

Nutritional and Anemia Status of Adolescent Girls in Kintamani, Bangli Based on School Screening Program

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ABSTRACT

Background. Adolescent girl is the key population for creating a healthy generation. However, stunting is still being a crucial problem in the community, especially in Bangli, Bali. Studies that focused on stunting in school-aged population is still lacking compared to others age-related population. This study was aimed to describe nutritional status and anemia among adolescent girls in Kintamani, Bangli. **Method.** This cross-sectional study was held alongside school screening program at two high schools in work area of Kintamani 6 Primary Health Care Centre. All girls aged 12-17 years on the first grade participated in this study. Analysis of nutritional status were done using WHO Anthro-plus software based on WHO Reference 2007. Hemoglobin level was measured by point-of-care testing using strip method with a calibrated device. **Result.** Total sample of 223 adolescent girls were participated. All numerical data were found in normal limits (Kolmogorov Smirnov test $p > 0.05$). Nutritional status with severe thinness 1 (0.4%), thinness 3 (1.3%), normal 187 (80.6%), overweight 26 (11.2%) and obesity 15 (6.5%). Anemia found in 64 adolescents with 32 (13.8%) equal numbers for both mild and moderate anemia (Hb level: 11.0-11.9, 8.0-10.9, respectively). In adolescent girls affected by anemia, 18.7% were facing nutritional problems either under or overnutrition. **Conclusion.** Double burden of malnutrition and anemia still being health problems among adolescent girls in Indonesia, especially Kintamani. Evidence-based interventions were needed for raising the awareness among adolescent girls who once will be future mother regarding a healthy diet and the importance of taking iron supplementation routinely.

Keyword: Nutritional status, anemia, adolescent girl, school screening program

ABSTRAK

Latar Belakang. Remaja putri merupakan kelompok strategis dalam mencetak generasi penerus yang sehat. Meskipun demikian, *stunting* masih menjadi masalah kesehatan masyarakat yang penting, termasuk di Kabupaten Bangli, Bali. Mengingat terbatasnya data mengenai *stunting* pada anak usia sekolah, penelitian ini bertujuan mendeskripsikan status nutrisi dan profil anemia pada remaja putri di Kintamani, Bangli. **Metode.** Penelitian potong lintang (*cross-sectional*) ini terintegrasi dengan program skrining kesehatan di dua sekolah menengah wilayah kerja Puskesmas Kintamani VI. Subjek penelitian meliputi seluruh remaja putri berusia 12-17 tahun pada tahun pertama sekolah menengah. Status nutrisi dianalisis menggunakan perangkat lunak WHO AnthroPlus (standar WHO Reference 2007), sementara kadar hemoglobin diukur melalui metode *point-of-care testing* (POCT) menggunakan alat berbasis strip yang telah dikalibrasi. **Hasil.** Penelitian melibatkan 232 remaja putri. Seluruh data numerik berdistribusi normal (uji Kolmogorov-Smirnov, $p > 0,05$). Proporsi status gizi subjek terdiri atas gizi buruk (0,4%), gizi kurang (1,3%), gizi baik (80,6%), gizi lebih (11,2%), dan obesitas (6,5%). Prevalensi anemia ditemukan sebesar 27,6% (64 subjek), yang terbagi rata antara kategori anemia ringan (13,8%; Hb 11,0-11,9 g/dL) dan anemia sedang (13,8%; Hb 8,0-10,9 g/dL).



Di antara subjek yang anemia, sebanyak 18,7% mengalami masalah gizi (*undernutrition* maupun *overnutrition*). **Simpulan.** Beban ganda malnutrisi dan anemia masih menjadi permasalahan kesehatan krusial pada remaja putri di Kintamani. Diperlukan intervensi berbasis bukti untuk meningkatkan kesadaran remaja mengenai pola makan sehat dan urgensi konsumsi Tablet Tambah Darah secara berkala.

Kata Kunci: *Status nutrisi, anemia, remaja putri, skrining kesehatan sekolah.*

Introduction

Adolescent girl is a key population for creating a healthy future generation and breaking the intergenerational cycle of malnutrition (Gonete et al., 2018). This transition period between childhood and adulthood is characterized by rapid physical, mental, and cognitive development, which significantly increases requirements for macro and micronutrients (Tandoh et al., 2021).

The nutritional status of adolescent girls represents a critical public health priority, as adolescence serves as the "second window of opportunity" to correct childhood growth deficits and prepare for future maternal health (Hadush et al., 2021). During this period, girls undergo rapid physiological changes, achieving up to 25% of their adult height and 50% of their adult weight. This intense growth creates high nutritional demands, making adolescent girls particularly vulnerable to a triple burden of malnutrition: the coexistence of undernutrition, overnutrition, and micronutrient deficiencies (Abubakar et al., 2024).

Undernutrition, manifesting as stunting (chronic) and thinness or underweight (acute), continues to be a severe public health challenge in low- and middle-income countries. In various regions, adolescent girls exhibit alarming rates of chronic and acute malnutrition. For instance, studies show stunting rates as high as 57.92% in parts of India and thinness/underweight prevalence reaching 86.9% in urban Pakistan (Zafar et al., 2025).

Simultaneously, a rapid "nutrition transition" is leading to increased overweight and obesity, often driven by high consumption of energy-dense, nutrient-poor fast foods. In Indonesia, nearly 1 in 7 adolescents is now overweight or obese (Rah et al., 2021). In Bangladesh, while stunting and thinness have decreased since 2001, the prevalence of overweight has risen from 1.7% to 7.4% (Mostafa et al., 2021).

Perhaps most critical for clinicians is the high prevalence of micronutrient deficiencies in girls who appear to have a normal BMI. Research in South India found that only 19.1% of adolescent girls had adequate levels of all essential micronutrients, with Vitamin B12 and Copper deficiencies being widespread (Sunitha et al., 2024).

Adolescent girls are uniquely susceptible to anemia due to these high nutritional demands during growth spurts combined with blood loss during menstruation.⁵ Anemia among adolescent girls is still being a significant global public health challenge, particularly in low- and middle-income countries, where it

is driven by a complex interplay of biological, nutritional, and socioeconomic factors (Fitariani et al., 2025).

Globally, anemia affects approximately 26% of adolescent girls in developing countries compared to 6% in developed nations. In South Asia, more than half (55%) of adolescent girls suffer from the condition. Studies also show prevalence rates of 42.75% in rural Western India, 32.88% (pooled) in East and West Africa, and approximately 17.4% to 18% in various regions of Nepal (Fitariani et al., 2025).

Anemia also remains a severe public health problem among adolescent girls in Indonesia, with prevalence rates varying significantly across regions, from 19.9% in Pekanbaru to as high as 76% in North Lombok. This condition is multifactorial, primarily driven by inadequate nutrient intake, poor dietary habits, and systemic nutritional deficiencies (Gimire et al., 2024).

Malnutrition in adolescent girls creates a vicious cycle. Malnourished girls are at higher risk for obstetric complications, preterm births, and delivering low-birth-weight babies (Melesse et al., 2025). This ensures that the next generation begins life in a malnourished state, perpetuating poverty and poor health outcomes across the community (Hadush et al., 2021). Adding into that, anemic adolescent girls also are at high risk of becoming anemic mothers who may experience chronic energy deficiency (CED) during pregnancy. This condition increases the likelihood of delivering low birth weight babies and perpetuating the cycle of stunting in their offspring (Tandoh et al., 2021).

Stunting is still being main concern of Indonesian Health Ministry. Bangli regency, based on Indonesian Health Survey at 2018 has the highest prevalence of children with stunting among other regencies in Bali Province with about 43.2% which is even higher than total prevalence in Indonesia (30.8%) (Dinkes Bali, 2024).

Kintamani is a subdistrict in Bangli regency, one out of 9 regencies in Bali province, Indonesia. Kintamani total population is 116,949 residents with total area 386.16 km². The socio-demographic profile of Kintamani, characterized by low to moderate education levels and strong local traditions, contributes to limited health awareness and suboptimal dietary patterns. This specific condition potentially exacerbates the risk of anemia and nutritional problems in the region. Therefore, it is essential to describe the nutritional and anemia status of adolescent girls in Kintamani, Bangli, Bali to inform for further actions regarding this health problems.

Material and Methods

This cross-sectional study was conducted alongside school screening program at February-March 2025 in Kintamani 6 Primary Health Care Center. The study population included total sampling of 232 adolescent girls aged 12-17 years old from first grade of 2 schools (junior and senior high school) in work area of Kintamani 6 primary health care center. Previously, all sample were asked to fill the digital form for identity (national identity registry, full name, birth date) and

informed oral consent from the parents at home. Those who were parents not willing to sign, have medical history of hemolytic anemia, incomplete identity data (birthdate/ age) were not included in the study.

For data collection, anthropometric and hemoglobin assessment were used. Anthropometric assessment includes weight and height measurements. Weight of the girl measured using digital weighting scale that has been calibrated previously and recorded to the nearest 0.1 kg. All sample were asked to use light clothing and also removed socks, shoes and hat for the measurement. Heights were measured using stadiometer and recorded to the nearest 0.1 cm. The body mass index was calculated from the weight in kilograms divided with height in meter square.

Analysis of nutritional status were done using WHO Anthro-plus software based on WHO Reference 2007 according to age, sex, weight, height, and body mass index. Nutritional status for children age 5 to 18 years old classified based on WHO Reference BMI for Age Z-score that is adopted by Indonesia Health Ministry Regulation with categorization: Severe Thinness (<-3 SD), Thinness (-3 to -2 SD), Normal (>-2 to <0.99), Overweight (1.00 to 1.99 Z), and Obese (≥ 2 Z score).

Hemoglobin (Hb) concentration was measured by point-of-care testing (POCT) using strip method with a calibrated device. A portable device was used to measure the hemoglobin level. The classification for anemia based on World Health Organization recommendation is mild anemia (Hb $11.0 - 11.9$ g/dl), moderate anemia (Hb $8.0 - 10.9$ g/dl), and severe anemia (Hb less than 8.0 g/dl). Data were collected by laboratory, nurse diploma, and dietitian professionals that has been trained previously in Kintamani 6 Health Care Centre. Informed consent was obtained from the from the participants' parents or guardians and head class teachers. Permission for the study was granted by Bangli District Health Office.

Result and Discussion

The results showed that 232 adolescent girls aged 12-17 years old participated in this study with characteristics and mean values summarized in Table 1.

Table 1. Total Sample Characteristics

Variable	Total
Total Sample	$n = 232$
Education Level	
Junior High School	126 (54.3%)
Senior High School	106 (45.7%)
Age (years)	13.92 ± 1.3
12	47 (20.3%)
13	78 (33.6%)
14	2 (0.9%)

15	57 (24.5%)
16	47 (20.3%)
17	1 (0.4%)
Height (mean)	151.20 ± 11.70
Weight (mean)	47.75 ± 10.04
Hemoglobin level (mean)	12.71 ± 1.5
Body Mass Index (mean)	20.68 ± 5.35
Anemia Status	
Severe Anemia	0 (0.0%)
Moderate Anemia	32 (13.8%)
Mild Anemia	32 (13.8%)
Normal	168 (72.4%)
Nutritional Status	
Severe thinness	1 (0.4%)
Thinness	3 (1.3%)
Normal	187 (80.6%)
Overweight	26 (11.2%)
Obese	15 (6.5%)

Our study showed that adolescent girls in Kintamani, Bangli, Bali is facing both undernutrition and overnutrition problems. The highlight of the finding is the trend of overweight and obese are dominating rather than undernutrition problems. The total of sample that categorized as overnutrition (overweight and obese) is 17.7% and undernutrition (severe thinness and thinness) is 1.7% (Table 1).

Anemia is also a health problem among adolescent girls in Indonesia with 64 out of 232 samples are anemic. The percentage of mild and moderate anemia were found in the same exact number. There is no sample found with severe anemia.

Table 2. Sample Characteristics Based on Education Level

Variable	Junior High (n=126)	Senior High (n=106)
Age	12.63 ± 1.02	15.45 ± 1.01
Height	149.19 ± 4.78	155.21 ± 5.65
Weight	45.26 ± 3.95	51.31 ± 5.28
BMI	20.01 ± 2.23	21.48 ± 2.45
Hb level	11.69 ± 0.35	13.00 ± 0.52
Nutrition status		
Severe thinness	1 (0.8%)	0 (0.6%)
Thinness	3 (2.4%)	0 (0.5%)

Normal	95 (75.4%)	92 (86.8%)
Overweight	16 (12.7%)	10 (9.4%)
Obese	11 (8.7%)	4 (3.7%)
Anemia status		
Severe Anemia	0 (0.0%)	0 (0.0%)
Moderate Anemia	22 (17.5%)	10 (9.4%)
Mild Anemia	20 (15.8%)	12 (11.3%)
Normal	84 (66.7%)	84 (79.3%)

Table 2 showed that in these 2 education levels, overall health problems were found higher in junior high school girls rather than senior high schoolers. The case of severe thinness and thinness even only found among junior high schoolers. Both education level has higher number of students with overnutrition. Anemia also found in moderate and mild categorization in both levels with higher percentage among junior high school girls.

The nutritional status and anemia prevalence among adolescent girls represent a critical global health challenge, as this group is in a vital transitional period for physical growth, cognitive development, and future reproductive health (Annisa et al., 2025). Our study results indicate a "double burden" of malnutrition, where high rates of undernutrition persist alongside a rapid rise in overweight and obesity (Jiwani et al., 2020). While 80.6% of the girls have a normal nutritional status, there is a notable prevalence of overweight (11.2%) and obesity (6.5%), alongside cases of thinness (1.3%) and severe thinness (0.4%). Crucially, 18.7% of adolescent girls in Kintamani who are affected by anemia also face concurrent nutritional problems.

The global prevalence of obesity among adolescent girls has seen a significant and concerning increase over the last three decades. Globally, one in three adolescents is now affected by overweight or obesity. Between 1990 and 2022, the age-standardized prevalence of obesity in girls aged 5–19 years rose from 1.7% to 6.9%. By 2022, approximately 65.1 million girls worldwide were living with obesity, an increase of over 51 million since 1990 (NCD-Risc, 2024). Adding into that, we also found that the overnutrition problems arising with percentage 11.2% overweight and 6.5% obesity. This number is similar with the result from Indonesian Health Survey for Bali Province in 2023 for adolescent girls aged 13-15 years (overweight 15.9%, obesity 4.1%) and 16-18 years (overweight 10.4%, obesity 2.8%) (Kemenkes RI, 2024).

Obesity prevalence increased in girls in 186 countries (93%) between 1990 and 2022 (NCD-Risc, 2024). A more recent meta-analysis covering 2000–2023 found a 1.5-fold increase in pediatric obesity rates when comparing the period of 2012–2023 to 2000–2011 (Zhang et al., 2024). There has been a global shift from thinness

dominance to obesity dominance; by 2022, obesity was more prevalent than thinness among girls in 133 countries (67%) (NCD-Risc, 2024).

In United States, higher obesity rates are found among girls from low- and middle-income families (Deng et al., 2024). Conversely, in South Africa, adolescents from high-income families show higher prevalence, potentially due to the increased ability to purchase processed foods and electronic devices that encourage sedentary behaviour (Nwosu et al., 2022).

The primary factor that probably causing this trend is lifestyle, early life influences, and food environment. Lifestyle meaning common drivers include skipping breakfast, having fewer than three meals per day, regular computer use (over 2 hours daily), and a lack of regular physical activity (Zhang et al., 2024). Early Life Influences include maternal obesity, smoking during pregnancy, and high birth weight are strongly associated with a higher risk of adolescent obesity. Regarding food environment, a global "nutrition transition" has replaced traditional diets with commercial, highly processed, and calorie-dense foods (NCD-Risc, 2024).

Kintamani, Bangli, Bali is an agricultural area where most of the people work as a farmer. This area centralized by Batur mountain and surround by trees and gardens. But this area is also a crowded tourism area for the beauty of the mountain and cold environment, suitable for glamping, trekking, and also hiking. Many transportations already available in this area and people here also affected by digitalization. Adolescents in Kintamani predominantly already have smartphone and using public transportation to school. It also contributing to sedentary lifestyle and lack of physical activity among them, at last, causing the high prevalence of obesity among adolescent girls here.

Adolescent girls with obesity face significant health risks that can persist into adulthood, including hypertension, asthma, and dental caries. Psychological impacts are also prevalent; studies indicate that approximately one in three children with obesity may experience depression (Zhang et al., 2024).

Nutritional outcomes are heavily influenced by a girl's environment and background. Girls from lower-income families and those whose parents have lower education levels face significantly higher risks of anemia and stunting (Annisa et al., 2025). Rural girls often experience higher rates of severe thinness and stunting due to limited access to diversified foods and healthcare (Annisa et al., 2025). Water, Sanitation, and Hygiene (WASH) practices and lack of deworming lead to parasitic infections (like hookworm), which are major external causes of anemia (Annisa et al., 2025).

Based on our results, 27.6%, or nearly a third of the sample population of adolescent girls, suffered from anemia, either mild or moderate. This prevalence is composed of equal numbers of girls suffering from mild anemia (13.8%) and moderate anemia (13.8%). These results align with data from the 2018 Indonesian

Nutritional Status Survey (SSGI), which showed that 31.7% of adolescent girls suffered from anemia (Annisa et al., 2025).

The magnitude of anemia among adolescent girls differs significantly by geographic region. A study in India showed that in Nagpur district, a study found a high prevalence of 57%, with 84% of girls suffering from at least one micronutrient deficiency (Dhurde et al., 2024). In Ghana, prevalence rates approach 50%, while in Malawi, approximately 35% of adolescent girls are anemic (Ndovie et al., 2025). In Ethiopia, systematic reviews and local studies show a pooled prevalence of 23.02%, with specific districts like Jimma and Wayu Tuqa reporting rates of 26.7% and 27%, respectively (Fentie et al., 2020).

The sources identify several interconnected factors that drive anemia in this population. The first one is physiological demands regarding menstruation. The onset of menstruation is the most significant risk factor, as regular blood loss increases the need for iron (Li et al, 2022). In Ethiopia, girls who had attained menarche were twice as likely to be anemic. Late adolescence (ages 15–19) typically sees higher rates than early adolescence due to these cumulative physiological changes (Regasa & Haidar, 2019).

The second one regarding dietary inadequacies. Low dietary diversity is a primary cause of micronutrient deficiencies (Fentie et al., 2020). Many girls rely on starch-heavy staples, like maize in Malawi, which lack essential iron and zinc (Ndovie et al., 2025). Studies in China and India highlight that low consumption of "flesh foods" (meat, poultry, fish) and eggs is strongly associated with higher anemia risk (Dhurde et al., 2024).

The third probable causes are socioeconomic Factors. Living in rural areas significantly increases risk due to limited access to diverse foods and health information (Regasa & Haidar, 2019). Furthermore, low maternal education is a consistent predictor of anemia, while higher education serves as a protective factor, likely due to better nutritional knowledge and child-rearing practices (Fentie et al., 2020).

Evidence for the effectiveness of large-scale preventive nutrition interventions in low-to-middle income countries remains limited and of varying quality. Weekly Iron and Folic Acid (IFA) supplementation is a common strategy, but its success is often hampered by low compliance and supply chain bottlenecks (Li et al, 2022). In Kintamani, Bangli, Bali this is already being a routine program from Primary Health Care Centre for adolescent girls in Junior and Senior High School. Data from local sources show 97% adolescent girls at school is already receiving weekly IFA supplementation. But, alongside with result from Indonesian Health Survey 2023, some adolescents who received IFA supplementation didn't take it properly or routinely due to some reasons: didn't think it beneficial, dislike the smell, nausea, bored, and simply forget (Kemenkes RI, 2024).

The sources argue for inter-sectoral collaboration between health and education sectors to provide comprehensive nutritional counselling (Regasa & Haidar, 2019). Breaking the intergenerational cycle of malnutrition requires targeting girls before they become pregnant to ensure optimal health for both the mother and future offspring (Li et al, 2022). Nutrition education is important to encourage diet diversity and healthy eating behaviours (Annisa et al., 2025). This intervention is much needed in Kintamani, Bangli, Bali. In the future, nutritional education must be advocated for high schoolers when the school entrance socialization or “posyandu remaja” program in the villages.

Conclusion

Adolescence is a critical period of rapid physical growth and reproductive maturation, making girls particularly vulnerable to nutritional deficiencies and anemia due to increased nutrient demands. The prevalence and severity of these problems vary globally, but they remain a major public health concern, particularly in low- and middle-income countries. Double burden of malnutrition and anemia still being health problems among adolescent girls in Indonesia, especially Kintamani, Bangli, Bali. Evidence-based interventions were needed for raising the awareness among adolescent girls who once will be future mother regarding a healthy diet and the importance of taking iron supplementation routinely. Future research and analytical study about contributing factors regarding nutritional problems and anemia in Kintamani, Bangli, Bali is much needed.

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