

# Correlation of Protein Intake, Consumption of Fruit and Vegetables, and Sodium Intake in Packaged Food with the Incidence of Anemia

<sup>1</sup>Gita Restiana, <sup>2\*</sup>Saskiyanto Manggabarani, <sup>3</sup>Rani Rahmasari Tanuwijaya

<sup>1</sup>Program Studi Gizi, Sekolah Tinggi Ilmu Kesehatan Pertamedika, Jakarta, Indonesia

<sup>2</sup>Program Studi Gizi, Sekolah Tinggi Ilmu Kesehatan Pertamedika, Jakarta, Indonesia

<sup>3</sup>Program Studi Gizi, Sekolah Tinggi Ilmu Kesehatan Pertamedika, Jakarta, Indonesia

\***Corresponding author:** Saskiyanto Manggabarani, email: zhakymanggabarani@gmail.com

## ABSTRACT

Anemia among adolescents is still an important health problem due to adolescent growth. Anemia in adolescent girls is caused by irregular eating patterns, abstinence from eating eggs/meat/fish, a dislike of consuming vegetables, and eating habits of fast food and junk food. Objective: This study aims to determine the relationship between protein, vegetable, and fruit intake, and sodium intake in packaged foods with the incidence of anemia in adolescent girls at MA Darussa'adah Jakarta. Methods: The design of this research is a cross-sectional study with a purposive sampling technique according to the inclusion and exclusion criteria, totaling 37 respondents. This research was conducted in February 2022. The research instrument is a food recall form 2x24 hours to determine protein intake and sodium intake in packaged foods, SQ-FFQ form to determine the consumption of vegetables and fruits by interviewing respondents. Results: The statistical results of the Pearson correlation test ( $p$  0.825) and a positive pattern of  $r$  (0.38), vegetables and fruit ( $p$  0.333) with a positive pattern of  $r$  (0.164), sodium intake ( $p$  0.724) with a positive pattern of  $r$  (0.60). Conclusion: there is no relationship between protein, vegetable, and fruit intake, sodium intake in packaged foods, and anemia in adolescent girls.

## ARTICLE INFORMATION

**Submitted:** 17/10/2022

**Revised:** 28/10/2022

**Accepted:** 01/11/2022

**Published Online:** 02/11/2022

### Keywords:

*Anemia*

*Protein Intake*

*Sodium Intake in Packaging Food*

*Vegetables and Fruits*

**How to cite this article:** Restiana, G., Manggabarani, S., & Tanuwijaya, R. R. (2022). Correlation of Protein Intake, Consumption of Fruit and Vegetables, and Sodium Intake in Packaged Food with the Incidence of Anemia. *Journal of Nutrition Science*, 3(2), 45-50. doi:10.35308/jns.v3v2.6615

## Introduction

Anemia is commonly referred to as a deficiency in hemoglobin (Hb) levels in the blood which is caused by a lack of nutrients needed for the formation of hemoglobin. High-risk anemia occurs in pregnant women, women of childbearing age, young women and toddlers (Manikam, 2021). According to the results of a study conducted by the World Health Organization, the prevalence of anemia in young women aged 10-18 years reached 41.5% in developing countries. Indonesia is one of the developing country, with the prevalence of anemia among young women in Indonesia according to WHO, which is 37%

higher than the prevalence of anemia in the world (World Health Organization, 2014).

Lack of consuming food sources of protein is one of the causes of anemia in young women (Zhu et al., 2021). One of the nutrients that are very important for the body, namely Protein because in addition to functioning as a source of energy in the body it also functions as a builder and regulator substance. Protein plays an important role in the transportation of iron in the body. A lack of protein intake will result in hampered iron transport so iron deficiency will occur (Briawan, 2014). Adolescent girls experience anemia caused by consuming less protein-sourced foods and like to consume packaged tea. Apart from consuming protein

for iron transportation, consuming fruits and vegetables is also one of the important things for health (Jana et al., 2022).

Chronic iron deficiency anemia lowers work tolerance, productivity, and the quality of life. This leads to further socio-economic difficulties. Dysfunction in the immune system results in increased risks for infections (Abbaspour et al., 2014). Additionally, it is recognized that mild and moderate anemia may also contribute to mortality risk (Scott et al., 2014). Studies have documented the association of anemia in chronic heart failure (Sabah et al., 2020).

Adequate consumption of vegetables and fruit is an indicator of balanced nutrition because vegetables and fruits are a source of vitamins, minerals, and protein which act as antioxidants, maintain normal blood pressure, blood sugar, and risk of bowel movements or constipation and obesity (Fongar et al. al., 2019). Lack of consumption of fruits and vegetables can result in various effects, namely decreased immunity, such as being susceptible to colds, prone to stress or depression, high blood pressure, digestive disorders, low Hb levels, wrinkled skin, and eye disorders (Mboi, 2014).

Anemia in young women is caused by irregular eating patterns, abstinence from animal-based foods (eggs, meat and fish), dislike of consuming vegetables, and the habit of eating fast food and junk food (Mariana & Nur, 2013). Consuming vegetables and fruit, sodium intake also needs to be considered because it has an important role in controlling blood flow using sodium functioning to pump the heart, if consuming less sodium intake heart pumping function decreases and blood supply to the body decreases (Wu et al., 2021). According to Astawan, there is a relationship between sodium intake and Hb levels (Astawan, 2010). The overall prevalence of anemia is 14.0%, and iron deficiency is higher in women than in men (Andriastuti et al., 2020). The study aimed to determine the relationship between protein intake, vegetable and fruit consumption, sodium intake in packaged foods and the incidence of anemia in women.

## Method

The type of research is quantitative with a *cross-sectional study approach* which has been carried out at the MA Darussa'adah Jakarta in January 2022. Sampling used a *purposive sampling technique* with the criteria of not suffering from a chronic disease for the last 3 months, not taking iron tablets for the last 1

month, and not currently menstruating. The research sample consisted of 37 female students who met the criteria.

Instruments for measuring protein intake and sodium intake in packaged food use *Food Recall* 2x24 hours based on nutritional adequacy rate (RDA) and consumption of vegetables and fruit was measured by SQ-FFQ 2x24 hours as recommended by WHO (2013), Checking hemoglobin with *Easy Touch* GCHB. Recall 2 interviews 4 hours and SQ-FFQ conducted 2 times a week. This research has fulfilled the ethical test requirements at Muhammadiyah University Jakarta with number 360/PE/KE/FKK-UMJ/XII/2021. Analysis of the data used is the correlation test with a value of  $\alpha \leq 0.05$ , as the meaning of significance.

## Results

Table 1 is known that of the 37 students there are the highest was 17 years old with 16 respondents (43.3%), the father's job was mostly as a laborer with 19 respondents (51.4%), the mother's job was mostly as a housewife, namely 34 respondents (91.9%). Family income < UMR was 35 respondents (94.6 %) and the highest number of family members was 5 family members with 12 respondents (32.4%).

**Table 1. Characteristics of Respondents**

Characteristics	n	Percentage
<b>Age</b>		
15 Years	3	8.1
16 Years	12	32.4
17 Years	16	43.3
18 Years	6	16.2
<b>Father's occupation</b>		
Private sector employee	12	32.4
Online Ojek Drivers	3	8.1
Laborer	19	51.4
Trader	2	5.4
Seamstress	1	2.7
<b>Mother's occupation</b>		
Housewife	34	91.9
Private sector employee	1	2.7
Trader	2	5.4
<b>Family Income</b>		
≥ Regional Minimum Wage	2	5.4
< Regional Minimum Wage	35	94.6
<b>Family members</b>		
3 people	10	27.0
4 people	11	29.7
5 people	12	32.4
6 people	3	8.1
7 people	1	2.7

\*Descriptive

Descriptively, table 2 shows that out of 37 female students, the majority of female students consume less protein, as many as 23 female students (62.2%) and at least 7.4% based on RDA. Consuming vegetables and fruit found that female students consumed fewer vegetables and fruit 17 respondents (45.1%) and some did not consume vegetables based on

the interview results. Pan sodium intake in packaged food is not good as many as 2.6 respondents (43.2%) with the highest intake of 2410 mg. Based on blood hemoglobin examination there were female students experiencing anemia as many as 18 respondents (48.6%) with the lowest Hb level of 11.9g/dL

**Table 2. Intake of Protein, Vegetables and Fruits, Intake of Sodium in Packaging, Incidence of Anemia**

Variable	n	Percentage	Min-max
<b>Protein intake</b>			
Enough	14	37,8	7.4 - 80.4
Not enough	23	62,2	
<b>Consumption of Vegetables and Fruits</b>			
Enough	20	54,1	0 - 1179
Not enough	17	45,9	
<b>Sodium Intake in Packaged Foods</b>			
Well	21	56,8	88.2 - 2410
Not good	16	43,2	
<b>Anemia Incidence</b>			
Anemia	19	51,4	7.4 - 15.4
Not Anemia	18	48,6	

\*Descriptive

**Table 3. Correlation Analysis of Anemia Incidence**

Variable	Mean±SD	Standard Error	r	R <sup>2</sup>	Line Equation	p
Protein Intake	54.82±13.42	-136	0.38	0.01	194 + 136,961	0.825*
Consumption of Vegetables and Fruits	426.87±293.96	723	0.164	0.27	3,682+133,474	0.333*
Packaged food sodium intake	1383±608.45	-763	0.60	0.04	496 + 136,600	0.724*

\*Pearson Correlation

Mean protein intake was 54.82% RDA with a value ( $r=0.38$ ) showing a weak relationship between protein intake and anemia and a positive pattern. R average consumption of vegetables and fruit 426.87 grams with a value ( $r=0.164$ ) showing a very weak relationship between consumption of vegetables and fruit and anemia and a positive pattern. The average R intake of sodium in packaged food is 1383 mg with a value ( $r=0.60$ ) indicating the relationship between sodium intake in packaged food and anemia is strong and has a positive pattern. The results of the person correlation test obtained each p-value (0.825), (0.333), and (0.724) so that between protein intake, vegetable and fruit consumption, sodium intake in packaged foods did not correlate with the incidence of anemia.

## Discussion

### Protein Intake

Lack of protein intake causes anemia because protein can help in the formation of hemoglobin

in red blood cells. The relationship between protein intake and hemoglobin levels in female students obtained a weak correlation and a positive pattern, which means that the higher the protein intake, the higher the hemoglobin level of female students. There was no significant correlation between protein intake and anemia with an average protein intake of 54.82 g so the students' protein intake was stated to be insufficient. Protein has a function to transport iron, namely through transferrin. Lack of protein intake can disrupt iron transport, as well as the formation of hemoglobin and red blood cells, which in turn causes iron deficiency anemia. Iron deficiency is mainly concerned with increased hemopoietic activity and low iron stores (Huettmann et al., 2021).

Lack of protein intake in female students is mostly due to students' anxiety if they gain weight after consuming animal protein. Snacks at school also do not contain enough animal protein, some are sold containing vegetable

protein such as tempeh and fried tofu. Most stalls sell foods that contain high carbohydrates. One of the steps to prevent a lack of protein intake in female students is to bring provisions from home that have a balanced nutritional content.

Sufficient protein is needed for hemoglobin synthesis to run well because protein has an important role in the absorption and transportation of iron, so low protein intake cannot support the process of forming hemoglobin, low levels of hemoglobin in the body are an indicator of anemia. Protein has to do with iron (Roziqo & Nuryanto, 2016). This study is similar to research conducted by Novitasari in 2014 (Novitasari, 2014) on young women in Surakarta which stated that there was no relationship between protein intake and hemoglobin levels. This study contradicts the results of Choudhary's statement that there is a relationship between protein intake and hemoglobin levels in female adolescents (Choudhary et al., 2020).

#### **Consumption of Vegetables and Fruits:**

Fruit and vegetable consumption habits are closely related to food selection and preferences so in this study it was found that there were students who did not consume fruits and vegetables. The relationship between the consumption of vegetables and fruit and anemia shows a very weak relationship but has a positive pattern, which means that the higher the consumption of vegetables and fruit, the higher the hemoglobin level of female students. The average amount of protein consumed with hemoglobin levels did not correlate significantly.

Portions of vegetable and fruit consumption have been regulated so that they can meet the needs of fiber and microminerals. Vegetables should be eaten 2 servings per day and fruit eaten 1 serving per day (Howard Wilsher et al., 2019). Eat vegetables better fresh or steamed, because boiling tends to dissolve vitamins and minerals while the fruit must first be washed under running water and peeled from the skin of the fruit to eat the fruit flesh (Proverawati, 2011). This similar study shows that there is no significant relationship between vegetable and fruit consumption and the incidence of anemia (Jhee et al., 2019). However, this study is in contrast to research conducted by Permatasari which states that there is no significant relationship between fruit and vegetable

consumption and the incidence of anemia (Permatasari et al., 2020; Tata et al., 2019).

**Packaged Food Sodium Intake:** Sodium has a major role in hemoglobin levels. The basic function of sodium is to maintain fluid balance or fluid distribution and blood pressure. Sodium also plays a role in regulating the body's acid-base balance in neurotransmission and muscle contraction (Atun et al., 2014). This study found that the relationship between sodium intake in packaged food and anemia was strong and had a positive pattern, which means that the higher sodium consumption in packaged food, the higher the hemoglobin level of female students, but there was no significant correlation. The results of this study were supported by Sari & Yudhya stating that there was no significant relationship between snack foods containing high sodium intake and female student hemoglobin levels (Sari & Yudhya, 2011).

Insufficient sodium intake can cause a decrease in blood volume So blood pressure will also decrease. Low blood pressure along with fast pulse, dizziness, muscle cramps, weakness, fatigue, loss of appetite, memory loss, weakened immunity reduces infection, visual disturbances, unhealthy hair, and persistent cracks and white spots on nails will cause absorption of nutrients is disrupted both in terms of quality and quantity.

the habits of most respondents are not eating breakfast, being lazy to drink water, and unhealthy diets because they want to be slim (ignoring sources of protein, carbohydrates, vitamins, and minerals) which can affect the process of absorption of iron in the body. The habit of snacking and eating ready-to-eat food causes adolescents to be unable to meet the needs of the diversity of food substances needed by their bodies for the synthesis process of forming hemoglobin (Hb). If this happens for a long time, it will cause Hb levels to continue to fall and cause anemia (Sitanggang, 2019).

#### **Conclusion**

Lack of protein intake is caused by students' anxiety when they gain weight after consuming animal protein. Snacks at school also do not contain enough animal protein. Most stalls sell foods that contain high carbohydrates. In addition to a lack of protein intake, several female students consume fewer fruits and vegetables because they do not like them and are not available at home. Snacking habits,

namely snacking on packaged foods or snacks that contain protein and minerals to support the absorption of iron which is lacking but these snacks contain high sodium. There is no relationship between protein intake, vegetable and fruit consumption, sodium intake in packaged foods and the incidence of anemia in female students.

### Acknowledgement

Acknowledgments to all respondents who agreed to be interviewed and the school for giving permission and providing secondary data in this study.

### Author Contribution and Competing Interest

GR and SM play the role of initiating ideas and writing scripts. RRT acts data analysis and enumerator in collecting research data.

### References

- Abbaspour, N., Hurrell, R., & Kelishadi, R. (2014). Review on iron and its importance for human health. *Journal of Research in Medical Sciences*, 19(2), 164–174.
- Andriastuti, M., Ilmana, G., Nawangwulan, S. A., & Kosasih, K. A. (2020). Prevalence of anemia and iron profile among children and adolescent with low socio-economic status. *International Journal of Pediatrics and Adolescent Medicine*, 7(2), 88–92. <https://doi.org/10.1016/j.ijpam.2019.11.001>
- Astawan, M. (2010). *Atur Asupan Natrium dengan Cermat*. Jakarta. Gramedia Pustaka Utama.
- Atun, T. S., & Kurdanti W. (2014). Asupan Sumber Natrium, Rasio Kalsium Natrium, Aktivitas Fisik, dan Tekanan Darah Pasien Hipertensi. *Media Gizi Mikro Indonesia*, 1(6), 63–71.
- Briawan, D. (2014). *Anemia Masalah Gizi Pada Remaja Wanita*. Jakarta. EGC.
- Choudhary, M., Singh, S. P., & Patel, C. R. (2020). Effect of drumstick leaves supplementation for treating iron deficiency anemia in adolescence girls. *Journal of Pharmacognosy and Phytochemistry*, 9(3), 1446–1449.
- Fongar, A., Gödecke, T., Aseta, A., & Qaim, M. (2019). How well do different dietary and nutrition assessment tools match? Insights from rural Kenya. *Public Health Nutrition*, 22(3), 391–403. <https://doi.org/10.1017/S1368980018002756>
- Howard Wilsher, S., Fearne, A., & Panagiotaki, G. (2019). "That is an awful lot of fruit and veg to be eating". Focus group study on motivations for the consumption of 5 a day in British young men. *Nutrients*, 11(8), 1893. <https://doi.org/10.3390/nu11081893>
- Huettmann, C., Stelljes, M., Sivalingam, S., Fobker, M., Vrachimis, A., Exler, A., Wenning, C., Wempe, C., Penke, M., & Bunes, A. (2021). Iron Deficiency Caused by Intestinal Iron Loss—Novel Candidate Genes for Severe Anemia. *Genes*, 12(12), 1869. <https://doi.org/10.3390/genes12121869>
- Jana, A., Chattopadhyay, A., & Saha, U. R. (2022). Identifying risk factors in explaining women's anaemia in limited resource areas: evidence from West Bengal of India and Bangladesh. *BMC Public Health*, 22(1), 1–16. <https://doi.org/10.1186/s12889-022-13806-5>
- Jhee, J. H., Kee, Y. K., Park, J. T., Chang, T.-I., Kang, E. W., Yoo, T.-H., Kang, S.-W., & Han, S. H. (2019). A diet rich in vegetables and fruit and incident CKD: a community-based prospective cohort study. *American Journal of Kidney Diseases*, 74(4), 491–500. <https://doi.org/10.1053/j.ajkd.2019.02.023>
- Manikam, N. R. M. (2021). Known facts: iron deficiency in Indonesia. *World Nutrition Journal*, 5(S1), 1–9. <https://doi.org/10.25220/WNJ.V05.S1.0001>
- Mariana, W., & Nur, K. (2013). Hubungan Status Gizi dengan Kejadian Anemia Pada Remaja Putri di SMK Swadaya Wilayah Kerja Puskesmas Karangdoro Kota Semarang Tahun 2013. *Kebidanan*, 2(4), 35–36. <https://doi.org/10.31983/jkb.v2i4.98>
- Mboi, N. (2014). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 41 Tahun 2014 Tentang Pedoman Gizi Seimbang*. Jakarta. Kemenkes RI.
- Novitasari, S. (2014). *Hubungan Tingkat Asupan Protein, Zat Besi, Vitamin C Dan Seng Dengan Kadar Hemoglobin Pada Remaja Putri Di SMA Batik 1 Surakarta*. Universitas Muhammadiyah Surakarta. Permatasari, Briawan, D., & Madanijah, S.

- (2020). Hubungan Asupan Zat Besi Dengan Status Anemia Remaja Putri Di Kota Bogor. *Kesehatan Masyarakat*, 4(2), 95–100.  
<https://doi.org/10.31004/prepotif.v4i2.935>
- Proverawati, A. (2011). *Anemia dan Anemia Kehamilan*. Yogyakarta. Nuha Medika.
- Roziqo, O. I., & Nuryanto. (2016). Hubungan Asupan Protein, Zat Besi, Vitamin C Dan Seng Dengan Kadar Hemoglobin Pada Balita Stunting. *Journal Of Nutrition College*, 5(4), 419–427.  
<https://doi.org/10.14710/jnc.v5i4.16453>
- Sabah, Z., Aziz, S., Wani, J., Masswary, A., & Wani, S. (2020). The association of anemia as a risk of heart failure. *Journal of Family Medicine and Primary Care*, 9(2), 839.  
[https://doi.org/10.4103/jfmpc.jfmpc\\_791\\_19](https://doi.org/10.4103/jfmpc.jfmpc_791_19)
- Sari, N., & Yudhya, E. M. (2011). Kontribusi Makanan Jajanan, Inedeks-Massa-Tubuh Dan Kadar HB Remaja Putri, Pesantren Ibadurrahman Tangerang. *Nutrire Diaita*, 3(1), 46–55.  
<https://doi.org/10.47007/nut.v3i1.1231>
- Scott, S., Chen-Edinboro, L., Caulfield, L., & Murray-Kolb, L. (2014). The Impact of Anemia on Child Mortality: An Updated Review. *Nutrients*, 6(12), 5915–5932.  
<https://doi.org/10.3390/nu6125915>
- Sitanggang, M. R. (2019). *Faktor yang Mempengaruhi Anemia Pada Remaja Putri di SMA Prima Tembung*. Fakultas Farmasi dan Kesehatan. Intitusi Kesehatan Helvetia.
- Tata, C. Y., Ickowitz, A., Powell, B., & Colecraft, E. K. (2019). Dietary intake, forest foods, and anemia in Southwest Cameroon. *PloS One*, 14(4), e0215281.  
<https://doi.org/10.1371/journal.pone.0215281>
- World Health Organization. (2014). *Martenal Mortality : WHO Global Database On Anemia*. Geneva. WHO Press.
- Wu, J., Agbor, L. N., Fang, S., Mukohda, M., Nair, A. R., Nakagawa, P., Sharma, A., Morgan, D. A., Grobe, J. L., & Rahmouni, K. (2021). Failure to vasodilate in response to salt loading blunts renal blood flow and causes salt-sensitive hypertension. *Cardiovascular Research*, 117(1), 308–319.  
<https://doi.org/10.1093/cvr/cvaa147>
- Zhu, Z., Sudfeld, C. R., Cheng, Y., Qi, Q., Li, S., Elhoumed, M., Yang, W., Chang, S., Dibley, M. J., & Zeng, L. (2021). Anemia and associated factors among adolescent girls and boys at 10–14 years in rural western China. *BMC Public Health*, 21(1), 1–14. <https://doi.org/10.1186/s12889-021-10268-z>

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