

The Correlation between the Level of Hemoglobin and Learning Concentration on the Tenth-Grade Science Class Female Students in Senior High School of 3 Denpasar

Ni Made Sekar Sari¹, Ni Kadek Ayu Suarningsih², Gusti Ayu Ary Antari³

Nursing Study Program
Faculty of Medicine, Udayana University
Denpasar, Bali
ayusuarningsih@unud.ac.id
Nursing Study Program
Faculty of Medicine, Udayana University
Denpasar, Bali
Nursing Study Program
Faculty of Medicine, Udayana University
Denpasar, Bali

Abstract Hemoglobin is an iron rich protein present in red blood cells. Female student is vulnerable of having abnormally low levels of hemoglobin (≤ 12 g/dL) due to blood losses during monthly menstruation, which can have an impact on decreasing their concentration to learn. The purpose of this research was to determine the correlation of hemoglobin levels and learning concentration on the tenth-grade science class female students in senior high school of 3 Denpasar. It used quantitative type of research and cross-sectional study model approach. The sampling methods used simple random sampling, which is totaled 122 respondents. The data collection of hemoglobin levels used digital method Easy Touch GCHb and learning concentration used questionnaire with 27 statements. Based statistic test on *Pearson Product Moment*, it showed hemoglobin level with learning concentration on the tenth-grade science class female students in senior high school of 3 Denpasar, has a strong and positive correlation ($r=0,737$; $p<0,05$). The result of this research is expected to be used as a suggestion in helping female student to be active in the blood tablet administration program.

Index Terms— Hemoglobin Level, Learning Concentration, Female Student

I. INTRODUCTION

Teenage girls are vulnerable to nutritional problems. The menstruation period highly contributed to the teenage girls' nutritional problems. Teenage girls are at risk of various health problems if the food intake is not matched the need during the menstruation period. One health problem that can occur is anemia [1].

The anemia prevalence on the teenage girl is relatively high. World Health Organization (WHO) stated that 50% of the female world population in 2016 are diagnosed with anemia, one-third of that population are aged between 10-24 years old. Indonesia has contributed 12-37% female population with anemia (aged 15-49 years old), with the mean of the hemoglobin level were <12 g/dL [2]. Indonesia Health Survey Department in 2013 also found that 18.4% of anemia was found at the age of 15-24 [3].

The level of hemoglobin is an indicator used to classify an individual health status. Hemoglobin is a red-pigmented protein which used to delivers oxygen [4]. WHO in 2011 stated that the normal level of hemoglobin on females aged more than 15 years old is >12 g/dL [5].

The low level of hemoglobin affected the blood's ability to deliver oxygen and iron. A study conducted by Kusmiyati, Meilani, and Ismail in 2013, found that student's academic performances are parallel with the level of the hemoglobin. The academic performance was increasing 2.3 times if there was an improvement of hemoglobin level of 1 g/dL [6].

A good concentration would be increased the focus, which in other hand also improves the level of understanding of an object or information. Pratama, Sinaga, and Ompusunggu in 2017 also stated that the high level of hemoglobin correlated with better concentration [7]. The

low level of hemoglobin could cause some problems, such as psychomotor development disorder, intellectual and cognitive disorder, low studying concentration and some behavioral changes [8].

Senior High School of 3 Denpasar successfully gained the highest score on the computer-based national examination on the science and social program in 2018 [9]. Senior High School of 3 Denpasar held a program of Ferrous Tablet. Senior High School of 3 Denpasar was given ferrous tablets to their female students which already started in June 2017. Each female student received 6 ferrous tablets which have to be consumed once a week.

The previous study in Senior High School of 3 Denpasar showed that 64.1% of female students were having a low level of hemoglobin [10]. The pilot study also showed that 5 students from 10 students were having a low level of hemoglobin (<12 g/dL). We also found that only 3 students who consumed the ferrous tablets routinely. Based on those explanations, this study aimed to know the correlation between the level of hemoglobin and studying concentration on the tenth-grade science class female students in the Senior High School of 3 Denpasar.

II. METHOD

This was a descriptive correlational study with cross-sectional design. Bivariate analysis was done using the Pearson Product Moment test because the data was distributed in the normal pattern.

The study population was all the tenth-grade science class female students in Senior High School of 3 Denpasar, with a total of 152 students. Based on the Slovin formula, the total of required participants was 122 students. Participants who met the inclusion criteria were chosen randomly using a simple random sampling technique assisted by a computer program.

This study involved independent variables (hemoglobin level) and dependent variables (learning concentration on the tenth-grade science class female students in senior high school of 3 denpasar). Easy Touch GCHb was used to identify the level of hemoglobin. The studying concentration data was collected using a Studying Concentration Questionnaire which already modified by Setiani in 2014 [11]. This questionnaire consisted of 27 valid question items. Statistically, the reliability of the questionnaire's question item was 0.903 (r product-moment). This result indicated that the questionnaire could be categorized as a reliable questionnaire.

The data collection was done on April 15th and April 18th, 2019 in Senior High School of 3 Denpasar by the researcher and one enumerator. After Senior High School of 3 Denpasar granted the study, the data collection was done to all the tenth-grade science class female students in Senior High School of 3 Denpasar. The data was collected using the Study Concentration Questionnaire while the level of hemoglobin was checked using the Easy Touch GCHb meter. The data then filtered based on the inclusion and exclusion criteria. The participants who met the inclusion

criteria than randomly chosen by a computer program to achieve the number of participants required in the Study ($n=122$).

The data were analyzed by univariate and bivariate analysis. The univariate analysis was used to describe the study variables. The bivariate analysis was used to know the correlation between the effects happened on the dependent variable. Pearson Product Moment test was used because the data were distributed normally.

III. RESULT

Based on the demographic data, there were 72 participants (59%) were aged 16, 97 participants' parents (79.5%) were having a salary of \geq Rp. 2.500.000,00, and 99 participants (88.1%) were only joining one extracurricular activity. Based on the nutritional status, 90 participants (73.8%) were having a normal body mass index (BMI), 81 participants (66.4%) have a good quality of sleep, and 117 participants (95.9%) were having menstruation period in 3-7 days.

The result of the level of hemoglobin shows that the mean of the level of hemoglobin was 13.4 (SD=1.4). We estimated that 95% of the level of hemoglobin was between 13.12 until 13.63 with the lowest score of 8.9 and the highest score was 16.3. One-hundred five participants (86.1%) were having a normal level of hemoglobin (≥ 12 g/dL). There were no participants with a level of hemoglobin under <8 g/dL).

The participant's studying concentration result showed that the mean of the studying concentration was 69.0 (SD=7.0) with the lowest score 50 and the highest score of 88.9. We estimated that 95% of the studying concentration score was between 67.73 until 70.28. One-hundred and five participants (86.1%) were having moderate studying concentration.

The correlation between the level of hemoglobin and studying concentration was done using Pearson Product Moment test with a confidence interval of 95% ($\alpha = 0.05$). Based statistic test on *Pearson Product Moment*, it showed that there was a strong and positive correlation between the level of hemoglobin and studying concentration on the tenth-grade science class female students in Senior High School of 3 Denpasar ($r = 0.737$; p -value < 0.001 ; $\alpha = 0.05$). This result indicated that the higher the level of hemoglobin, correlates with the higher-level studying concentration on the female students. While the lower level of the hemoglobin causes the lower studying concentration. The value of p is $< \alpha$, so we can conclude that the H_0 were refused and H_a was accepted.

IV. DISCUSSION

This study showed that there was a strong and positive correlation between the hemoglobin level and studying concentration on the tenth-grade science class female student in Senior High School of 3 Denpasar. This result indicated that a higher level of hemoglobin caused a higher level of studying concentration.

This study result was similar to the study done by Lestari in 2016, which showed there was a positive correlation between the levels of hemoglobin, and studying concentration on the female students. She also noted that the higher level of hemoglobin correlated with the higher studying concentration [12]. This result is also parallel with a study conducted by Devi, Rahayu and Kes in 2018 that found the level of hemoglobin correlated with the studying concentration [13].

The low level of hemoglobin on the female students can be happened due to the menstruation period that routinely occur on each month. The menstruation period caused the iron level to decrease because of the release of blood through the menstruation cycle. If there is no substitution of the iron, anemia is possibly happened, especially iron deficiency anemia [14].

The iron deficiency anemia could cause serious health problems for teenage girls. Physiologically, teenage girls would be going through pregnancy in the next couple of years. Iron deficiency anemia could increase the risk of the mother's death during delivery, premature baby, and baby with low birth weight [15].

The low level of hemoglobin causes a change in individual behavior and cognitive function. The brain, myogenesis of the antibody, and myelin development plays a significant role in transporting the stimulus on the nervous system. This process can be affected by the level of iron on the body. Adequate intake of iron causes the ability to concentrate better, giving a good effect on the way of thinking, and increasing the academic performances [16].

The low level of iron also reduces the neurological monoamine oxidase activity. Neurological activity plays a role in the synthesis of the dopamine and tyrosin, which worked together on managing the motoric coordination and serotonin management (neurotransmitter activity) for the focus and concentration. A low level of iron would be affected the cognitive and studying concentration [14]. Motoric coordination disorder and difficulty concentrating can appear because of iron deficiency. This condition reduces the student's focus when studying at school [17].

The change, which happened because of the low level of iron, can cause many problems with memory, learning capacity, emotional and psychological problems. Iron deficiency causes change on the brain homeostatic, especially on the dopamine and monoamine metabolism [18]. The change of those metabolism processes could block the development of the nervous system, myelination, neurotransmission, and dopamine basal prefrontal cortex which can be manifested by anxiety. Anxiety and depression feelings could make difficulty concentrating on the school [19].

The low level of hemoglobin also can cause the lower oxygen delivered to the body. This condition usually affects the metabolism. The metabolism activity can be decreased [20]. The inadequate metabolism activity reduced the energy for studying. Hence, the low level of hemoglobin could decrease the ability to study, reduce the level of concentration, and reduce the immunity. These things are

affected the academic performances. Studying concentration is playing an important role in determining whether the students can study on the higher grade [21].

The result showed that the studying concentration was classified in the range of moderate. This can be happened due to the effect of some factors which affected that studying concentration during the study. We didn't investigate in detail about those factors. Other factors that can affect the studying concentration are health status, attention, interest, preparedness, family support, infrastructure, and environment condition.

V. CONCLUSION

Results showed that there was a strong and positive relationship between the level of hemoglobin and studying concentration on the tenth-grade science class female students in Senior High School of 3 Denpasar.

This study didn't describe other factors that affected the studying concentration. Based on the result, further study needs to identify the correlation between the other factors (age, parents' salary, extracurricular activity, nutritional status, quality of sleep, and menstruation period) with the studying concentration.

ACKNOWLEDGMENT

The author thanks to Senior High School of 3 Denpasar for the research permission, and UPPM Faculty of Medicine, Udayana University, Bali.

REFERENCES

- [1] Kaimudin, N. I., Lestari, H., & Afa, J. R., "Skining dan determinan kejadian anemia pada remaja putri SMA Negeri 3 Kendari tahun 2017", *Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat*. 2017. 2(6), 1-10. ISSN:250-731X
- [2] World Health Organization (WHO), "Prevalence of anemia among women of reproductive age (% of women ages 15-49)", 2016. Retrieved from: <https://data.worldbank.org/>
- [3] Indonesia Ministry of Health, "Riset kesehatan dasar (Riskesdas) 2013", Jakarta: Badan Penelitian dan Pengembangan Kesehatan, 2013. Retrieved from <http://www.depkes.go.id/>
- [4] Hidayat, N., & Sunarti, S., "Validitas pemeriksaan kadar hemoglobin menggunakan metode hb meter pada remaja putri di Wonosari", *Kes Mas: Jurnal Fakultas Kesehatan Masyarakat*. 2015. 9(1), 11-17. doi: <http://dx.doi.org/10.12928/kesmas.v9i1.1548>
- [5] World Health Organization (WHO), "Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity", 2011. Retrieved from: <http://www.who.int/>
- [6] Kusmiyati, Y., Meilani, N., & Ismail, S., "Kadar hemoglobin dan kecerdasan intelektual anak", *Kesmas: National Public Health Journal*, 2013. 8(3), 109-114. doi: <http://dx.doi.org/10.21109/kesmas.v8i3.353>
- [7] Pratama, I. Y., Sinaga, J. L., & Ompusunggu, H. E. S., "Korelasi antara kadar hemoglobin dengan tingkat konsentrasi pada mahasiswa laki-laki Fakultas Kedokteran Universitas HKBP Nommensen Medan", *Nommensen Journal of Medicine*, 2017. 3(2), 58-62. Retrieved from: <https://uhn.ac.id/>
- [8] Almatsier, S., "Prinsip dasar ilmu gizi", Jakarta: Gramedia Pustaka Utama, 2010.
- [9] Balipost. "Sekolah ini raih hasil terbaik UN di Bali", 2018. Retrieved from: <http://www.balipost.com/news/2018/05/02/44481/Sekolah-Ini-Raih-Hasil-Terbaik...html>

- [10] Trisnawati, I.G.A., "Hubungan intelegensia dan kadar haemoglobin dengan prestasi belajar siswa SMA Negeri 3 Denpasar", *Unpublished Thesis*. Denpasar: Poltekkes Denpasar, 2011. Retrieved from: <http://repository.poltekkes-denpasar.ac.id/>
- [11] Setiani, A. C., "Meningkatkan konsentrasi belajar melalui layanan bimbingan kelompok pada siswa kelas VI SDN 2 Karangcegak, Kabupaten Purbalingga tahun ajaran 2013/2014", *Unpublised Research Paper*, Semarang: Semarang University, 2014. Retrieved from: <https://lib.unnes.ac.id/>
- [12] Lestari, N. C. A., "Hubungan antara anemia dengan daya konsentrasi pada remaja putri siswi SMP N 1 Sumowono di Desa Sumowono Kec. Sumowono Kab. Semarang tahun 2012", *Jurnal Nifas*. 2016. 2(1), 1-12.
- [13] Devi, S. A., Rahayu, T., & Kes, M., "Hubungan tanda-tanda vital dan kadar hemoglobin dengan konsentrasi belajar pada remaja putri", *Jurnal Prodi Biologi*, 2018. 7(5).
- [14] Dumilah, P. R. A., & Sumarmi, S., "Hubungan anemia dengan prestasi belajar siswi di SMP Unggulan Bina Insani", *Amerta Nutrition*, 2017. 1(4), 331-340. DOI: <http://dx.doi.org/10.20473/amnt.v1i4.2017.331-340>
- [15] Indonesia Ministry of Health, "Kenali masalah gizi yangancam kesehatan remaja Indonesia", 2018. Retrieved from: <http://www.depkes.go.id/>
- [16] Mamun, M. A., & Ghani, R. B. A., "The role of iron and zinc in cognitive development of children", *Asian Journal of Medical and Biological Research*. 2017. 3(2), 145-151. DOI : [10.3329/ajmbr.v3i2.33561](https://doi.org/10.3329/ajmbr.v3i2.33561)
- [17] Sudisa, A., & Rokhanawati, D., "Hubungan kejadian anemia dengan prestasi belajar pada siswa remaja putri kelas XI SMA Negeri 1 Tanjungsari Kecamatan Tanjungsari Kabupaten Gunung Kidul Yogyakarta", *Unpublished Research Paper*. Yogyakarta: Aisyiyah Yogyakarta University, 2017.
- [18] Thalanjeri, P., Karanth, H., Shankar, V., & Kutty, K., "Impact of iron deficiency anemia on cognition of school children of South India", *Indian Journal of Clinical Anatomy and Physiology*. 2016. 3(2), 135-138. DOI: [10.5958/2394-2126.2016.00032.3](https://doi.org/10.5958/2394-2126.2016.00032.3)
- [19] Su, J., Cui, N., Zhou, G., Ai, Y., Sun, G., & Zhao, S. R., "Hemoglobin status and externalizing behavioral problems in children", *International Journal of Environmental Research and Public Health*, 2016. 13(8), 1-13. DOI : <http://dx.doi.org/10.3390/ijerph13080758>
- [20] Yanti, J. S., Saputri, E. M., Edigan, F., & Muhamadiyah, M., "Hubungan anemia dengan prestasi belajar mahasiswa kebidanan tingkat II dan III di Akademi Kebidanan Helvetia Pekanbaru. *Al-Insyirah Midwifery: Jurnal Ilmu Kebidanan (Journal of Midwifery Sciences)*. 2019. 8(1), 6-9. Retrieved from: <https://jurnal.stikes-alinsyirah.ac.id/>
- [21] Watuna, P., Mantik, M. F., & Gunawan, S., "Perbedaan kadar hemoglobin antara anak usia sekolah yang berprestasi dan yang kurang berprestasi", *e-CliniC*. 2015. 3(1). Retrieved from: <https://ejournal.unsrat.ac.id/>