Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Medicine

Risk Factors Associated With Blood Hemoglobin Levels in Adolescent Girls in the East Ratahan District, Southeast Minahasa Regency

Youla Annatje Assa[1*], Alexander Sam Leonard Bolang[1], Martha Marie Kaseke[1]

[1]Faculty of Medicine, Sam Ratulangi University, Jln Kampus Unsrat, Bahu Manado, 95115, Indonesia

DOI: 10.36347/sjams.2022.v10i12.049 | **Received:** 01.11.2022 | **Accepted:** 06.12.2022 | **Published:** 13.12.2022

***Corresponding author:** Youla Annatje Assa
Faculty of Medicine, Sam Ratulangi University, Jln Kampus Unsrat, Bahu Manado, 95115, Indonesia

Abstract **Original Research Article**

Anemia is a health problem that is most often found in developing countries, including Indonesia. Adolescents are an age group that is very at risk for the incidence of anemia due to nutritional needs, especially iron and could cause reduced physical, mental capacity, and diminished concentration in work and educational performance, as well as early motherhood in girls. Adolescent girls are a group that need sufficient iron, since they are prone to anemia and malnutrition because of menstruation every month. This study aimed to determine the risk factors associated with blood levels in adolescent girls in the East Ratahan District, Southeast Minahasa Regency. This was quantitative research with a cross-sectional design. 96 adolescents were willing to participate in the research, and only 79 people continued to participate until the study was terminated. The sampling technique was purposive sampling. Data on iron and protein intake was collected using the Food Frequency Semi-Quantitative Form. Hemoglobin (Hb) concentrations were determined on finger-prick blood samples, while the protein intakes were obtained by interviews conducted 24 hours after the food recall. The result shows that there is no connection between hemoglobin levels and nutritional status (weight, height, BMI, LILA, and BMI/U). Most subjects have a good nutritional status. Intake of macronutrient proteins is strongly correlated with female adolescents' hemoglobin levels and anemia status. Most subjects have a normal level of protein adequacy. Iron intake has a strong relationship with hemoglobin levels and anemia status in female adolescents. Furthermore, risk factors associated with hemoglobin levels are protein intake and iron intake in female adolescents.

Keywords: Hemoglobin, Nutritional status, Protein intake, and Iron level.

INTRODUCTION

Anemia is a global public health problem affecting both developing and developed countries and has major consequences for human health as well as social and economic development. It affects 24.8% of the world's population [1]. According to the World Health Organization (WHO), anemia is a condition in which the concentration of red blood cells or hemoglobin is lower than normal [2]. Normal hemoglobin levels are critical to maintaining health because they transport oxygen to all body tissues and carbon dioxide back to the lungs. The incidence of anemia in Indonesia is still high. Based on data from Badan Penelitian dan Pengembangan Kesehatan in 2018, the prevalence of anemia in adolescents is 48.9%, meaning that 4–5 out of 10 adolescents suffer from anemia [3]. Adolescence is defined by the WHO as a period of life that includes ages between 10 and 19 years. [4]. Adolescents are an age group that is very at risk for the incidence of anemia due to nutritional needs, especially iron. This age group's needs exceed those of other age groups due to accelerated growth and increased physical activity. Insufficient intake of protein, iron, vitamin B12, vitamin C, folic acid, and other nutrients related to hemoglobin levels can cause nutritional deficiency anemia. Adolescent girls aged 10–18 years are a group that is prone to anemia and malnutrition [5, 6]. Adolescent girls need more iron than boys because young girls experience menstruation every month. This is partly due to the health quality of children and adolescents who do not get a balanced nutritional intake, as well as young women who experience anemia due to an iron deficiency [7]. Nutritional or food intake factors can also affect hemoglobin levels. The health quality of adolescent girls is the key to preventing stunting [6]. The problem of stunting cannot be solved in one way but must be solved at all levels, especially by improving the life quality of young women who will give birth to the next generation. Stunting is a condition of failure to thrive in toddlers due to chronic malnutrition in the first 1000 days of life (HPK) [8].

MATERIALS AND METHODS

The present study was arranged in an analytic observational study with a cross-sectional design. Research permits and ethical clearance were obtained from the Research Ethics Committee of the Faculty of Medicine, Sam Ratulangi University, Manado, Indonesia. The research was conducted in East Ratahan District, Southeast Minahasa Regency, Indonesia and carried out from March 2022 to August 2022. The research samples were 79 teenage girls who met the inclusion criteria. The sampling technique was purposive sampling. Data on iron and protein intake were collected using the Food Frequency Semi-Quantitative Form. The data on hemoglobin levels was obtained by checking the blood, while the protein intakes were obtained by interviews conducted 24 hours after the food recall. Data from consumption interviews using the FFQ were processed using the Nutrisurvey application to determine the average specific intake that affects hemoglobin levels. Nutritional status data were obtained by measuring the body mass index. The data obtained were processed using the SPSS (Statistical Program for Social Sciences) application. Data analysis was carried out descriptively by presenting the results in the form of tables. Bivariate analysis; Categorical variable data were analyzed statistically using non-parametric tests to determine the relationship between variables measured. For non-parametric correlation test, Spearman's rank correlation test was employed.

RESULT AND DISCUSSION

Ninety-six adolescents were willing to participate in the research, and only 79 people continued to participate until the study was terminated. The description of univariate analysis samples is shown in Table 1, while the distribution of the nutritional status of study samples is shown in Table 2. Based on the data shown in Table 2, most of the adolescent girls who became the study sample (58.2%) were classified as having good nutritional status while adolescents with poor nutritional status had the smallest percentage (6.3%) this could be seen in the average value of nutritional status based on BMI, which was 20.05 ± 3.50 kg/kg m2.

Table 1: Description of results of univariate analysis of research samples

Variable	n	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	79	11	17	13.54	1.49
Body Weight (kg)	79	30.80	68.00	47.281	8.64
Height (cm)	79	131.0	166.5	153.50	6.31
BMI (kg/m2)	79	14.41	30.18	20.05	3.50
LiLA (cm)	79	19.00	32.00	23.86	2.91
Hemoglobin (g/dL)	79	10.30	16.60	13.42	1.28
Calorie intake (kkal)	79	1375.80	2956.90	2048.44	358.42
Protein (gr)	79	54.3	118.30	92.147	13.91
Zat Besi (mg)	79	6.10	19.30	15.00	2.80

Table 2: Distribution of nutritional status of study samples

Classification of Adolescent Nutritional Status	n	%
Undernutrition (-3SD s/d <-2SD)	5	6.3
Good Nutrition (-2SD s/d 1SD)	46	58.2
Overnutrition (1SD s/d 2SD)	21	26.6
Obesity (>2SD)	7	8.9
Total	79	100.0

Table 3: Distribution of anemia in research samples

Anemia Classification	n	%
Anemia (<12 g/dL)	2	2.5
Not Anemia (≥12 g/dL)	77	97.5
Total	79	100.0

Data in Table 3 shows that the number of cases of anemia in adolescents who became the research sample was relatively small, namely 2 people (2.5%). This situation is supported by the data on blood hemoglobin levels which have an average value of 13.42 ± 1.28 gr/dL. The correlation of age and nutritional status with hemoglobin levels and anemia status of the adolesent girls is shown in Table 4. The analysis of the variables of age and nutritional status (weight, height, BMI, Lila, and nutritional status

BMI/A) shows that there is no relationship with hemoglobin levels and the incidence of anemia in adolescents.

Table 4: Correlation of age and nutritional status with hemoglobin levels and anemia status

Variable	Statistical Value	Hemoglobin	Anemia
Age	Correlation Coefficient (r)	-0.030	-0.067
	Significance p	0.792	0.555
	N	79	79
Body weight	Correlation Coefficient (r)	0.084	0.000
	Significance p	0.459	1.000
	N	79	79
Body Height	Correlation Coefficient (r)	0.138	-0.071
	Significance p	0.225	0.535
	N	79	79
BMI	Correlation Coefficient (r)	-0.039	0.014
	Significance p	0.734	0.902
	N	79	79
Lila	Correlation Coefficient (r)	0.109	0.004
	Significance p	0.337	0.975
	N	79	79
Nutritional Status (BMI/A)	Correlation Coefficient (r)	-0.028	0.060
	Significance p	0.808	0.600
	N	79	79

Table 5: Correlation of Nutrient Intake with Hemoglobin Levels and Anemia Status

Variable	Statistical Value	Hemoglobin	Anemia
Calorie intake	Correlation Coefficient (r)	0.029	0.042
	Significance p	0.798	0.711
	N	79	79
Protein	Correlation Coefficient (r)	0.271*	0.265*
	Significance p	0.016	0.018
	N	79	79
Iron	Correlation Coefficient (r)	0.572**	0.251*
	Significance	0.000	0.026
	N	79	79

* Significant correlation at 0.05 level
** Significant correlation at 0.01 level

The results of the correlation between nutrition intake with hemoglobin and anemia has been shown inTable 5. Protein intake has a strong relationship with hemoglobin levels (r=0.271, p=0.016) and anemia status (r=0.265, p=0.018) in female adolescents. Intake of micronutrients, namely intake of iron, had a strong positive correlation with hemoglobin levels (r=0.572, p=0.000) and anemia status (r=0.251, p=0.026). This suggested that the increased consumption of iron will help to raise hemoglobin levels and improve anemia status in adolescents.

CONCLUSION

It can be concluded that there is no correlation between hemoglobin levels and nutritional status (weight, height, BMI, LILA, and BMI/U). Most subjects have a good nutritional status. Intake of macronutrient proteins is strongly correlated with female adolescents' hemoglobin levels and anemia status. Most subjects have a normal level of protein adequacy. Iron intake has a strong relationship with hemoglobin levels and anemia status in female adolescents.

ACKNOWLEDGEMENTS

Acknowledgements go to Sam Ratulangi University, which has provided grants for the implementation of this research, as well as to the adolescent girls in East Ratahan District, Southeast Minahasa Regency, who have been the subjects of this research.

REFERENCES

1. De, L. M., Pena-Rosas, R. J. P., & Cusick, S. (2011). *Hemoglobin Concentrations for the Diagnosis of Anemia and Assessment of Severity; Vitamin and Mineral Nutrition Information System*. (11^{th} ed). World Health Organization. Geneva.

2. Benoist, B. D., McLean, E., & Egli, I. (2008). *Worldwide Prevalence of Anemia 1993–2005*. World Health Organization. Geneva.
3. Badan Penelitian dan Pengembangan Kesehatan. (2018). *Riset Kesehatan Dasar (Riskesdas) 2018 Laporan Nasional*. Badan Litbangkes Depkes. Jakarta.
4. Hamal, S., Dhungana, G. P., Shrestha, P., & Niraj, K. C. (2018). Prevalence of anemia and its associated factors among school adolescent girls in Baglung municipality. *Global Journal of Medicine and Public Health*, 7(5), 1-8.
5. Whitney, E., & Rolfes R. S. (2008). *Understanding Nutrition* (11^{th} ed). Thomson Wadsworth. USA.
6. Gallagher, M. L. (2008). *The Nutrients and Their Metabolism*. Missouri Saunders Elsevier, St. Louis.
7. Mahan, L. K., & Escott-Stump, S. (2012). *Krause's Food, Nutrition, and Diet Therapy*. (12^{th} ed). Saunders. Philadelphia.
8. Soliman, A., Alaaraj, N., Hamed, N., Alyafei, F., Ahmed, S., Shaat, M., Itani, M., Elalaily, R., & Soliman, N. (2022). Nutritional interventions during adolescence and their possible effects. *Acta Biomed*, 93(1).