

Comparison between the Effectiveness of Tomatoes Juice and Spinach Juice Consumption on Hemoglobin Level of Third Trimester Mothers with Anemia

Retno Widowati*, Nurhasanah, Bunga Tiara Carolin

Universitas Nasional Jakarta, Indonesia

* Correspondent Author: retno.widowati@civitas.unas.ac.id

ABSTRACT

Government has established the provision of Fe tablet for pregnant mothers. However, third trimester mothers who are suffering from anemia still presents. Therefore, additional nutrition needs to be given aiming to increase their hemoglobin level. This research was carried out to compare the effectiveness of tomatoes juice and spinach juice consumption to increase hemoglobin level on third trimester mothers with anemia. The current research was conducted through a quasi-experimental research using two group pretest-posttest design. Furthermore, data analysis was done by using dependent t-test and independent t-test. As many as 30 pregnant mother suffering from anemia were involved and divided into two groups. The first group consumed tomatoes juice, while the second group consumed spinach juice every day for 14 days. All mothers also consumed Fe tablet every day according to the regulation. This research was carried out in Tangerang District on January 2021. These research results revealed that there was significant differences on the hemoglobin level before and after tomatoes juice and spinach juice consumption on the experimental groups. Significant differences on hemoglobin level were also found between the effectiveness of tomatoes juice and spinach juice on trimester pregnant mothers suffering from anemia (p value 0.037). Hence, it can be summed up that spinach juice is more effective in increasing the hemoglobin level of third trimester mothers suffering from anemia compared to tomatoes juice. It is suggested for the health workers to recommend pregnant mothers to consume spinach juice to increase or maintain their hemoglobin level.

Keywords: Anemia, Hemoglobin, Spinach Juice, Tomatoes Juice

Received March 18, 2021; Revised April 11, 2021; Accepted April 28, 2021



STRADA Jurnal Ilmiah Kesehatan, its website, and the articles published there in are licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

BACKGROUND

Anemia is one of a condition where hemoglobin level in blood is below normal, so it is insufficient to meet an individual physiological need (World Health Organization, 2017). Anemia on pregnancy has bigger risk on low birthweight, premature birth, as well as perinatal and neonatal mortality (Rahman et al., 2016). Heavy anemia is related to higher maternal mortality rate (Daru et al., 2018). Anemia also affects more than a half billion productive women in the world. Particularly, it was estimated to affect 38% (32.4 million) pregnant mothers globally, with the highest prevalence was in Southeast Asia (48.7%) and Africa (46.3%) (World Health Organization, 2015).

Based on the World Health Organization (2017) anemia on pregnant mother is divided into non-anemia if the hemoglobin level is more than or equal to 11 g/dL. On the other hand, a pregnant mother is considered to suffer from anemia if the hemoglobin concentration is less than 11 g/dL during the first trimester, less than 10.5 g/dL during the second trimester, and less than 11 g/dL during the third trimester. This is a diagnostic for anemia during pregnancy. During pregnancy, due to the increased blood volume and blood thinning, hemoglobin concentration naturally decreases during the first and second trimester, then increased periodically during the third trimester (International Nutritional Anemia Consultative Group, 2012).

In Indonesia, based on the Basic Health Research 2018, there were 48.9% pregnant mothers who suffered from anemia. This increased from 37.1% in 2013. To overcome anemia, government has established the regulation of provision of blood booster tablet or iron tablets or Fe tablet for pregnant mothers. Data from the Basic Health Research in 2018 showed that not all pregnant mothers consumed Fe tablet. It was known that only 72.3% pregnant mothers obtained Fe tablet, and all of them obtained only 90 Fe tablet or only 76%. Meanwhile, pregnant mothers who obtained more than 90 tablets were only 24%. However, pregnant mother who consumed more than 90 Fe tablets were only 38.1% (Ministry of Health of RI, 2018).

Based on the data issued by Mothers' Health Annual Report from Sukadiri Public Health Center of Tangerang in 2018, there were 157 pregnant mothers (12.17%) of total 1,290 pregnant mothers who suffered from anemia. Meanwhile, third trimester pregnant mothers who suffered from anemia were 45 pregnant mothers (3.48%). Treatment has been done to handle pregnant mothers who suffered from anemia in Sukadiri Public Health Center of Tangerang through the provision of Fe table (Profile of Sukadiri Public Health Center, 2019). Based on the data above, various solutions are required so that pregnant mothers will not suffer from anemia and their pregnancy becomes healthier.

Several research projects have been done to increase hemoglobin level on pregnant mothers, one of them is by adding nutritional food intake such as tomatoes juice by Fitriani et al. (2020) and Novyriana & Caesarani (2019); dragon fruit juice by Soleha et al. (2020) and Sitepu & Hutabarat (2020); red spinach juice by Astuti et al. (2017); and spinach juice Kundaryanti et al., 2018).

Therefore, based on the explanation above, current research was carried out aiming to compare the effectiveness of tomatoes juice and spinach juice consumption on hemoglobin level of third trimester pregnant mothers suffering from anemia.

METHODS

This research employed quasi-experimental research using pretest and posttest two groups design. The number of respondents involved in this research was 30 pregnant mothers on their third trimester suffering from anemia. The inclusion criteria of choosing the

respondents mild anemia (hemoglobin >8 g/dL and <11 g/dL), no allergic to tomatoes and spinach, no comorbidities during pregnancy and labor, and willing to participate in the research procedure to the end. Furthermore, research respondents were divided into two groups, the first group consumed tomatoes juice, while the second group consumed spinach juice. In addition, all respondents still consumed Fe tablet according to the provisions from health workers in Public Health Center. This research was carried out at Sukadiri Public Health Center, Sukadiri Sub-District, Tangerang District, Banten Province in January 2021.

Respondents' hemoglobin level was measured before the intervention and after 14 days of consuming juice. Tool used was digital Hb measurer. Blood collection process was done hygienely. Tomatoes or spinach juice consumed by the resepondents were 200 ml. Tomatoes juice was made by blending red and clean 200g tomatoes, 50 mL water, and 2 g sugar. Meanwhile, spinach juice was made by cooking 50 g spinach leaves, 150 ml water, 1 shallot clove, $\frac{1}{4}$ tsp of salt, and $\frac{1}{2}$ tsp of sugar. After thia mixture was cooked, the mixture was then blended to make it juice.

After all hemoglobin data were collected, the data were then tabulated and analyzed. Analysis was done by calculating the average of hemoglobin level from the two groups before and after consuming juice for 14 days. Data normality test was then performed by using Skewness-Kutosis test. If the data normality test results show that the data is distributed normally, then it can be continued by dependent t-test to compare the condition before and after the intervention. Test between the groups was done by using independent t-test by comparing the effectiveness of tomatoes juice and spinach juice consumption in increasing hemoglobin level.

RESULT

Research results were obtained and presented in detail in Table 1, Table 2, Table 3, and Table 4. Table 1 shows the mean and standard deviation of the hemoglobin before and after the interventions of both consuming tomatoes juice and spinach juice. The data normality test that was conducted by using Skewness-Kurtosis found that the data were not normally distributed. Furthermore, Table 2 shows the results of dependent t-test which compare the mean hemoglobin level of third trimester pregnant mothers suffering from anemia before and after consuming tomatoes juice after 14 days. Meanwhile, Table 3 indicates the dependent t-test results which compare the mean hemoglobin level of third trimester pregnant mothers suffered from anemia before and after consuming spinach juice after 14 days. In addition, Table 4 shows the independent t-test obtaining the effectiveness of tomatoes juice and spinach juice consumption on the mean increase of hemoglobin level of third trimester pregnant mothers suffering from anemia.

Table 1. Mean hemoglobin level (g/dL) before and after consuming tomatoes or spinach juice

Intervention	Tomatoes Juice			Spinach Juice		
	n	Mean	SD	n	Mean	SD
Before	15	10.160	0.5462	15	10.073	0.6364
After	15	10.933	0.4835	15	11.400	0.6698

Table 2. Dependent t-test of hemoglobin level (g/dL) before and after consuming tomatoes juice

No	Treatment	n	Mean	SD	P-value
1	Before	15	10.160	0.5462	0.000
2	After	15	10.933	0.4835	

Table 3. Dependent t-test of hemoglobin level (g/dL) before and after consuming spinach juice

No	Treatment	n	Mean	SD	P-value
1	Before	15	10.073	0.6364	0.000
2	After	15	11.400	0.6698	

Table 4. Independent t-test results of the differences of consuming tomatoes juice and spinach juice on hemoglobin level (g/dL) of third trimester pregnant mothers suffering from anemia

Intervention Groups	N	Mean	SD	SE	p value
Consuming Tomatoes Juice	15	10.933	0.4835	0.1248	0.037
Consuming Spinach Juice	15	11.400	0.6698	0.1729	

DISCUSSION

Anemia occurs when someone does not have sufficient red blood cells or hemoglobin in blood. Hemoglobin can be formed if there is sufficient Fe. When hemoglobin is sufficient, the red blood cells will be formed. The function of red blood cell is to bring oxygen from the lungs to all parts of body. Hemoglobin is part of red blood cells which bring oxygen. Therefore, if the iron in the body is insufficient, then hemoglobin will not be formed or red blood cell becomes imperfect. Iron can be obtained from food or supplement in the form of pill or liquid. Lack of iron is the most general cause of anemia during pregnancy.

Iron deficiency is considered as the most common nutritional deficiency which can cause anemia. However, lack of other nutrition also can cause anemia, including lack of vitamin A, B12, B6, C, D, and E, folate, riboflavin, copper, and zinc (Wieringa et al., 2016). These nutrition — vitamin A, B6, dan B12, folate acid, and riboflavin — are needed to produce red blood cells normally. Other nutrition such as vitamin C and E can protect red blood cell through its antioxidant function (Chaparro & Suchdev, 2019). Vitamin C is vitamin cofactor and has the ability to increase the iron adsorption from food. In addition, vitamin c can regulate metabolism in mammals (Lane & Richardson, 2014).

Based on the results of current research, it was known that the mean hemoglobin level of third trimester pregnant mothers before consuming tomatoes juice was 10.160 g/dL, while after consuming tomatoes juice after 14 days was 10.933 g/dL. The mean hemoglobin level between before and after consuming tomatoes juice show significant increase (p value $0.000 < 0.05$). This shows that consuming tomatoes juice regularly for 14 days on third trimester pregnant mothers gave significant effect on the increase of hemoglobin level. This research result is supported by several previous research projects. One of them is a research conducted by Fitriani et al. (2018) on 15 pregnant mothers suffering from anemia whose hemoglobin level increased after consuming tomatoes juice. Another research on related topic was also carried out by Novyriana and Chaesarani (2019) on 5 pregnant mothers

suffering from anemia whose hemoglobin level increased significantly after consuming tomatoes juice.

Based on USDA (2019a), there were 2.57 mg iron, vitamin C in the form of 25.7 mg ascorbate acid, 714 IU vitamin A in 100 gram tomatoes. The nutritional content of tomatoes significantly support the increase of hemoglobin in pregnant mothers because it contains iron, vitamin A, and vitamin C which can increase the formation of red blood cells.

Another finding from this research also obtained that the hemoglobin level of third trimester pregnant mothers before consuming spinach juice was 10.073 g/dL, while after consuming spinach juice after 14 days it increased to 11.400 g/dL. Therefore, the mean hemoglobin between before and after consuming spinach juice increased significantly (p value $0.000 < 0.05$). This shows that there was an effect from consuming spinach juice regularly for 14 days on the hemoglobin level of third trimester pregnant mothers. This research result is in line with the previous research conducted by Kundaryanti et al. (2015) that by consuming spinach juice every morning and afternoon for 7 days on 13 third trimester pregnant mothers suffering from anemia would increase their hemoglobin level significantly. This research result is also supported by another previous research carried out by Astuti et al. (2015) showing that there was significant effect from consuming red spinach juice in increasing hemoglobin level.

Spinach is one of green vegetables which has sufficient complete nutrition. According to USDA (2019b), there is 2.71 mg of iron, vitamin C in the form of 28.1 mg ascorbate acid, 9377 IU of vitamin A 0.195 mg Vitamin B6, 194 ug folate, and 0.189 mg riboflavin in 100 gram tomatoes. As how tomatoes juice affect the hemoglobin level, spinach juice is also vegetable which increases the hemoglobin level of third trimester pregnant mothers suffering from anemia. In addition to iron, spinach also contains vitamin C, vitamin A, folate, and riboflavin which are the elements needed to form red blood cells.

However, based on the comparison of the effectiveness between consuming tomatoes juice and spinach juice in increasing the hemoglobin level of third trimester pregnant mothers suffering from anemia, it shows that there was significant difference between consuming tomatoes juice and spinach juice (p value $0.037 < 0.05$). The increase of hemoglobin level on third trimester pregnant mothers after consuming spinach juice is higher than consuming tomatoes juice. This can also be seen from the mean hemoglobin level of third trimester pregnant mothers who consumed spinach juice which was 11.400 g/dL or it was not anemia anymore.

Regular consumption of spinach juice for 14 days can give higher increase of hemoglobin level compared to tomatoes juice. The comparison of nutritional content between spinach and tomatoes according to USDA (2019a, 2019b) also revealed that iron, vitamin C, and vitamin A are higher in spinach than in tomatoes. In addition, spinach also contains folate and riboflavin.

Vitamin C in the form of 28.1 mg of ascorbate acid in 100 g spinach is higher than 25.7 mg/100 mg tomatoes. Ascorbate acid in food has the same effect in increasing the adsorption of iron. Research results indicated that iron is found in foods such as meat, nuts, dark green vegetables, and cereal for breakfast. Iron contained in meat (heme iron) and vegetable sources (non-heme iron) is absorbed differently. Human body does not absorb iron from plant sources well. However, vitamin C which can increase non-heme iron adsorbed from vegetable source is found (Morino, 2015). Iron in environment and food dominated by ferric iron (Fe^{3+}) which is not dissolved and bio-available. Therefore, before being adsorbed, non-heme iron must be reduced from ferric iron (Fe^{3+}) into ferrous iron (Fe^{2+}) by the food reducer agent. One of the elements which can change ferric into ferrous

is ascorbate acid or vitamin C (Beck et al., 2014).

Increasing hemoglobin in third trimester pregnant mothers suffering from anemia can be done by consuming Fe tablet obtained from midwife or public health center, or consuming spinach regularly.

CONCLUSION

Current research found that hemoglobin level on third trimester pregnant mothers suffering from anemia by consuming Fe tablet that: Consuming tomatoes juice can increase the mean hemoglobin level significantly, Consuming spinach juice can increase hemoglobin level significantly, Consuming spinach juice is more effective compared to consuming tomatoes juice in increasing mean hemoglobin level.

ACKNOWLEDGEMENT

Researchers would like to express gratitude to the head of Sukadiri Public Health Center of Tangerang District and its ranks. Researchers would also say thanks to pregnant mothers who have become respondents in this research.

CONFLICT OF INTEREST

Researchers claimed that there is no conflict of interest in this research.

REFERENCES

- Astuti, K. H., Sugit & Widyastuti, A. H. (2015). Pengaruh konsumsi jus bayam merah terhadap peningkatan kadar Hb pada ibu hamil di Kecamatan Tawangmangu. *Bidan Prada: Jurnal Publikasi Kebidanan Akbid YLPP Purwokerto*, 6(1), 72–79.
- Beck, K. L., Conlon, A. A., Kruger, R., Coad, J. (2014). Dietary Determinants of and Possible Solutions to Iron Deficiency for Young Women Living in Industrialized Countries: A Review. *Nutrients*, 6, 3747-3776. <https://doi.org/10.3390/nu6093747>
- Chaparro, C. M., & Suchdev, P. S. (2019). Anemia epidemiology, pathophysiology, and etiology in low- and middle-income countries. *Annals of the New York Academy of Sciences*, 1450(1), 15–31. <https://doi.org/10.1111/nyas.14092>.
- Daru, J., Zamora J., Fernández-Félix, B. M. et al. (2018). Risk of maternal mortality in women with severe anaemia during pregnancy and post partum: a multilevel analysis. *The Lancet Global Health*, 6(5), e548–e554.
- Fitriani, Evayanti, Y., & Isnaini, N. (2020). Pemberian Jus Tomat Terhadap Kadar Hemoglobin Pada Ibu Hamil Trimester III Tahun 2019. *Jurnal Kebidanan*, 6(2), 230-235.
- International Nutritional Anemia Consultative Group (INACG). 2012. Adjusting hemoglobin values in program surveys. INACG/USAID.
- Kementerian Kesehatan RI. (2018). Hasil Utama Riset Kesehatan Dasar. https://kesmas.kemkes.go.id/assets/upload/dir_519d41d8cd98f00/files/Hasil-risikesdas-2018_1274.pdf. Diakses 5 Maret 2021. Pukul 10.31.
- Kundaryanti, R., Fardillah, N. & Widowati, R. (2020). Pengaruh Pemberian Jus Bayam Hijau Terhadap Peningkatan Kadar Hemoglobin Pada Ibu Hamil Anemia Di Wilayah Kerja Puskesmas Pasar Minggu Jakarta Selatan Tahun 2018. *Jurnal Ilmu Keperawatan dan Kebidanan Nasional*, 1(1).
- Lane, D. J. R., & Richardson, D.R. (2014). The active role of vitamin C in mammalian iron metabolism: Much more than just enhanced iron absorption. *Free Radical Biology and Medicine*, 75, 69-83, <https://doi.org/10.1016/j.freeradbiomed.2014.07.007>

- Marino S. (2015). Iron and vitamin C: the perfect pair?. *Michigan State University Extension, Colleen Kokx, Dietetic Intern.* https://www.canr.msu.edu/news/iron_and_vitamin_c_the_perfect_pair. Diakses 5 Maret 2021. Pukul 21.40.
- Novyriana, E. & Caesarani, M.R. (2019). Pemberian Jus Tomat terhadap Peningkatan Kadar Hemoglobin Pada Ibu Hamil Trimester III Di Puskesmas Bonorowo Kebumen. Urecol. *Procedding The 10th University Research Colloquium 2019*, 928-933.
- Profil Puskesmas Sukadiri (2019). Tidak dipublikasikan.
- Rahman, M.M., Abe, S.K., Rahman, M.S. et al. (2016). Maternal anemia and risk of adverse birth and health outcomes in low- and middle-income countries: systematic review and meta-analysis^{1,2}. *The American Journal of Clinical Nutrition*. 103(2), 495–504.
- Sitepu S.A. & Hutabarat V., (2020). Pengaruh Pemberian Jus Buah Naga Terhadap Perubahan Kadar Profil Darah Ibu Hamil Dengan Anemia Yang Mendapatkan Suplementasi Fe. *Jurnal Online Keperawatan Indonesia*, 3(2): 73-81.
- Soleha, N., Astriana, A. & Amirus, K. (2020). Pemberian Jus Buah Naga Mempengaruhi Kadar Hemoglobin Pada Ibu Hamil. *Jurnal Kebidanan Malahayati*, 6(3), 335-341.
- Wieringa, F. T., Dahl, M., Chamnan, C., Poirot, E., Kuong, K., Sophonneary, P., Sinuon, M., Greuffeille, V., Hong, R., Berger, J., Dijkhuizen, M. A., & Laillou, A. (2016). The High Prevalence of Anemia in Cambodian Children and Women Cannot Be Satisfactorily Explained by Nutritional Deficiencies or Hemoglobin Disorders. *Nutrients*, 8(6), 348. <https://doi.org/10.3390/nu8060348>
- USDA (US Department of Agriculture). (2019a). Food data central: tomato <https://fdc.nal.usda.gov/fdc-app.html#/food-details/475200/nutrients>. Diakses 5 Maret 2021. Pukul 15.06.
- USDA (US Department of Agriculture). (2019b). Food data central: spinach, raw. <https://fdc.nal.usda.gov/fdc-app.html#/food-details/168462/nutrients>. Diakses 5 Maret 2021. Pukul 16.11.
- World Health Organization. (2015). The Global Prevalence of Anemia in 2011, World Health Organization, Geneva, Switzerland.
- World Health Organization. (2017). Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity Accessed August 4, 2017 <http://www.who.int/vmnis/indicators/haemoglobin.pdf>.