How to Cite:
Frianti, N., Arifuddin, S., Hadju, V., Aminuddin, A., Nontji, W., Bahar, B., & Hariati, M. C. (2022). The effect of moringa leaf capsules and fe administration to increase hemoglobin levels, weight, and upper arm circumference (LILA) in trimester II pregnant women with chronic energy deficiency (KEK). *International Journal of Health Sciences*, *6*(S3), 12524–12534. https://doi.org/10.53730/ijhs.v6nS3.9600

The effect of moringa leaf capsules and fe administration to increase hemoglobin levels, weight, and upper arm circumference (LILA) in trimester II pregnant women with chronic energy deficiency (KEK)

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International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
Manuscript submitted: 18 Feb 2022, Manuscript revised: 27 April 2022, Accepted for publication: 9 June 2022

***Abstract*---**Moringa leaves are nutrient-rich plants that increase hemoglobin (Hb) levels, nutritional intake, and nutritional status. Therefore, this research aims to determine the effect of administering Moringa leaf capsules and Fe to increase hemoglobin levels, body weight, and upper arm circumference (LILA) in second-trimester pregnant women suffering from chronic energy deficiency (KEK). It was carried out for 2 months in the working area of the Banabungi Public Health Center, Buton Regency, Indonesia. The method adopted was an experimental design using a double-blind randomized controlled trial with a pre and post-test as well as a control group pattern. The samples were 34 second-trimester pregnant women suffering from KEK and divided into 2 groups, namely Moringa capsules + Fe (n=17) and Fe (n=17). The data were analyzed using the Chisquare, Paired, and Independent T-Test. The analysis was conducted based on the characteristics of the majority of the samples aged from 20 to 35 years, gravida, higher education, work, and income less than the minimum wage with a p-value > 0.05. The results showed a significant increase in hemoglobin levels in the Moringa leaf capsule group + Fe from 9.47 ± 2.11 to 11.67 ± 1.32 p = 0.001. In the Fe group, it ranged from 11.10 ± 1.56 to 11.05 ± 1.69 p = 0.918 with a p-value of 0.246. The body weight also increased from 45.45 ± 5.32 to 49.85 ± 6.50 p = 0.000 and 50.20 ± 7.65 to 53.24 ± 8.11 p = 0.000 with a p-value of 0.188 in both groups. For LILA, there was an increase in the Moringa leaf capsule group + Fe from 20.91 ± 1.33 to 23.13 ± 1.51 p = 0.000 and the Fe group from 20.96 ± 1.91 to 22.12 ± 1.58 p = 0.000 with a p-value of 0.067. The difference in the magnitude of the change was not significantly different for hemoglobin levels, body weight, and LILA (p>0.05). However, the effect of administering Moringa leaf capsules + Fe was higher than only Fe tablets.

***Keywords*---**moringa leaf capsules, trimester pregnant women II, chronic energy deficiency (KEK).

Introduction

Nutritional status is an important aspect to determine whether a pregnant woman can have a successful pregnancy without any disturbances. Moreover, chronic energy deficiency (KEK) is a nutritional problem caused by a lack of food intake for a long time (Kementrian Kesehatan Republik Indonesia, 2018). In Indonesia, *Basic Health Research* (RISKESDAS) stated that the prevalence of pregnant women suffering from KEK in 2018 was 36.8%, with the highest proportion (WUS) occurring at the age of 15-49 years at 17.3% (Kementerian Kesehatan RI Badan Penelitian dan Pengembangan Kesehatan, 2018). The Ministry of Health also reported a percentage of 9.70%, which was targeted to be 16% in 2020, thereby the performance is 164.95%. According to the World Health Organization (WHO, 2010), for pregnant women at risk of SEZ, Indonesia is still in the moderate category of public health problems, which ranged from 10 to 19% (Kementrian Kesehatan Republik Indonesia, 2021).

Based on RISKESDAS data, the number of anemia among pregnant women in Indonesia is 48.9%, which almost occurred between the ages of 15 and 24 years with a total of 84.6%. Meanwhile, the proportion of those who received blood-enhancing tablets was 73.2%, where 24% were administered 90 and 76% received < 90 tablets, while approximately 26.8% did not receive (Kementerian Kesehatan RI Badan Penelitian dan Pengembangan Kesehatan, 2018). In 2018, the Ministry of Health reported that the coverage of blood-added tablets in young women was 46.56%, which fulfilled the 2019 Strategic Plan target of 30%. The coverage of administering blood tablets in 2019 was 64.0%, which has not reached the target of 98% (Kementrian Kesehatan Republik Indonesia, 2020).

Moringa leaf has been widely investigated for its nutritional content and uses. The leaves are very rich in nutrients such as calcium, Fe, protein, as well as vitamins A, B, and C (Prod *et al.*, 2014). One of the most important ingredients of the Moringa plant is antioxidants, specifically in the leaves which contain a high proportion. Based on phytochemical tests, Moringa (*Moringa oleifera*) leaves contain several antioxidants such as tannins, steroids, triterpenoids, and flavonoids (Kasolo *et al.*, 2010). A total of 6 full tablespoons can meet the needs of calcium and iron for pregnant and lactating women. It was also discovered that β–Carotene contained in Moringa leaves is a precursor to retinol (vitamin A) (Gopalakrishnan, Doriya and Kumar, 2016).

Materials and Methods

Research Location and Design

This research was carried out from August 29 to October 29, 2021, at the Banabungi Health Center, Buton Regency, Southeast Sulawesi Province. The experimental design was involved using a double-blind Randomized Controlled Trial with a pre and post-test pattern as well as a control group. The samples were divided into 2, namely the intervention and the control group. Before intervention was given, the samples were subjected to a pretest examination by measuring hemoglobin (Hb), body weight, and lilac levels from both groups. This was followed by the adminstration of Moringa leaf extract 2x1000 + Fe 1x500 mg to the intervention (X_1), and Fe 1x500 mg to the control group (X_2) (Bruton, Lazo and Parker, 2006; Kepala Badan Pengawas Obat Dan Makanan Republik Indonesia, 2014; Setianingsih, Nurani, and Rohman, 2018).

Population and Sample

The population used includes 101 pregnant women with SEZ in the working area of the Banabungi Health Center, from January to December 2020. A total of 34 samples were collected using the formula (Stanley *et al.*, 1997), which was carried out by random sampling through inclusion and exclusion criteria. Subsequently, the samples were divided into 2 groups of 17 respondents, where the first group was given Moringa leaf capsules + Fe and the second received Fe tablets. This research received a recommendation for approval from the Health Research Ethics Commission, Faculty of Public Health, Hasanuddin University Makassar with Number 6011/UN4. 14. 1/TP.01.02/2021 and Protocol Number 14621092072.

Method of Collecting Data

The data on age, education, parity, occupation, as well as income were collected and measured through interviews using a questionnaire. At the beginning of this research, respondents were subjected to a pretest to check their hemoglobin levels, body weight, and upper arm circumference (LILA). The samples were treated with Moringa leaf capsule therapy 1x2 a day, which was taken in the morning, and 1x1 Fe tablet at night before going to bed for 60 days. Finally, a post-test was carried out to determine the success of giving Moringa leaf capsules and Fe tablets, by checking hemoglobin levels, weight, and LILA.

Data Analysis

Data analysis was carried out with the SPSS (Statistical Product and Service) program. This consists of a Paired T-test to compare the values before and after treatment as well as an Independent T-Test to compare the results of the intervention and the control group.

Research Result

The characteristics of respondents include age, gravida, education, occupation, and income.

Table 1
Respondents' Characteristics

Characteristics	Group				Total		*P Value*
	Moringa Capsules and Fe Tablet		Tablet Fe				
	n	%	n	%	n	%	
Mother's Age							
High Risk	3	60.0%	2	40.0%	5	100	0.633[b]
Low Risk	14	48.3%	15	51.7%	29	100	
Gravida							
Primigravida	6	46.2%	7	53.8%	13	100	0.500[a]
Multigravida	11	52.11%	10	47.6%	21	100	
Education							
High	15	51.7%	14	48.3%	29	100	0.500[a]
Low	2	40.0%	3	60.0%	5	100	
Work							
Working	16	50.0%	16	50.0%	32	100	1.000[b]
Does not work	1	50.0%	1	50.0%	2	100	
Income							
≥2.500.000	0	0%	2	100%	2	100	0.151[b]
<2.500.000	17	53.1%	15	46.9%	32	100	

Chi-Square

Table 1 shows that out of 34 pregnant women with KEK based on age characteristics for the high-risk category (36-40 years), the majority are in the Moringa capsules + Fe tablets group, with 3 respondents (60.0%), while there are 15 participants (51.7%) in the low-risk category (20-35 years). Meanwhile, in the gravida category, the majority were multigravida in the Moringa capsules + Fe tablets group, with 11 respondents (52.11%). In the educational characteristics, 15 (51.7%) respondents with higher education were in the group of Moringa leaf capsules + Fe tablets. For the occupational category, 16 pregnant women (50.0%) in the working category are in the Moringa capsules and Fe tablets group, while only one who does not work is in the Fe tablet group. Based on UMR, a total of 17 respondents (53.1%) with low income were mostly in the intervention group, while 2 respondents (100)% have high income in the Fe tablets group according to the Regional Minimum Wage.

Changes in Hemoglobin, Body Weight, and Upper Arm Circumference (LILA)

Changes in hemoglobin levels before and after the administration of Moringa leaf capsules + Fe in the intervention group and Fe in the control group.

Table 2
Changes in hemoglobin levels before and after administration of Moringa leaf capsules + Fe in the intervention group and Fe in the control group

Group	N	Mean ± SD Hb level (mg/dl)		P Value	Difference (X ± SD)	P Value
		Pre	Post			
Moringa capsules + Fe	17	9.47 ± 2.11	11.67 ± 1.32	0.001*	2.1 ± 2.2	0.246**
Fe	17	11.10 ± 1.56	11.05 ± 1.69	0.918*	0.04 ± 1.8	

* Paired T-test **Independent T-Test

Table 2 shows that there was an increase in the average hemoglobin level in the intervention group after the administration of Moringa capsules + Fe tablets from 9.47 ± 2.11 mg/dl to 11.67 ± 1.32 mg/dl. Based on the results of the Paired T-test, a p-value of 0.001 (<α=0.05) was obtained. Meanwhile, the control group that was given Fe tablets obtained 11.10 ± 1.56 mg/dl to 11.05 ± 1.69 mg/dl, with a p-value of 0.918 (>α= 0.05). This showed that the administration of Fe had no effect on increasing hemoglobin levels. The Independent T-test shows a p-value of 0.246 (> 0.05). The difference in the hemoglobin levels in the Moringa leaf capsule group + Fe was higher, which indicates the supplement efficiency.

Table 3
Changes in body weight before and after administration of Moringa leaf capsules + Fe in the intervention group and Fe in the control group

Group	N	Mean ± SD Weight Body (kg)		P Value	Difference (X ± SD)	P Value
		Pre	Post			
Moringa capsules + Fe	17	45.45 ± 5.32	49.85 ± 6.50	0.000*	4.3 ± 2.3	0.188**
Fe	17	50.20 ± 7.65	53.24 ±.8.11	0.000*	3.0 ± 1.8	

* Paired T-test **Independent T-Test

Table 3 shows the average increase in body weight in the intervention group after the administration of Moringa capsules + Fe tablets from 45.45 ± 5.32 kg to 49.85 ± 6.50 kg with a difference of 4.3 ± 2.3 kg, with a p-value of 0.000 (<α=0.05). This indicates that the Moringa leaf capsules and Fe can increase body weight. Furthermore, the control group also showed an increase in the average weight from 50.20 ± 7.65 kg to 53.24 ± 8.11 kg with a difference of 3.0 ± 1.8 kg changes and a p-value of 0.000 (<α=0.05), which indicates that Fe tablets in the control group increased body weight. The table also shows the result of the Independent T-test statistic with a value of 0.188 (p>0.05) in both groups. However, the difference in body weight in the Moringa leaf capsule group + Fe was higher compared to the Fe tablet group. This shows that Moringa + Fe capsules can increase body weight significantly. The administration of Moringa + Fe capsules in the intervention group and only Fe tablets in the control group increased maternal weight. The increase in body weight of those who received Moringa capsules and Fe tablets was more significant compared to the control group.

Table 4
Changes in LILA before and after administration of Moringa leaf capsule + Fe in the intervention group and Fe in the control group

Group	N	Mean ± SD LILA (cm)		P Value	Difference (X ± SD)	P Value
		Pre	Post			
Moringa capsules + Fe	17	20.91 ± 1.33	23.13 ± 1.51	0.000*	2.2 ± 0.9	0.067**
Fe	17	20.96 ± 1.91	22.12 ± 1.58	0.000*	1.1 ± 0.8	

* Paired T-test ** Independent T-Test

Table 4 shows an increase in the mean LILA in the intervention group after the administration of Moringa capsules + Fe tablets, from 20.91 ± 1.33 cm to 23.13 ± 1.51 cm with a difference of 2.2 ± 0.9 cm. Based on the results of the Paired T-test, a p-value of 0.000 was obtained (<α=0.05), indicating the effect on intervention group to increase LILA. The control group given Fe tablets also showed an increase in the mean LILA from 20.96 ± 1.91 cm to 22.12 ± 1.58 cm

with a difference of 1.1 ± 0.8 cm and a p-value of 0.000 was obtained (<α=0.05). This shows that the administration of Fe tablets in the control group increased LILA. Moreover, Table 4 also showed the result of the Independent T-test statistical test, which was 0.067 (p>0.05). The difference in LILA in the Moringa leaf capsule group + Fe was higher compared to the Fe tablet. This shows that the Moringa leaf capsule supplement + Fe can significantly increase LILA. The administration of Moringa and Fe capsules in the intervention group and Fe tablets in the control group both increased LILA in pregnant women. The increase in LILA in the intervention group who received Moringa capsules + Fe tablets was more significant. This can improve the nutritional status of pregnant women with chronic energy deficiency. Compared to the control group who received Fe tablets, LILA increased but could not improve the nutritional status.

Discussion

The results of this study showed a significant increase in hemoglobin levels, body weight, and LILA after the administration of Moringa leaf capsules + Fe tablets compared to only Fe tablets. One of the natural ingredients that used as an alternative to increasing hemoglobin levels and preventing anemia in pregnant women naturally that is easily obtained and cultivated is Moringa (*Moringa oleifer* L.) (Nurdin *et al.*, 2018). These plants are useful because of the high iron (Fe) level, although the Fe content in Moringa leaves that have been made into flour is much higher, namely 28.2 mg/100 grams. The nutritional elements in the leaves are vitamin C and A, as well as calcium, potassium, iron, and protein (Krisnadi, 2015). To meet the need for Fe during pregnancy, pregnant women receive 90 tablets of blood-added (Fe). However, this quantity is not sufficient because the fulfillment of iron needs to be supported by considering the consumption of vegetables such as Moringa leaves which are more efficient in preventing anemia and maintaining normal hemoglobin levels (Hartati and Sunarsih, 2021).

The results of statistical tests in the Moringa leaf capsule group + Fe showed an increase in hemoglobin levels. However, the control group that received Fe tablets had a P-value of 0.918 (>α = 0.05), indicating no significant effect on hemoglobin levels. This is because the absorption of Fe and vitamin C contained in tablets (Fe) is very low. Since the body's iron requirement for pregnant women is ±2-3 mg per day, there is a need to supplement with 200 mg iron tablets per day with a 66 mg Fe. When the amount of Fe in the body is small, there will be limitations in the synthesis of components containing active content, thereby affecting the functional processes of other body tissues which will cause anemia or hemoglobin levels in the blood to be less than normal (Ani, 2013).

This research is in line with (Nurdin *et al.*, 2018) who administered Moringa leaf extract in powder form to pregnant women, which showed an increase in hemoglobin levels. The previous report by (Iskandar *et al.*, 2015) on the effect of Moringa leaf extract supplementation in preventing maternal anemia and low birth weight showed that the group given Moringa Oleifera extract capsules + Fe, as well as folic acid capsules, increased hemoglobin levels compared to those who were given placebo capsules, Fe, and folic acid. The weight of pregnant women is a crude index of a healthy diet, which indicates plasma volume expansion and a positive caloric balance (Fitri and Wiji, 2019). Based on the results, the weight

gain of pregnant women in the second trimester is 0.35-0.4 kg/week (Paramashanti, 2020; Pratiwi and Fatimah, 2020). Moringa leaves are a source of food that contains all the essential amino acids, which can increase the efficiency of metabolic transformation to improve muscle growth and quality. Moreover, protein derivatives in form of amino acids are nutrients that play an important role in tissue formation and fetal growth, which affects changes in body weight and nutritional status during pregnancy. Since protein and calcium supplementation as well as other micronutrients through the intervention of Moringa leaf capsules is important for nutritional needs, it can support fetal growth and maternal nutritional status during pregnancy (Rani *et al.*, 2019).

In a comparison of the average change in body weight (Bb) between the intervention and the control groups after giving treatment using the Paired T-test, the P-value was 0.000 (<α=0.05). This shows that there is a simultaneous effect of the treatment on weight gain in second-trimester pregnant women suffering from chronic energy deficiency. The results are supported by (Hadju *et al.*, 2020), where the Moringa leaves in form of extracts, powders, and honey can increase maternal weight during pregnancy. This shows that the need for Fe in pregnant women is higher to increase red blood cells and form fetal as well as placental red blood cells (Rahayu *et al.*, 2019). (Hermansyah, Hadju, and Bahar, 2014) also examined the effect of Moringa leaf extract on the increasing intake and weight of pregnant women who work in the informal sector.

LILA is an early detection tool to determine the risk of KEK in women of childbearing age (WUS), with a threshold value of risk 23.5 cm in Indonesia. When the size is less than 23.5 cm or is in the red part of the band, it indicates that the woman has a risk of KEK (Supariasa, Bakti, and Fajar, 2014). Previous study showed that Moringa leaves are a source of nutrients needed by pregnant women such as beta-carotene, vitamin B1 (thiamin), B2 (riboflavin), and B3 (Niacin), calcium, phosphorus, iron, magnesium, zinc, and vitamin C is one alternative to improve the nutritional status (Hermansyah, Hadju, and Bahar, 2014). (Muis *et al.*, 2014) stated that Moringa leaf extract in informal workers of pregnant women can increase LILA. From the statistical test results in the Moringa leaf capsule group + Fe tablets as well as the administration of Fe tablet in the control group, there was an effect on increasing LILA as shown by a p-value of 0.000 (<α=0.05). Since the required Fe cannot be met through dietary only, Fe tablets are given to all pregnant women at about 60 mg/day for 90 days (Ani, 2013). (Nadimin *et al.*, 2019) also examined the improvement of the nutritional status of pregnant women after Moringa leaf extract (*Moringa oleifera*) in the coastal area of Makassar, Indonesia. It was discovered that an increase in the nutritional status of pregnant women who consumed Moringa leaf extract was not different from those who received supplements of Fe folate, specifically in the size of LILA.

Conclusion

The difference between the 2 groups was not significant in increasing hemoglobin levels, body weight, and LILA. However, the effect of administering Moringa leaf capsules + Fe tablets was higher compared to only Fe tablets.

References

1. Ani, L. S. (2013) "Manfaat Ekonomi Pada Penanganan Anemia Defisiensi Besi", in Ester, M. and Praptiani, W. (eds) Buku Saku Anemia Defisiensi Besi Masa Prahamil & Hamil. I. Jakarta: Buku Kedokteran EGC, pp. 1–141.
2. Bruton, L. L., Lazo, J. S. and Parker, K. L. (2006) "Pharmacokinetics And Pharmacodynamys The Dynamics of drug absorption, Distribution, Action, And Elimination", in Brunton, L. L. (ed.) Goodman & Gilman's The Pharmacological Basic Of Therapeutics. 11th edn. New York Chicago San Francisco Lisbon London Madrid Mexico City: Medical Publishing Division, pp. 12–42. doi: 10.1036/0071422803.
3. Fitri, I. and Wiji, R. N. (2019) "Nutrisi Gizi Ibu Hamil", in Buku Ajar Gizi Reproduksi Dan Bukti. I. Yogyakarta: Gosyen, pp. 106–08.
4. Gopalakrishnan, L., Doriya, K. and Kumar, D. S. (2016) "Moringa Oleifera : A Review On Nutritive Importance And Its Medicinal Application", Food Science and Human Wellness, 5(2), pp. 49–56. doi: 10.1016/j.fshw.2016.04.001.
5. Hadju, V., Dasir, M., Sadapotto, A., Putranto, A., Marks, G., Arundhana, A. I. (2020) "Effects OfMoringa Oleifera Leaves And Honey Supplementation During Pregnancy On Mothers And Newborns : A Review Of The Current Evidence", Medicall Sciences, 8(20), pp. 208–14. doi: 10.3889/oamjs.2020.4670.
6. Hartati, T. and Sunarsih. (2021) "Konsumsi Ekstrak Daun Kelor Dalam Meningkatkan Kadar Hemoglobin Pada Ibu Hamil", Manuju Malahayati Nursing, 3(1), pp. 101–107.
7. Hermansyah, Hadju, V. and Bahar, B. (2014) "Ekstrak Daun Kelor Terhadap Peningkatan Asupan Dan Berat Badan Ibu Hamil Pekerja Sektor Informal (Moringa Leaves Extract On Food Intake And Weight Gain OF Pregnant Working In Informal Sector)", Ilmu Kesehatan Masyarakat, 5(3), pp. 192–201.
8. Iskandar, I., Hadju, V. As'ad, S., Natsir, R. (2015) "Effect Of Moringa Oleifera Leaf Extracts Supplementation In Preventing Maternal Anemia And Low-Birth-Weight", Scientific and Research Publications, 5(2), pp. 5–7.
9. Kasolo, J. N., Bimenya, G. S., Ojok, L., Ochieng, J., Okeng, J. W. o. (2010) "Phytochemicals And Uses Of Moringa Oleifera Leaves In Uganda Rural Communities", Medicinal Plants Research, 4(9), pp. 753–57. doi: 10.5897/JMPR10.492.
10. Kementerian Kesehatan RI Badan Penelitian dan Pengembangan Kesehatan (2018) "Kesehatan Ibu", in Laporan Nasional RIskesdas 2018. Jakarta: Jakarta, pp. 1–365.
11. Kementrian Kesehatan Republik Indonesia (2018) "Kesehatan Keluarga", in Kurniawan, R., Hardhana,B., Yudianto., Siswanti, T. (eds) Data Dan Informasi Profil Kesehatan Indonesia 2018. Jakarta: Kementrian Kesehatan Republik Indonesia, pp. 1–207.
12. Kementrian Kesehatan Republik Indonesia (2020) "Profil Kesehatan Indonesia 2019", in Profil Kesehatan Indonesia Tahun 2019. Jakarta: Kementrian Kesehatan Republik Indonesia, p. 496. doi: 10.1002/qj.
13. Kementrian Kesehatan Republik Indonesia (2021) "Akuntabilitas Kinerja", in Laporan Kinerja Kementrian Kesehatan Tahun 2020. Jakarta: Kementrian Kesehatan RI 2021, pp. 1–24.

14. Kepala Badan Pengawas Obat Dan Makanan Republik Indonesia (2014) "Peraturan Kepala Badan Pengawas Obat Dan Makanan Republik Indonesia Tentang Pedoman Uji Klinik (PP Nomor 13 Tahun 2014)". Jakarta, pp. 1–10.
15. Krisnadi, A. D. (2015) "Anugerah Kelor", in Moringa Oleifera Kelor Super Nutrisi. Revisi. Blora: Keloriina, pp. 1–20.
16. Muis, M., Hadju, V., Russeng, S., Naiem, M. F. (2014) "Effect Of Moringa Leaves extract on occupational stress and nutritional status of pregnant women informal sector workers", Current Research And Academic Review, 2(11), pp. 86–92.
17. Nadimin., Hadju, V., As'ad, S., Buchari, A., Haruna, I., Hartono, R. (2019) "Increasing Of Nutrition Status Of Pregnant Women After Supplementation Of Moringa Leaf Extract (Moringa Oliefera) In The Coastal Area Of Makassar , Indonesia", Publich Health Research & Development, 10(1), pp. 522–25. doi: 10.595/0976-5506.
18. Nurdin, M. S., Hadju, V., Ansariadi., Zulkifli, A., Arundhana, A. I. (2018) "Pengaruh Ekstrak Dan Serbuk Daun Kelor terhadap Konsentrasi Hemoglobin Ibu Hamil Di Kabupaten Jeneponto", Publich Health Research & Development, 9(2), pp. 263–67. doi: 10.5958/0976-5506.
19. Paramashanti, B. A. (2020) "Masalah Gizi Pada Ibu Hamil", in Rachamawati, D. (ed.) Gizi Bagi Ibu & Anak Untuk Mahasiswa Kesehatan dan Kalangan Umum. Yogyakarta: PT. Pustaka Baru, pp. 152–53.
20. Pratiwi, A. M. and Fatimah. (2020) "Kehamilan", in Kusuma, I. (ed.) Patologi Kehamilan Memahami Berbagai Penyakit Dan Komplikasi Kehamilan. 2nd edn. Yogyakarta: Pustaka Baru Press, pp. 35–36. doi: 978-602-376-243-9.
21. Prod, J. N., Resour, P., Misra, S., Misra, M. K. (2014) "Nutritional Evaluation Of Some Leafy Vegetable Used By The Tribal And Rural People Of South Odisha , India", Natural Product And Plant Resourse, 4(1), pp. 23–8.
22. Rahayu, A., Yulidasari, F., Putri, A. O., Anggraini, L. (2019) "Peningkatan Kebutuhan Zat Besi", in Noor, M. S., Rahman, F., Rosadi, D., Sari, A. R., Laily, N., Anhar, V. Y. (eds) Buku Referensi Metode Orkes-ku (Raport Kesehatanku) Dalam Mengidentifikasi Potensi Kejadian Anemia Gizi Pada Remaja Putri. I. Yogyakarta: CV Mine, pp. 1–18.
23. Rani, K. C., Ekajayanti, N. I., Darmasetiawan, N. K., Dwei, A. D. R. (2019) "Kandungan Nutrisi Tanaman Kelor (Moriga Oleifera)", in Modul Pelatihan. I. Surabaya: Fakultas Farmasi Universitas Surabaya, pp. 1–5.
24. Setianingsih, S., Nurani, L. H. and Rohman, A. (2018) "Effect Of The Ethanolic Extract Of Red Roselle Calyx (Hibiscus Sabdariffa L .) On Hematocrit , Platelets , And Erythrocytes In Healthy Volunteers", Pharmaciana, 8(2), pp. 257–66. doi: 10.12928/pharmaciana.v8i2.8738.
25. Stanley, L., W, H. D., Janelle, K., Stephen, L. (1997) "Medicine-Sample Size-Research", in Dibyo, P. (ed.) Adequacy Of Sample Size In Health Studies. I. Yogyakarta: Gadjah Mada University Press, pp. 1–50.
26. Supariasa, I. D. N., Bakti, B. and Fajar, I. (2014) "Lingkar Lengan Atas", in Rezkina, E. and Agustin, C. A. (eds) Penilaian Status Gizi. 2nd edn. Jakarta: Buku Kedokteran EGC, pp. 1–57.
27. Nyandra, M., Kartiko, B.H., Susanto, P.C., Supriyati, A., Suryasa, W. (2018). Education and training improve quality of life and decrease depression score in elderly population. Eurasian Journal of Analytical Chemistry, 13(2), 371-377.

28. Nyandra, M., Suryasa, W. (2018). Holistic approach to help sexual dysfunction. Eurasian Journal of Analytical Chemistry, 13(3), pp. 207–212.
29. Lestari, W. O. S. W., Syarif, S., Hidayanty, H., Aminuddin, A., & Ramadany, S. (2021). Nutrition education with android-based application media to increase knowledge, attitudes, and behaviors of pregnant women about chronic energy deficiency (KEK). International Journal of Health & Medical Sciences, 4(1), 15-22. https://doi.org/10.31295/ijhms.v4n1.440