level of health literacy, indicating that a higher level of health literacy corresponds with better physical and psychological health (Mao et al., 2020; Zhang et al., 2020).

In this research, we combine various factors influencing health literacy to create a health asset profile that reflects an individual's potential to achieve optimal health. This is tied to their literacy level and assessed from multiple perspectives to allow a more objective evaluation. The health asset profile includes family financial conditions, students' psychological status, family and peer social conditions, and school environment, while health literacy is measured comprehensively and functionally. Most previous studies on health literacy have focused on late adolescence or early adulthood. This study, however, focuses on school-aged children, as this is the stage when individuals should begin developing healthy habits and behaviors based on adequate health literacy, which is expected to predict their future health. Based on this rationale, conducting this study is important. The purpose of this study was to determine the health asset profile in terms of family financial situations, student health, students' psychological well-being, health behaviors, and health literacy among school-aged children, and to examine the relationship between the health asset profile and health literacy.

2. Methods

2.1. Research design

This study employed a cross-sectional design, utilizing data from elementary school students. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were followed to report the methodological processes. Each research variable was compared based on gender. An analysis was conducted on each independent variable (family affluence, self-esteem, BMI, physical activity, student behavior, sleep pattern, wake-up time, and smoking), with health literacy as the dependent variable.

2.2. Setting and samples

The subjects in this study were elementary school students in Sumedang Regency, West Java Province, Indonesia. The sample was calculated using the Cochran formula, yielding a minimum of 385 participants. An additional 10% was added to account for potential non-response, resulting in a total sample of 431 students from five elementary schools across five sub-districts in Sumedang Regency. All participants were 6th-grade students. The inclusion criteria included 6th-

grade students who were actively registered in the Basic Education Data System *(Dapodik)*, were willing to complete the research questionnaire within the specified timeframe, had written parental/guardian consent, and were in good health during the data collection period. Students with physical or visual impairments that hindered participation, as well as those with cognitive or developmental disorders, were excluded. The study samples were selected using a proportional random sampling method. Five sub-districts were selected from a total of 18, and two elementary schools were randomly chosen from each selected sub-district, resulting in a total of 10 primary schools. Approximately 40-45 sixth-grade students were selected from each school, yielding a total sample of 431.

2.3. Measurement and data collection

All questionnaires used in this study were available in the Indonesian language. The research team rechecked the contents to ensure alignment with the study objectives.

2.3.1. Health assets

Health assets were quantified using various sub-variables, including family financial status, students' self-esteem (Paakkari et al., 2019; Prihanto et al., 2021). Health indicators, including Body Mass Index (BMI) and health behaviors, were also assessed (Loer et al., 2022).

The Family Affluence Scale (FAS-III) was used to assess family financial status. It consists of six items: number of vehicles owned (0, 1, 2 or more), number of bathrooms (0, 1, 2, 3 or more), number of computers/laptops (0, 1, 2, or more), personal bedroom (yes/no), presence of a dishwashing area (yes/no), and number of vacations in the previous year (0, 1, 2, 3 or more). The total score ranges from 0–13 (0–7 = poor, 8–11 = medium, 12–13 = high affluence) (Corell et al., 2021). The FAS III showed moderate external validity through Spearman correlation with FAS II and other SES indicators (parental education and perceived family wealth) (r=0.48–0.51, p<0.001) and ordinal regression (Liu et al., 2012).

The Rosenberg Self-Esteem Scale (RSES) was used to assess students' self-esteem. It contains 10 items with a total score ranging from 0 to 30 (Berg et al., 2022). Self-esteem can reflect a child's psychological status as it is an indicator of overall psychopathological state in children (Berg et al., 2022; Ngo et al., 2020). The Indonesian version of the RSES has an ordinal alpha coefficient of 0.75 and an average variance extracted (AVE) score above 0.50, indicating good construct validity (Muslih & Chung, 2024).

BMI was measured using direct measurements of height and weight to assess the nutritional status of the children. It was calculated using the WHO BMI-for-age guidelines for children aged 5 to 19 years (WHO, 2022).

Health Behaviors in School-Aged Children (HSBC) was used to measure children's expected behaviors (Guo et al., 2022; Kohoutek et al., 2022). It consists of 23 items addressing physical activity (4 items), bedtime (2 items), wake-up time (2 items), sedentary behaviors (8 items), and smoking behaviors (7 items). This instrument exhibits acceptable test-retest reliability, with weighted kappa values ranging from 0.43 to 0.70, percentage agreement ranging from 37% to 87%, and Spearman correlations ranging from 0.52 to 0.82 (Vereecken & Maes, 2003).

2.3.2. Health literacy

Health literacy was assessed through two sub-variables: comprehensive health literacy and functional health literacy, which are considered reliable and valid indicators of an individual's health literacy (Guo et al., 2022).

Comprehensive Health Literacy (CHL) was measured using the European Health Literacy Scale (HLS-EU), a shortened form of the HLS-EU-47. It consists of 16 items designed to determine an individual's perception of their ability to seek, comprehend, make decisions, and use knowledge to maintain and improve their health. Each item was rated on a 4-point Likert scale (very easy, easy, difficult, and extremely difficult), with a score of 1 for 'very easy' and 'easy' and 0 for 'difficult' and 'extremely difficult'. The CHL score ranges from 0-16 and is classified as 'sufficient' for scores greater than 12, 'problematic' for scores 9-12, and 'inadequate' for scores less than 9 (Prihanto et al., 2021). The questionnaire demonstrated good construct validity, satisfactory goodness-of-fit of the data to the hypothetical model across three health literacy domains, high internal consistency (Cronbach's alpha > 0.90), and satisfactory item-scale convergent validity (item-scale correlation ≥ 0.40) (Duong et al., 2017).

Functional health literacy was assessed using the Newest Vital Sign (NVS), a tool that measures an individual's ability to read and comprehend information in a medical setting. The NVS consists of six items, presented in both words and figures, based on the nutritional information of packaged snack foods. Each correct response scores 1 point while incorrect responses score 0. Total scores are interpreted as follows: ≥4 correct answers indicate average literacy, 2-3 correct answers indicate marginal literacy, and <2 correct answers indicate limited literacy (Linnebur & Linnebur, 2018; Prihanto et al., 2021). The NVS showed a weak internal consistency (Cronbach's alpha = 0.59) and a small but significant correlation with the HLS-Q16 ($r = 0.11$, $p \leq 0.001$) (Sopamena et al., 2022).

To minimize misunderstanding of the questionnaire by study participants, the data collectors (referred to as numerators) were trained beforehand. This study involved 10 numerators who delivered the questionnaires to selected schools and directly measured the height and weight of the research subjects. Prior to data collection, the researchers gathered the research subjects to provide instructions on how to complete the questionnaire accurately and to distribute written informed consent forms, which were to be approved or declined by the parents or guardians of the students. After obtaining consent, data collection was conducted by distributing questionnaires for students to complete. If students experienced difficulty, the numerators provided careful guidance on any unclear or confusing items. Data collection took place from March to August 2023 in selected primary schools in Sumedang District, West Java, Indonesia.

2.4. Data analysis

The collected data were analyzed using JASP 0.17.2.1, and two stages of data analysis were carried out. The first stage involved identifying each sub-variable using numerical and categorical data. The second stage compared all sub-variables of health asset profile and health literacy based on gender using the Mann-Whitney test, as the study compared ordinal data. Additionally, cross-tabulation was used to describe the distribution of students' health asset profiles within the context of a health literacy school. The Chi-square test was employed to examine the correlation between two related variables, as it was appropriate for analyzing relationships between categorical variables.

2.5. Ethical consideration

The present study was approved by the Ethics Committee of the Institute for Research and Community Service at Universitas Pendidikan Indonesia (Reference Number B1668/UN40.PL/P100.00/2023) and was conducted in accordance with the principles of the General Data Protection Regulation (GDPR) and the 2013 Declaration of Helsinki. Parents/guardians and students were informed about the study's aims and procedures, and written consent was obtained. Questionnaires were distributed only to participants whose parents had given permission. The data collection process was carried out in groups, with careful attention to participants' privacy and confidentiality. Participation in the questionnaire survey was anonymous and voluntary.

3. Results

3.1. Socioeconomic characteristics and health literacy profile of the participants

As presented in Table 1, the majority of participants' households (48.03%) were classified as poor. Most individuals rated their self-esteem as moderate (76.10%) and were underweight (65.20%). Regarding physical activity, more than half of the participants (56.84%) engaged in less than two hours of physical activity per week, despite spending over two hours per week on academic activities. The participants' sleeping patterns were classified based on bedtime and wake-up time. The findings showed that most participants (48.72%) went to bed after midnight (slept relatively late after 00.00), and the majority (80.28%) woke up at a maximum of 07:00. Only a small proportion of participants (12.99%) reported smoking. In the health literacy sub-variable, more than half of the data obtained using the HLS-EU instrument (54.06%) fell into the problematic category, while most of the data obtained using the NVS (70.53%) were categorized as limited.

Differential tests based on gender showed varied results. Sub-variables differing significantly by gender included self-esteem (p=0.042), nutritional status (as measured by BMI) (p<0.001), physical activity (p<0.001), bedtime (p=0.004), wake-up time (p=0.005), and smoking behavior

(p=0.001). Meanwhile, no significant gender differences were found in family affluence status (p=0.363), sedentary behavior (p=0.690), HLS-EU (p=0.614), and NVS (p=0.117) (Table 1).

Table 1. Socioeconomic characteristics and health literacy profile of the participants (n=431)

Variables	Gender		Total	p-value
	Male	Female		
	f(%)	f(%)		
Family affluence				
Low	106 (51.21)	101 (48.79)	207 (48.03)	0.363
Moderate	93 (47.21)	104 (52.79)	197 (45.71)	
High	12 (44.44)	15 (55.56)	27 (6.26)	
Self-esteem				
Low	35 (36.84)	60 (63.16)	95 (22.04)	0.042
Moderate	174 (53.05)	154 (46.95)	328 (76.10)	
High	2 (25.00)	6 (75.00)	8 (1.86)	
BMI				
Underweight	154 (54.80)	127 (45.20)	281 (65.20)	<0.001
Normal	49 (36.30)	86 (63.70)	135 (31.32)	
Overweight	4 (40.00)	6 (60.00)	10 (2.32)	
Obese	4 (80.00)	1 (20.00)	5 (1.16)	
Health Behavior (HSBC)				
Physical activity				
Max 2 hours/week	90 (36.73)	155 (63.27)	245 (56.84)	<0.001
>2 hours/week	121 (65.05)	65 (34.95)	186 (43.16)	
Sedentary behavior				
Max 2 hours/week	29 (39.73)	44 (60.27)	73 (16.94)	0.690
>2 hours/week	182 (50.84)	176 (49.16)	358 (83.06)	
Bedtime				
Max at 10:00 p.m.	36 (61.02)	23 (38.98)	59 (13.69)	0.004
> 10:00 p.m.-00:00	73 (45.06)	89 (54.94)	162 (37.59)	
> 00:00	102 (48.57)	108 (51.43)	210 (48.72)	
Wake-up time				
Max 07:00 a.m.	156 (45.09)	190 (54.91)	346 (80.28)	0.005
> 07:00-11:00 a.m.	48 (62.34)	29 (37.66)	77 (37.66)	
>11:00 a.m.	7 (87.50)	1 (12.50)	8 (1.86)	
Smoking behavior				
No smoking	155 (41.44)	219 (58.56)	374 (86.77)	0.001
Smoking	56 (100.00)	0 (0.00)	56 (12.99)	
Health literacy				
HLS-EU				
Inadequate	90 (50.28)	89 (49.72)	179 (41.53)	0.614
Problematic	113 (48.50)	120 (51.50)	233 (54.06)	
Sufficient	8 (42.11)	11 (57.89)	19 (4.41)	
NVS				
Limited	142 (46.71)	162 (53.29)	304 (70.53)	0.117
Marginal	62 (52.54)	56 (47.46)	118 (27.38)	
Average	7 (77.78)	2 (22.22)	9 (2.09)	

3.2. Correlations between health asset profile and comprehensive health literacy and functional literacy

The results of data analysis comparing health asset profile sub-variables with comprehensive health literacy revealed a significant relationship with self-esteem (p<0.001), bedtime (p=0.032), and wake-up time (p=0.001). No significant relationships were found with family affluence (p=0.212), BMI (p=0.276), physical activity (p=0.125), sedentary behavior (p=0.773), and smoking habit (p=0.087) (Table 2).

Furthermore, as shown in Table 3, the correlation analysis between functional health literacy and health asset profile sub-variables revealed a significant relationship with self-esteem (p<0.001), sedentary behavior (p=0.010), wake-up time (p<0.001), and smoking habit

(p<0.001). No significant relationships were found between functional health literacy and family affluence (p=0.868), BMI (p=0.809), physical activity (p=0.087), and bedtime (p=0.092).

Table 2. Correlations between health asset profile and comprehensive health literacy (n=431)

Variable	HLS -EU			Total	*p*-value
	Inadequate	Problematic	Sufficient		
	f(%)	f(%)	f(%)		
Family affluence					
Low	92 (44.44)	109 (52.66)	6 (2.90)	207 (48.03)	0.212
Moderate	80 (40.61)	105 (53.30)	12 (6.09)	197 (45.71)	
High	7 (25.93)	19 (70.37)	1 (3.70)	27 (6.26)	
Self-esteem					
Low	69 (72.63)	24 (25.26)	2 (2.11)	95 (22.04)	<0.001
Moderate	109 (33.23)	203 (61.89)	16 (4.88)	328 (76.10)	
High	1 (12.50)	6 (75.00)	1 (12.50)	8 (1.86)	
BMI					
Underweight	128 (45.55)	139 (49.47)	14 (4.98)	281 (65.20)	0.276
Normal	46 (34.07)	84 (62.22)	5 (3.70)	135 (31.32)	
Overweight	3 (30.00)	7 (70.00)	0 (0.00)	10 (2.32)	
Obese	2 (40.00)	3 (60.00)	0 (0.00)	5 (1.16)	
Health Behavior (HSBC)					
Physical activity					
Max 2 hours/week	101 (41.22)	129 (52.65)	15 (6.12)	245 (56.84)	0.135
>2 hours/week	78 (41.94)	233 (125.27)	19 (10.22)	186 (43.16)	
Sedentary behavior					
Max 2 hours/week	28 (38.36)	41 (56.16)	4 (5.48)	73 (16.94)	0.773
>2 hours/week	151 (42.18)	192 (53.63)	15 (4.19)	358 (83.06)	
Bedtime					
Max at 10:00 p.m.	29 (49.15)	27 (45.76)	3 (5.08)	59 (13.69)	0.032
> 10:00 p.m.-00:00	77 (47.53)	82 (50.62)	3 (1.85)	162 (37.59)	
> 00:00	73 (34.76)	124 (59.05)	19 (9.05)	210 (48.72)	
Wake-up time					
Max 07:00 a.m.	130 (37.57)	200 (57.80)	16 (4.62)	346 (80.28)	0.001
> 07:00-11:00 a.m.	41 (53.25)	33 (42.86)	3 (3.90)	77 (17.87)	
>11:00 a.m.	8 (100.00)	0 (0.00)	0 (0.00)	8 (1.86)	
Smoking behavior					
No smoking	163 (43.58)	195 (52.14)	16 (4.28)	374 (86.77)	0.087
Smoking	16 (28.07)	38 (66.67)	3 (5.26)	57 (13.23)	

4. Discussion

This study aimed to provide a comprehensive overview of the health asset profile and health literacy among school-aged children. The findings showed variation in scores across the assessed sub-variables of health asset profiles. Each finding is discussed in the following section.

4.1. Health asset profiles

Although Indonesia's economic status shifted from lower-middle-income to upper-middle-income in 2020 (Indonesian Ministry of Communication and Information Technology, 2022), the COVID-19 pandemic likely impacted the household income levels across all countries, including Indonesia. This may explain the findings of the present study. According to FAS estimations, approximately half of the participating households were classified as having a poor (low) socioeconomic status. This condition is also likely to have a significant impact on participants' nutritional health as measured by BMI; more than half of the students were underweight. Poverty, food insecurity, abuse, parental mental illness, substance use, and exposure to violence and conflict are all early-life risk factors for children. Over 43% of children and adolescents worldwide are at risk of achieving their full developmental potential (WHO, 2023a).

School-aged children in this study had low levels of physical activity, spending less than 2 hours per week engaging in moderate to vigorous physical activity and more than 2 hours per week doing school assignments, which is consistent with previous research on physical inactivity

among children aged 11-17 years (van Sluijs et al., 2021). The WHO recommends at least 60 minutes of moderate- to vigorous-intensity physical activity per day for children, with most of it being aerobic activity, while also limiting sedentary behavior, particularly leisure-time television viewing (WHO, 2020). This finding should be of particular interest to health researchers, as physical activity is thought to be particularly essential during childhood and adolescence (5-17 years), as it is directly associated with their health outcomes (Chaput et al., 2020; Dutil et al., 2022). Physical activity improves cardiovascular and muscular fitness (e.g., blood pressure, dyslipidemia, glucose, and insulin resistance), bone health, mental health, cognitive function (including reduced depressive symptoms), and helps prevent obesity in children and adolescents (Chaput et al., 2020; WHO, 2020).

Table 3. Correlations between health asset profile and functional health literacy (n=431)

Variables	NVS			Total	*p*-value
	Limited	Marginal	Average		
	f(%)	f(%)	f(%)		
Family affluence					
Low	148 (71.50)	54 (26.09)	5 (2.42)	207 (48.03)	0.868
Moderate	138(70.05)	55 (27.92)	4 (2.03)	197 (45.71)	
High	18(66.67)	9(33.33)	0 (0.00)	27 (6.26)	
Self-esteem					
Low	63 (66.32)	32 (33.68)	0 (0.00)	95 (22.04)	<0.001
Moderate	235 (71.65)	86 (26.22)	7 (2.13)	328 (76.10)	
High	6 (75.00)	0 (0.00)	2 (25.00)	8 (1.86)	
BMI					
Underweight	194 (69.04)	79 (28.11)	8 (2.85)	281 (65.20)	0.809
Normal	98 (72.59)	36 (26.67)	1 (0.74)	135 (31.32)	
Overweight	8 (80.00)	2 (20.00)	0 (0.00)	10 (2.32)	
Obese	4 (80.00)	1 (20.00)	0 (0.00)	5 (1.16)	
Health Behavior (HSBC)					
Physical activity					
Max 2 hours/week	182 (74.29)	60 (24.49)	3 (1.22)	245 (56.84)	0.087
>2 hours/week	122 (65.59)	58 (31.18)	6 (3.23)	186 (43.16)	
Sedentary behavior					
Max 2 hours/week	62 (84.93)	11 (15.07)	0 (0.00)	73 (16.94)	0.010
>2 hours/week	242 (67.60)	107 (29.89)	9 (2.51)	358 (83.06)	
Bedtime					
Max at 10:00 p.m.	45 (76.27)	13 (22.03)	1 (1.69)	59 (13.69)	0.092
> 10:00 p.m.-00:00	118 (72.84)	44 (27.16)	0 (0.00)	162 (37.59)	
> 00:00	141 (67.14)	61 (29.05)	8 (3.81)	210 (48.72)	
Wake-up time					
Max 07:00 a.m.	258 (74.57)	80 (23.12)	8 (2.31)	346 (80.28)	<0.001
> 07:00-11:00 a.m.	46 (59.74)	30 (38.96)	1 (1.30)	77 (17.87)	
>11:00 a.m.	0 (0.00)	8 (100.00)	0 (0.00)	8 (1.86)	
Smoking behavior					
No smoking	278 (74.33)	92 (24.60)	4 (1.07)	374 (86.77)	<0.001
Smoking	26 (45.61)	26 (45.61)	5 (8.77)	57 (13.23)	

This study also showed that, in terms of sleep behaviors, many participants reported going to bed (bedtime) after midnight and waking up by 7:00, resulting in less than 8 hours of sleep per night. However, children aged 6 to 12 require approximately 10 to 12 hours of sleep daily to support their growth and development (Suni & Singh, 2023). Many schoolchildren today have later bedtimes and shorter overall sleep durations (Dresp-Langley & Hutt, 2022). These trends have been associated with poorer emotional regulation, lower cognitive and academic performance, unhealthy eating behaviors, reduced physical activity, and increased sedentary behavior (Dutil et al., 2022).

Alarmingly, this study also showed that some male participants had already begun smoking, with frequencies ranging from one cigarette per day to more than one. This is concerning given the young age of initiation (10-13 years), which is a relatively early age to begin smoking. Globally,

men are significantly more likely to smoke than women, accounting for 36.7% and 7.8% of the world's population, respectively. In addition to cigarette users, 80% of the world's 1.3 million smokers reside in low and middle-income nations (WHO, 2023b).

4.2. Health literacy

Two instruments, the HLS-EU and the NVS, were used to assess health literacy holistically. Based on the findings of this study, most school-aged participants were categorized as having "problematic" comprehensive health literacy (HLS-EU) and "limited" functional health literacy levels (NVS). A review of 17 studies revealed that 14 reported that most students aged 6-18 had poor or marginal reading levels (Jafari et al., 2021). Adolescents with low health literacy tend to have poor general health, eating habits, nutritional status, and other harmful behaviors (Park et al., 2017). An individual's level of literacy is highly influenced by demographic, social, and economic factors, as well as internet use (Sarhan et al., 2023). As many factors influence the health literacy of school-aged children, it is equally important to consider the supporting factors that impact health literacy, in addition to increasing literacy skills through health education. These include demographic aspects, such as gender, parents' income, children's and parents' education levels, type of family, family marital status, and religious and cultural background (Sarhan et al., 2023).

4.3. Correlation between the health asset profile and health literacy

According to a comparative analysis of health asset profile and health literacy variables by gender, this study revealed disparities between boys and girls in terms of self-esteem, nutritional status (as measured by BMI), physical activity, bedtime, wake-up time, and smoking behavior. Male students reported smoking habits, and none of the girls smoked. This finding is quite consistent with a WHO survey, which found that internationally, at least one in ten adolescent boys aged 13-15 years uses tobacco. In some regions, the prevalence is substantially higher (WHO, 2022). The smoking rate among teenage boys is also higher at 40.9%, compared to 26.1% among girls (Parizadeh et al., 2018).

Based on self-esteem scores, it was shown that boys had higher self-esteem than girls. Previous studies have also indicated that self-concept is important during adolescence; it is closely tied to self-esteem and has a direct impact on an individual's psychological and physical well-being. Males tend to have a more positive physical self-concept and health self-perception than females (Palenzuela-Luis et al., 2022). Meanwhile, self-esteem is inextricably linked to both self-concept and self-perception.

Self-esteem, bedtime habits, and waking-up habits are three sub-variables from the health asset profile that are associated with overall health literacy. Comprehensive health literacy (CHL) refers to the ability to seek, comprehend, assess, and apply information to make informed health decisions (Sørensen et al., 2012). CHL includes interactive and critical health literacy (Nutbeam, 2015). More advanced cognitive and literacy abilities, coupled with social skills, enable individuals to actively participate in everyday settings, extract information, draw meaning from diverse forms of communication, and apply it to changing circumstances (Sørensen et al., 2012).

Functional health literacy, on the other hand, refers to an individual's ability to read and comprehend health-related information (Nutbeam, 2015). It includes fundamental health literacy skills that enable individuals to access relevant health information (e.g., about health risks and how to utilize the healthcare system) and apply that knowledge to specific tasks (Nutbeam, 2015). This type of literacy is associated with several health asset profile sub-variables, including self-esteem, sedentary behavior, wake-up time, and smoking behavior. Individuals with higher self-esteem tend to be more motivated to seek health information and make informed decisions about health. Good health literacy enables individuals to comprehend health information, assess the credibility of information sources, and take effective action to maintain or improve their health. Low self-esteem can hinder a person's ability to seek and use health information effectively (Adrian, 2024). Good health literacy can encourage individuals to seek further information about how to maintain health, including the importance of physical activity and reducing sedentary time (Rohman et al., 2021). Health literacy is closely linked to healthy behaviors, as it enables individuals to understand health information, make informed decisions, and take actions that support their overall well-being. Conversely, low health literacy can lead to unhealthy behaviors and increase risks of health problems (Centers for Disease Control and Prevention [CDC], 2024).

5. Implications and limitations

The findings of this study have practical implications for nursing, particularly in the context of school-based health promotion. This study highlights that current health education efforts have not significantly improved children's health literacy. Therefore, nurses must continue to innovate in selecting appropriate methods and media for delivering health promotion programs, moving beyond merely increasing knowledge to effectively enhancing health literacy, especially those who work in community and school health programs. Enhancing functional health literacy should be prioritized through the use of culturally relevant materials, interactive learning resources, and age-appropriate communication techniques. To better meet the varied needs of students, school-based interventions should also consider socioeconomic backgrounds and gender differences when creating health promotion programs.

However, this study has limitations. First, the researchers were not present during the data collection process, so it was not possible to cross-check the accuracy of the answers given in the questionnaires. Second, the study's cross-sectional design limits its ability to establish a causal relationship between health asset profiles and health literacy. Third, as the study was limited to a single district (Sumedang, West Java, Indonesia), the results may not apply to children in other areas with distinct cultural, social, or economic contexts. Despite the limitations, this study contributes valuable insights for nursing professionals, particularly in the context of health promotion within school settings.

6. Conclusion

This study found significant gender-based differences in health asset profiles and health literacy among school-aged children, particularly in self-esteem, nutritional status (as measured by BMI), health behaviors (including physical activity, sedentary behavior, bedtime, wake-up time, and smoking behavior). Despite many participants coming from low-income homes and having poor nutritional status, they reported relatively high self-esteem. However, their limited reading abilities may be related to their low socioeconomic background, which restricts access to health information. Given the critical importance of health literacy in adolescence, further research is needed to identify the key factors that most influence their reading abilities. In addition, poor nutritional status, which remains below WHO criteria, can serve as a basis for future studies investigating the causes of underweight in adolescents.

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Author contribution

NSS, PS, and HP were responsible for formulating the research idea, objectives, and design. NSS, SWL, and EL contributed ideas and concepts for adding research variables and refining research objectives. NSS, DN, and PS prepared the ethical review and collected the research data. NSS and HP performed data analysis and drafted the manuscript. All authors agree to be accountable for the published work.

Conflict of interest

Nothing to declare. No Conflict of Interest.

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