How to Cite:
Ayuni, Q., Hadju, V., Sartini, S., Ahma, M., Hidayanti, H., & Maddeppungeng, M. (2022). The effect of moringa oleifera leaf extract capsules from preconception to pregnancy on hemoglobin levels of three months postpartum mother. *International Journal of Health Sciences*, *6*(S6), 465–474.
https://doi.org/10.53730/ijhs.v6nS6.9473

The effect of moringa oleifera leaf extract capsules from preconception to pregnancy on hemoglobin levels of three months postpartum mother

Qurratul Ayuni
Midwifery Study Program, Graduate School, Hasanuddin University, Indonesia
Email: ayuniq20p@student.unhas.ac.id

Veni Hadju
Department of Nutrition Science, Faculty of Public Health, Hasanuddin University, Indonesia
Email:phunhas@gmail.com

Sartini Sartini
Department of Pharmacy, Science, and Technology, Faculty of Pharmacy, Hasanuddin University, Indonesia
Email: sardj@farmasi.unhas.ac.id

Mardiana Ahma
Department of Midwifery, Graduate School, Hasanuddin University, Indonesia
Email:mardianaahmad@pasca.unhas.ac.id

Healthy Hidayanti
Department of Nutrition Science, Faculty of Public Health, Hasanuddin University, Indonesia
Email: hhidayanti@yahoo.com

Martira Maddeppungeng
Department of Pediatrics, Faculty of Medicine, Social Development-Paediatrics Subdivision, Hasanuddin University, Indonesia
Email: martira711@yahoo.com

***Abstract*---** Introduction: One health problem affecting a third of women of childbearing age is anemia. This study aims to determine the effect of Moringa leaf extract capsules from preconception to pregnancy on hemoglobin levels of three months postpartum mothers. Method: The study was conducted in the North Polongbangkeng Subdistrict, Takalar Regency, South Sulawesi Province. This

analytical observational study employs a follow-up study design which is a continuation of the intervention of the administration of Moringa leaf extract capsules + Iron Folic Acid (IFA) and IFA from preconception to pregnancy. The population consisted of 60 three-month postpartum mothers, where 32 were taken as samples by purposive sampling technique. Hemoglobin levels were measured with the Easy touch GCHb tool. Data were analyzed through the chi-square test, Fisher's Exact Test, Repeated measure ANOVA, General linear model, and Independent sample t-test. Results: Characteristics of age, education, employment, income, ANC visits, and type of delivery of the two groups were homogeneous with $p>0.05$. Most subjects were aged 20-35 years, had secondary education, were unemployed, earned between IDR 1-2 million, had 4 ANC visits, and had a normal delivery. There was a significant change in hemoglobin levels from preconception to three months postpartum with $p=0.001$ ($p<0.05$) in the Moringa leaf extract capsule + IFA group and $p=0.007$ ($p<0.05$) in the IFA group. There was no significant difference in hemoglobin levels between the two groups, with a p-value = 0.866 ($p>0.05$). Conclusion: Although changes in hemoglobin levels in the Moringa leaf extract capsule + IFA group appeared to be higher, the difference with the IFA group was insignificant. Thus, it is necessary to conduct a study with larger sample size.

***Keywords*---** Moringa Leaf Extract Capsules; Hemoglobin; Three Months Postpartum.

.

Introduction

One health problem affecting the population and one-third of women of childbearing age (15-49 years) worldwide is anemia[1,2]. The reduction in anemia rates in women of reproductive age by up to 50% in 2025 has become one of the WHO's global nutrition targets[2]. During the postpartum period, a mother needs much energy. Anemia will cause some disturbance to the mother during this period[3]. The impacts include impaired physical work capacity, symptoms of depression, fatigue, and decreased immune function [4].

On a global scale, anemia in non-pregnant women of reproductive age is a health problem in 141 countries and increased to 578 million in 2016. Southeast Asia is one of the regions with the highest prevalence, with more than 35%[2], while in Indonesia, the prevalence is 48.9 %[5]. In Takalar Regency, there were 420 anemic pregnant women in 2019, which increased to 632 in 2020[6]. Based on data from previous studies, 70 out of 300 (23%) preconception women in the North Polongbangkeng area were anemic, and 18% experienced chronic energy deficiency (KEK)[7].

In general, anemia is caused by deficiency of iron, vitamin A, vitamin B12, and folate, dietary iron, chronic bleeding, malnutrition, impaired absorption of nutrients by the intestines, congenital diseases, and parasitic infections [2,8–10]. Preconceptional and pregnant women are at high-risk for anemia and chronic

energy deficiency (KEK)[11,12]. In adolescents, anemia affects health status, pregnancy, and lactation [3,13]. Therefore, WHO recommends the promotion of preconception in adolescents and nutrition during pregnancy to overcome nutritional deficiencies and produce quality pregnancy outcomes[14].

The government provided MMN (iron $FeSO_4$ 60 mg and folic acid 0.25 mg) to support the First 1000 Days of Life (HPK) movement, especially in overcoming anemia in women of childbearing age[15]. Another effort to increase iron intake is consuming *Moringa Oleifera* leaves or Moringa leaf powder[16,17]. *Moringa Oleifera* contains 40 essential macro and micronutrients consisting of antioxidant active ingredients[16,18], such as complete protein (nine essential amino acids), calcium (Ca), iron (Fe), Phosphorus (P), Riboflavin, Folic Acid, Pyrodicin, potassium, magnesium, and vitamins A, C, E, and B[1,18–20].

Mun'im et al. [21] showed that the total iron content in Moringa leaf extract was 19.38 mg/kg on average. It also contains vitamin C, which accelerates the absorption of iron[16,22], vitamin B6 as a coenzyme in the biosynthesis of hemoglobin[23], and vitamin B12 for the production and maturation of red blood cells[24]. Other substances in Moringa leaves are riboflavin which absorbs iron, folic acid synthesis, heme protein synthesis[25], and essential protein and AA, which form the structure of red blood cells. This study aims to determine the effect of capsules of Moringa oleifera leaf extract from preconception to pregnancy on the hemoglobin levels of three months postpartum mother as a follow-up study by Nurul et al. [7].

Method

Location

This study was conducted in North Polongbangkeng Subdistrict, Takalar Regency, South Sulawesi Province, from January to March 2022 with a permit from the ethics committee of Faculty of Public Health, Hasanuddin University number 585/UN4.14.1/TP.01.02/2022.

Design

This analytic observational study used a follow-up study design, a follow-up of the intervention study by Rahayu[26], by administering Moringa leaf extract capsules + IFA in the intervention group and IFA in the control group from preconception to pregnancy.

Sample

The population consisted of 60 three-month postpartum mothers, of which 32 were taken as non-probability samples using the purposive sampling technique. The subjects were primiparous three-month postpartum mothers who had consumed Moringa leaf extract capsules + IFA and IFA during preconception and pregnancy. Mothers who experienced bleeding were excluded from this study.

Instrument

Data were obtained directly from the subjects through questionnaires and food recall sheets. Blood was taken through capillaries and then measured using the Hb Easytouch GCHb tool to determine the hemoglobin level. Data on

preconception and pregnancy hemoglobin levels were obtained from previous studies.

Data analysis

Chi-square test and Fisher's Exact Test were conducted to determine the homogeneity of the characteristics of the two groups, while the repeated measure ANOVA test was to identify changes in hemoglobin levels from preconception to three months postpartum. Meanwhile, the general linear model test and the independent-sample t-test were used to determine the difference in hemoglobin levels between the Moringa leaf extract capsule + IFA group and the IFA group from preconception to three months postpartum.

Results

Table 1. shows the distribution of the characteristics of the subjects, where most are aged 20-35 years (93.8%). The majority of subjects have secondary education (62.5%), are unemployed (75%), have incomes in the range of IDR 1,000,000-2,000,000 (50%), have a history of ANC ≥4 times (100%), and give birth normally (90.6%). Statistically, there was no significant difference ($p>0.05$) between the Moringa leaf extract capsule + IFA group and the IFA group on all subject characteristics. It means that the two groups are homogeneous so that the characteristics of the sample do not influence the results.

Figure 1. shows the prevalence of anemia-non-anemia from preconception to three months postpartum. The number of pre-conceptional women who did not experience anemia was 93.8% in the IFA group and 87.5% in the Moringa leaf extract capsule + IFA group. The number of third-trimester pregnant women who dit not experience anemia was 62.5% in the IFA group and 81.3% in the Moringa leaf extract capsule + IFA group. Meanwhile, all three months of postpartum mothers in both groups did not experience anemia.

Table 2. shows the change in the average value of hemoglobin levels from preconception to three months postpartum using the Repeated measure ANOVA test. The value of $p=0.001$ ($p<0.05$) in the Moringa leaf extract capsule + IFA group and 0.007 ($p<0.05$) in the IFA group. The general linear model test showed no significant difference between the Moringa leaf extract capsule + IFA group and the IFA group, where the p-value = 0.866 ($p>0.05$). The Independent sample t-test showed no significant difference in the average difference in hemoglobin levels between the two groups ($p>0.05$).

Table 1. Frequency Distribution Based on Characteristics of Respondents

Characteristics of Respondents	Moringa leaf extract capsules + IFA (n=16)		IFA (n=16)		Total		*P-Value*
	n	%	n	%	N	%	
Age							
< 20 and > 35 years old	0	0	2	12,5	2	6,3	0,484[a]
20-35 years old	16	100	14	87,5	30	93,8	
Education							
Secondary	9	56,3	11	68,8	20	62,5	0,716[b]
Higher	7	43,8	5	31,3	12	37,5	
Employment							
Unemployed	10	62,5	14	87,5	24	75	0,220[a]
Employed	6	37,5	2	12,5	8	25	
Income							
< 1.000.000	1	6,3	2	12,5	3	9,4	
1.000.000-2.000.000	8	50	8	50	16	50	0,815[b]
> 2.000.000	7	43,8	6	37,5	13	40,6	
ANC Visit							
<4 times	0	0	0	0	0	0	*
≥4 times	16	100	16	100	32	100	
Type of Delivery							
Sectio Cesarea	1	6,3	2	12,5	3	9,4	1,000[a]
Normal	15	93,8	14	87,5	29	90,6	

[a] *Fisher's Exact Test*
[b] *Chi-square*
**Constant*

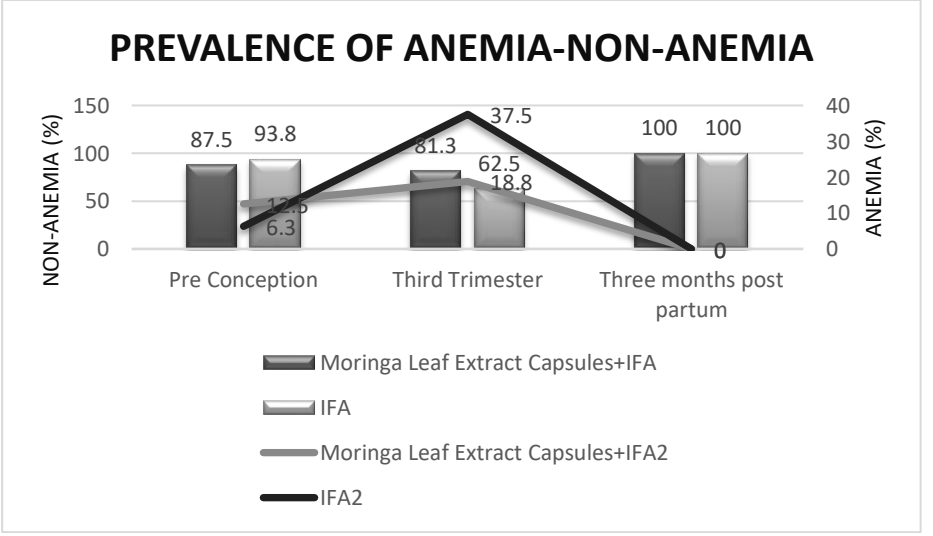

Figure 1. Prevalence of Anemia-Non-Anemia

Table 2. Analysis of Changes and Differences in Mean Hemoglobin Levels in the Moringa Leaf Extract Capsule + IFA Group and IFA Group

Hemoglobin levels	Moringa Leaf Extract Capsules + IFA Mean±SD	IFA Mean±SD	P-Value
Pre Conception	13,13±0,94	12,99±1,02	0,685[c]
TM III	11,99±1,72	12,23±2,04	0,717[c]
3 Months PP	14,11±1,01	13,96±1,05	0,684[c]
P-Value	0,001[b]	0,007[a]	
Δ Preconception-TMIII	-1,14±2,18	-0,76±2,43	0,644[d]
Δ Preconception-3 Months	0,99±1,45	0,98±1,55	0,981[d]
Δ TMIII-3 Months	2,13±2,15	1,73±1,96	0,593[d]

[a]Repeated ANOVA test. Bonferroni's post hoc analysis: Preconception vs. TMIII (p=0,696>0,05); Preconception vs. 3 Months (p=0,072>0,05); TMIII vs. 3 Months PP (p=0,009<0,05).
[b]Repeated ANOVA test. Bonferroni's post hoc analysis: Preconception vs. TMIII (p=0,163>0,05); Preconception vs. 3 Months PP (p=0,046<0,05); TMIII vs. 3 Months PP (p=0,004<0,05).
[c]General linear model test. Post hoc analysis p=0.866
[d]*Independent-Sample T Test*

Discussion

Moringa leaf extract capsules are an alternative to increase hemoglobin levels. The results showed a change in hemoglobin levels from preconception to three months postpartum in the Moringa leaf extract capsule + IFA group and the IFA group. Statistically, the Moringa leaf extract capsule + IFA group had a significant p-value of 0.001 (p<0.05), while the IFA group had a p-value of 0.007 (p<0.05). It means that both groups are equally influential in increasing hemoglobin levels.

The results are in line with the study of Suzana et al.[27] on the effect of Moringa leaf extract capsules on hemoglobin levels of women with iron deficiency anemia. The study found that p-Value = 0.001 (p<0.05) in the Moringa leaf extract capsule group and 0.004 (p<0.05) in the Fe tablet group, which means that both groups affect increasing hemoglobin levels. Another study by Nadimin et al.[28] showed that the hemoglobin levels in the Moringa leaf extract group and the IFA group experienced a significant increase (p<0.05) but did not differ statistically (p>0.05).

The increase in hemoglobin levels in the Moringa leaf extract capsule + IFA group was influenced by various components of macro and micronutrients. Some studies state that the protein, vitamin B, vitamin C, and iron in Moringa leaves are very high[29]. Other nutrients are Vitamin A, potassium, calcium, essential amino acids, magnesium, and phosphorus[30,31]. Protein functions in the biochemical process of making hemoglobin; vitamin C can increase iron absorption in food and has a significant role in iron metabolism, while vitamin B6 functions in forming red blood cells[31].

The general linear model test showed no significant difference in hemoglobin levels between the Moringa leaf extract capsule + IFA group and the IFA group, where the p-value = 0.866 (p>0.05). This study also showed that hemoglobin levels in each group decreased from preconception to the third trimester of pregnancy, then increased again from the third trimester of pregnancy to three months postpartum. The decrease in hemoglobin levels during pregnancy is caused by the hemodilution process during pregnancy[29,32], while the increase in hemoglobin levels at three months postpartum showed that Moringa leaf extract capsules had a long-term effect in increasing hemoglobin levels.

This result is in line with the study by Nur et al.[33], who found a significant effect of Moringa leaf extract on the increase in hemoglobin in post-disaster pregnant women with a p-value of 0.000 (p<0.05). Another study by Shija et al.[34] on the effect of Moringa leaf powder supplementation on hemoglobin levels in children under two years old stated that there was an increase in the average hemoglobin level in the intervention group after six months of intervention with a p-value of 0.002 (p<0.05). The same study by Mustapa et al.[15] stated that administration of Moringa leaf extract capsules could significantly increase hemoglobin levels (p<0.05).

The lifespan of erythrocytes ranges from 105 to 120 days. When erythrocytes age, the cells will be fragile and immediately burst so that the hemoglobin will be released. Moringa leaves contain several hematopoietic properties, such as alkaloids, flavonoids, phytosterols, and saponins.[29]. Flavonoids have antioxidant properties and can prevent or repair damage to red blood cells because they can inhibit the production of free radicals[35,36], while saponins and alkaloids are reported to have anti-anemic potential[37]. In addition, other properties of Moringa leaves, such as vitamins A, B, and C, iron, and protein, also play a role in the formation of red blood cells, especially in the formation of hemoglobin in the blood[29]. The various essential content of Moringa leaves administered from preconception to pregnancy can maintain and even increase hemoglobin levels for up to three months postpartum.

Conclusion

Based on the results and discussion, it can be concluded that the increase in erythrocyte index (MCV, MCH, MCHC) in the combination syrup group (dates and bee pollen) was higher than in the date syrup group, where the P-value was lower than 0.05.

Acknowledgments

Infinite Gratitude goes to the supervisors, examiners, leaders, staff, and students at the Tarbiyah Modern Islamic Boarding School Palleko, Mahyajatul Qurra' Modern Islamic Boarding School Lassang, and Assalam Islamic Boarding School Timbuseng in North Polobangkeng Subdistrict, Takalar Regency, South Sulawesi Province. The acknowledgment is also addressed

References

Manggara, A. B. & Shofi, M. Analisis Kandungan Mineral Daun Kelor (Moringa oleifera Lamk.) Menggunakan Spektrometer XRF (X-Ray Fluorescence). *Akta Kim. Indones.* **3**, 104 (2018).

WHO. Weekly iron and folic acid supplementation as an anaemia-prevention strategy in women and adolescent girls Lessons learnt from implementation of programmes among non-pregnant women of reproductive age. *World Heal. Organ.* 40 (2018).

Mhaske, G., Vadehra, P. & Maran, C. Compare the safety and efficacy of intravenous iron supplementation with iron sucrose to the oral supplementation with ferrous ascorbate in subjects with post-partum anemia. *Int. J. Reprod. Contraception, Obstet. Gynecol.* **8**, 3590 (2019).

Zhao, A. *et al.* Prevalence of anemia and its risk factors among lactating mothers in Myanmar. *Am. J. Trop. Med. Hyg.* **90**, 963–967 (2014).

Kementerian Kesehatan RI. Hasil Riset Kesehatan Dasar Tahun 2018. *Kementrian Kesehat. RI* **53**, 1689–1699 (2018).

Dinas kesehatan Kabupaten Takalar. Dinas kesehatan Kabupaten Takalar. *Badan Pus. Stat. RI* 1–2 (2021).

Nurul, R., Hadju, V., Indriasari, R. & Muis, M. Anemia , chronic energy deficiency and their relationship in preconception women ☪. *Enfermería Clínica* **30**, 76–80 (2020).

Rahayu, A., Yulidasari, F., Putri, A. O. & Anggraini, L. *BUKU REFERENSI Metode Orkes-Ku (Raport Kesehatanku) dalam Mengindentifikasi Potensi kejadian Anemia Gizi pada Remaja*. (CV Mine Perum, 2019).

Abu-Baker, N. N., Eyadat, A. M. & Khamaiseh, A. M. The impact of nutrition education on knowledge, attitude, and practice regarding iron deficiency anemia among female adolescent students in Jordan. *Heliyon* **7**, (2021).

Iskandar, I., Hadju, V., As 'ad, S. & Natsir, R. Effect of Moringa Oleifera Leaf Extracts Supplementation in Preventing Maternal Anemia and Low-Birth-Weight. *Int. J. Sci. Res. Publ.* **5**, 2250–3153 (2015).

Abu-Ouf, N. M. & Jan, M. M. The impact of maternal iron deficiency and iron deficiency anemia on child's health. *Saudi Med. J.* **36**, 146–149 (2015).

Dieny, F. F. *et al.* Kualitas diet, kurang energi kronis (KEK), dan anemia pada pengantin wanita di Kabupaten Semarang. *J. Gizi Indones.* **8**, 1 (2020).

Shaka, M. F. & Wondimagegne, Y. A. Anemia, a moderate public health concern among adolescents in South Ethiopia. *PLoS One* **13**, 1–14 (2018).

WHO. *Guideline: Implementing Effective Actions for Improving Adolescent Nutrition*. *Who* (2018).

Mustapa, Y. *et al.* The effect of moringa oleifera to hemoglobin levels of preconception women in the health center tibawa district tibawa, gorontalo. *Open Access Maced. J. Med. Sci.* **8**, (2020).

Anwar, Y. *et al.* Pemberian Ekstrak Daun Kelor terhadap Peningkatan Kadar Hemoglobin pada Remaja Putri Putus Sekolah Usia 12 – 18 Tahun. *J. Kesehat. Manarang* **6**, 131 (2020).

Gopalakrishnan, L., Doriya, K. & Kumar, D. S. Moringa oleifera: A review on nutritive importance and its medicinal application. *Food Sci. Hum. Wellness* **5**, 49–56 (2016).

Retnaningsih, R. & Safitri, R. Role Of Moringa Oleifera Leaf Extract In Increasing Hemoglobin Levels In Pregnant Rats With Anemia. *J. Heal. Sci.* **14**, 8–13

(2019).
Meireles, D., Gomes, J., Lopes, L., Hinzmann, M. & Machado, J. A review of properties, nutritional and pharmaceutical applications of Moringa oleifera: integrative approach on conventional and traditional Asian medicine. *Adv. Tradit. Med.* **20**, 495–515 (2020).
Martínez-González, C. L. *et al.* Moringa oleifera, a species with potential analgesic and anti-inflammatory activities. *Biomed. Pharmacother.* **87**, 482–488 (2017).
Mun'im, A., Puteri, M. U., Sari, S. P. & Azizahwati. Anti-anemia effect of standardized extract of moringa oleifera lamk. Leaves on aniline induced rats. *Pharmacogn. J.* **8**, 255–258 (2016).
Li, N. *et al.* The Efficacy and Safety of Vitamin C for Iron Supplementation in Adult Patients With Iron Deficiency Anemia: A Randomized Clinical Trial. *JAMA Netw. open* **3**, e2023644 (2020).
Dror, D. K. & Allen, L. H. Interventions with Vitamins B6, B12 and C in pregnancy. *Paediatr. Perinat. Epidemiol.* **26**, 55–74 (2012).
Azzini, E., Raguzzini, A. & Polito, A. A brief review on vitamin B12 deficiency looking at some case study reports in adults. *Int. J. Mol. Sci.* **22**, (2021).
Fouad, S., Ibrahim, G. E., Hussein, A. M. S., Ibrahim, F. A. & El, A. Physicochemical properties of and volatile compounds in ribo fl avin forti fi ed cloudy apple juice ; study of its effect on job fatigue among Egyptian construction workers. *Heliyon* **7**, e08246 (2021).
Nurul, R., Hadju, V., Indriasari, R. & Muis, M. Food intake and anemia among preconception women in Takalar district , Indonesia &. *Enfermería Clínica* **31**, S834–S839 (2021).
Suzana, D. *et al.* Effect of moringa oleifera leaves extract against hematology and blood biochemical value of patients with iron deficiency anemia. *J. Young Pharm.* **9**, S79–S84 (2017).
Nadimin, Hadju, V., As'ad, S. & Buchari, A. The Extract of Moringa Leaf Has an Equivalent Effect to Iron Folic Acid in Increasing Hemoglobin Levels of Pregnant Women: A randomized Control Study in the Coastal Area of Makassar. *Int. J. Sci. Basic Appl. Res.* **22**, 287–294 (2015).
Loa, M., Hidayanty, H., Arifuddin, S., Ahmad, M. & Hadju, V. Moringa oleifera leaf flour biscuits increase the index of erythrocytes in pregnant women with anemia. *Gac. Sanit.* **35**, S206–S210 (2021).
Rani, N. Z. A., Husain, K. & Kumolosasi, E. Moringa genus: A review of phytochemistry and pharmacology. *Front. Pharmacol.* **9**, 1–26 (2018).
Manggul, M. S. *et al.* Biscuits containing Moringa oleifera leaves flour improve conditions of anemia in pregnant women. *Gac. Sanit.* **35**, S191–S195 (2021).
Rizki, F., Lipoeto, N. I. & Ali, H. Hubungan Suplementasi Tablet Fe dengan Kadar Hemoglobin pada Ibu Hamil Trimester III di Puskesmas Air Dingin Kota Padang. *J. Kesehat. Andalas* **6**, 502 (2017).
Nur, R. *et al.* The effect of moringa leaf extracton increasing hemoglobin and bodyweight in post-disaster pregnant women. *Enferm. Clin.* **30**, 79–82 (2020).
Shija, A. E., Rumisha, S. F., Oriyo, N. M., Kilima, S. P. & Massaga, J. J. Effect of Moringa Oleifera leaf powder supplementation on reducing anemia in children below two years in Kisarawe District, Tanzania. *Food Sci. Nutr.* **7**, 2584–2594 (2019).
Sheth, P. A., Pawar, A. T., Mote, C. S. & More, C. Antianemic activity of polyherbal formulation, Raktavardhak Kadha, against phenylhydrazine-induced anemia in rats. *J. Ayurveda Integr. Med.* **12**, 340–345 (2021).

Muhtadi, Hidayati, A. L., Suhendi, A. & Sudjono, T. A. Kulit Buah Asli Indonesia Dengan Metode Ftc K-50 K-51. *Simp. Nas. RAPI XIII - 2014 FT UMS* 50–58 (2014).

Ighodaro, O. M. *et al.* Erythropoietic potential of Parquetina nigrescens in cephalosporin-induced anaemia model. *Metab. Open* **8**, 100064 (2020).