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Evaluation of Mung Bean Supplementation for Anaemic Pregnant Women

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ABSTRACT

Background: The global prevalence of anaemia among pregnant women is 37%, which means that 4 out of 10 pregnant women experience anaemia during pregnancy, 70% of which is moderate and occurs during the third trimester of pregnancy.

Methods: *Literature review* research method based on national and international scientific journals on the evaluation of supplementary feeding of mung bean biscuits to anaemic pregnant women on delivery outcomes. Publications between 2019-2024 on Pub-Med, Science-Direct, Google Scholar, and Semantic databases using the keywords "anaemia in pregnancy", "mung beans", "vigna radiata", "birth outcome". 140 articles were identified then screened resulting in 87 articles, then selection was made regarding abstracts, full text, open access and type of research, 30 articles were obtained. The final process is to read and select eligible articles based on the criteria obtained 30 relevant articles consisting of 4 international articles and 26 national articles.

Result: The results of the literature search explain that anaemia in pregnancy is caused by increased iron requirements in pregnant women needed to support pregnancy, coupled with insufficient iron intake, can interfere with *uteroplacental oxygenation*, potentially inhibiting fetal growth and development. Providing additional food and a good diet for anaemic pregnant women can increase haemoglobin levels. Mung beans contain iron, vitamin C and zinc, and vitamin A which are necessary for the formation of haemoglobin. Giving mung beans can increase Hb levels

Conclusion: Mung beans can significantly increase blood Hb levels because they contain iron, vitamin C and zinc, and vitamin A which have many functions in the body, including the growth and differentiation of progenitor cellserythrocytes, the body's resistance to mobilisation of iron reserves throughout tissues and infections.

Keywords: *Supplementary food, mung beans, anaemia of pregnant women and outcomes*

1. INTRODUCTION

Anaemia is a serious global public health problem, especially affecting one of them pregnant women where 37% of pregnant women, worldwide experience anaemia(1) . The prevalence of anaemia among pregnant women in Indonesia is still high, with 48.9% of pregnant women experiencing anaemia and 70% of pregnant women experiencing moderate anaemia during the third trimester of pregnancy(2)

During pregnancy, the mother's body undergoes anatomical and physiological changes. In the third trimester of pregnancy, blood volume increases rapidly, while red blood cell growth is not comparable. This leads to blood *dilution (haemodilution*) and decreased *haemoglobin* (Hb) levels in the blood. This condition can contribute to the occurrence of anaemia in pregnant women(3) . In addition, in the third trimester of pregnancy, fetal growth reaches its peak and requires greater amounts of iron for the formation of sufficient red blood cells(4) . Iron is an essential component in the production of haemoglobin, which is responsible for binding and transporting oxygen throughout the body. If the supply of iron is insufficient, the production of haemoglobin and the number of red blood cells in the body may be impaired, leading to anaemia(3) . Anaemia

is a condition where the number of red blood cells (*erythrocytes*) is lower than normal, even though these cells contain *haemoglobin* which is responsible for distributing nutrients and oxygen throughout the body(5)

Pregnant women who experience iron anaemia due to lack of Fe consumption can reduce the Hemoglobin (Hb) level of the pregnant woman's blood so that blood flow to the fetus becomes obstructed and causes the flow of oxygen and nutrient supply from the mother to the fetus to be disrupted. This will inhibit fetal growth and lead to inhibition of fetal weight gain so that babies who will be born usually experience low birth weight (LBW)(6) . One of the efforts to prevent or overcome anaemia can be done by adjusting the diet, namely by combining and consuming a menu of foods rich in iron(7) . Foods that contain iron with good quality are found in animal foods, such as meat, chicken, and fish(8) . Other good sources are eggs, cereals, legumes, green vegetables and some fruits(9) . Addressing anaemia requires a comprehensive approach involving many aspects. In this context, an in-depth understanding of the background of anaemia problems among pregnant women in Indonesia is crucial for designing and implementing more effective intervention programme. Effective prevention and intervention programme in an effort to increase nutritional awareness in the community in a holistic manner are a must to achieve positive changes in addressing anaemia among pregnant women in Indonesia.

One form of treatment for anaemia in pregnancy so as not to cause problems in childbirth is to provide additional food from beans including green beans. Mung beans are rich in iron. Mung beans (vigna radiata) can increase Hb levels and can prevent Fe deficiency. In mung beans there is an iron content of 6.7 mg/100 gr of mung beans, besides that there is an iron content of 5.9-7.8%, protein 19.7-24.2%, phosphorus 0.326 mg, calcium 0.124 gr which is useful for strengthening the bone skeleton. Iron in mung beans is found in the seed coat and embryo(10)

Local food-based supplementary foods such as mung beans have been shown in previous studies to increase haemoglobin levels in pregnant women. Mung beans are a source of protein and iron needed in the formation of Haemoglobin. Ma'rifah(11) in her research made *cookies* substituting green spinach *puree* and mung bean flour, the results showed that there was an effect of substituting green spinach *puree* and mung bean flour on nutritional content (water content 6.12%, ash 3.20%, fat 10.90%, protein 28.23%, carbohydrates 51.60%, and iron 7.66 mg). After calculating the contribution of nutrients to the Nutrition Adequacy Rate (AKG) and Nutrition Label Reference (ALG), it was found that cookies substituted with green spinach puree and mung bean flour per serving size of 60gram (3 pieces) met the AKG (Nutrition Adequacy Rate) of adolescent girls. Cookies are claimed to be a high iron food product because it has a %ALG of 34.82% (high) and protein has a %ALG of 47.05% (high), so it can be used as a high protein and iron snack food for anaemic adolescent girls. The results of research by Puspita et al (2021), giving mung beans in the form of juice can increase haemoglobin levels in pregnant women from 10.49 g% to 11.2 g%, because consuming 2 cups of mung bean juice can meet 50% of daily iron needs and 80% meet vitamin C needs and other vitamins such as thiamine, riboflavin and niacin.

This study is a literature review or search for articles related to supplementary feeding of mung bean biscuits in anaemic pregnant women on childbirth outcomes. The purpose of the study was to analyse the evaluation of supplementary feeding of mung bean biscuits in anaemic pregnant women on childbirth outcomes.

2. METHODS

The research method is a *literature review* based on national and international scientific journals on the evaluation of supplementary feeding of mung bean biscuits to anaemic pregnant women on delivery outcomes. Publications between 2019-2024 on PubMed, ScienceDirect, Google Scholar, and Semantic databases using Indonesian and English keywords namely "anaemia", "anaemia in pregnancy", "green beans", "mung beans", "vigna radiata", "childbirth outcomes", "birth outcomes", identified 140 articles then screened resulting in 87 articles then selected related to abstracts, full text, open access and type of research, obtained 30 articles. The final process is to read and select articles that are eligible based on the criteria obtained 30 articles that are relevant (Figure 1). Articles were evaluated based on:

1. Inclusion criteria

a. The article discusses educating adolescents on stunting management.

b. Publication year 2019-2024

c. International and National Publications

d. Articles in English and Indonesian

e. Original article, abstract, full text and open access

2. Exclusion Criteria

a. Type of research literature review

b. Publication in community service journals

The article search strategy can be seen in Figure 1.

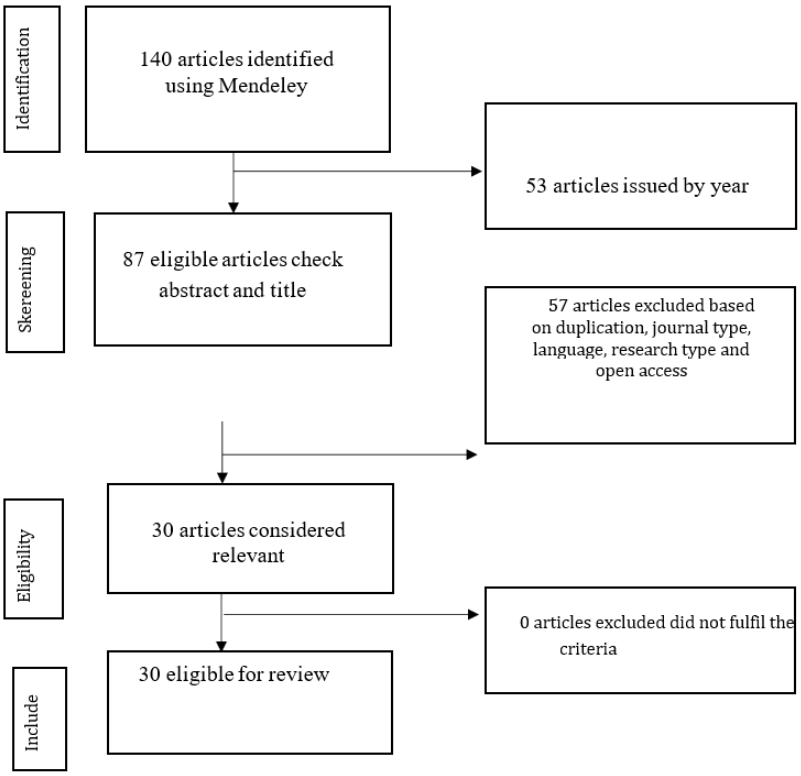

Figure 1. Flow Chart of Article Search

3. RESULTS

This literature review was synthesize using a narrative approach by grouping the identified and extracted literature data according to the research objectives. The extracted literature was then read, reviewed and analyses based on the abstract and full text. A summary of the results of the review or analysis contained in the research results/findings is presented in table 1.

Table 1. Summary of Research Literature Extraction Results

No.	Author/Year	Title	Type of Research	Sample	Data Analysis	Research Results
1	Ernawati, S and La Ode, M (2023)(12)	Influence of Maternal Nutrition Knowledge and Adherence to Fe Tablet Consumption on Incidence of Anaemia in Pregnant Women	Research analytical observational approach cross sectional.	The sample was 240 pregnant women	*Chi Square*	Nutritional knowledge and Fe tablet consumption influence the incidence of anaemia.
2	Finasari, R.D., Alifiyanti, M., Aftulesi, N. and Ikhwan, A. (2023)(13)	Relationship between Iron and Zinc Intake and Haemoglobin Level in Pregnant Women at UPTD Puskesmas Bumiratu Work	This type of research is quantitative with cross sectional design.	The sample in this study amounted to 86 pregnant women trimester II and III	*Chi Square*	Research results It was found that there was a relationship between iron intake (p value = 0.019) and iron levels (p value =

		Area in 2022				0.019). haemoglobin in pregnant women and there was no association between zinc intake (p value = 0.05). 0.248) with haemoglobin levels in pregnant women.
3	Suparyanto, T., Milka, A., and Rita A. Y (2023)(14)	The Relationship of Zinc Tablet Administration, Lifestyle, and Protein Intake to Ferritin Levels in Pregnant Women in Trimester Iii at Krakatau Medika Cilegon Hospital in 2022	Quantitative approach with cross sectional design	80 pregnant women	chi-squere and logistic regression.	There is an association between the variables of zinc administration, lifestyle and protein intake with ferritin levels in pregnant women.
4	Arniati, Adeliana, Hasnitang (2022)(15)	Analysis of Risk Factors for Anaemia in Pregnancy during the Pandemic Period Covid-19	This research used an analytical observational study with a case-control study design.	A sample of 99 people consisting of 33 cases and 66 controls	Chi Square	There is an effect of age pregnant women, parity, spacing, education, consumption compliance Fe tablets and LiLA status on anaemia in pregnancy.
5.	Apriliana, M., Rifatoliska, T and Gelora, M (2022)(16)	Determinants of anaemia among pregnant women Third trimester	Descriptive quantitative research with a cross sectional approach.	The sample was 31 pregnant women who were taken by purposive sampling.	Univariate	Determinant factors in the incidence of anaemia in pregnant women are parity, pregnancy spacing, occupation, income, adherence to taking blood supplement tablets and frequency of pregnancy.
6	Ariendha, D.S.R., Setyawati, I, Kusniyati, U and Hardaniyati (2022)(17)	Anaemia among pregnant women based on age, knowledge, And Nutritional Status	Type of analytical observational research with a cross sectional study approach	There were 93 pregnant women who met the criteria.	Chi Square	There is a relationship between age, knowledge and nutritional status with the incidence of anaemia in pregnant women.

7	Asmin, E., Salulinggi, A., Christiana R. T., and Johan B,B (2021)(18)	Relationship between knowledge and adherence of pregnant women to take added tablets Blood with anaemia incidence in South Leitimur and Ambon Bay sub-districts	Research analytic with a cross sectional approach.	Samples in this study were second trimester pregnant women and III who live in South Leitimur Sub-district and Teluk Ambon as many as 165 people who were taken by purposive sampling.	Chi Square	There is no significant relationship between TTD knowledge and anaemia incidence (p=0.443). There was no association significant between TTD consumption compliance behaviour with the incidence of anaemia (p=0.135). Although Thus, the percentage of anaemia was lower in pregnant women who adhere to TTD consumption
8	Harahap, D.A., Nur.A and Hamidi (2021)(19)	Differences in Food Consumption of Anaemic Pregnant Women and Non-anemia at Tapung Hilir 1 Public Health Centre	This type of research is quantitative with case control method.	The sample of this study were mothers pregnant women in trimester 2 and 3 in the UPTD Tapung hilir I Health Centre working area Hilir 1 totalled 60 pregnant women consisting of 30 pregnant women anaemic and 30 non-anemic pregnant women.	Mann Whitnet Test	There were differences in energy, carbohydrate and iron consumption between anaemic and non-anemic pregnant women while protein intake showed no difference.
9	Srimulyawati, T., Russiska, and Fitry M.J (2020)(20)	Factors associated with anaemia in pregnant women Trimester I in the Cidahu Health Centre Working Area Kuningan Regency	This type of research is analytical with a cross-sectional design	The sample of pregnant women was 35 people. Total sampling	Spearman Rank correlation test	There is an association between Fe tablet consumption and anaemia incidence, and there is no association between pregnancy spacing, income and anaemia incidence.

10	Hariati, Andi, A and Thamrin, A.I (2019)(21)	Incidence of Anaemia in Pregnant Women (Analytical Study at Pertiwi Health Centre, Makassar City, South Sulawesi Province)	The type of research used was an analytical survey with a design of cross sectional	108 pregnant women at the health centre Pertiwi Makassar by accidental sampling, that is, all pregnant women who suffering from anaemia listed in the register.	Chi Square	The results showed that there was a relationship between knowledge and anaemia (p=0.009), there is a relationship between dietary intake and anaemia (p=0.004), and there is a relationship between dietary intake and anaemia (p=0.004). Fe tablet consumption compliance with anaemia (p=0.004)
11	Sjahriani, T and Vera, F (2019)(22)	Factors associated with anaemia in pregnant women	Research quantitative analytic with research design cross sectional.	The sample of pregnant women who met the criteria was 49 people using the Slovin formula	Chi Square	There is an association between maternal age, birth spacing, gestational age and knowledge with the incidence of anaemia in pregnant women. And there was no the relationship between parity and anaemia in pregnant women.
12	Sopiah, P., Rukmaini and Anni, S (2022)(23)	The Effect of Diet on Anaemia in Pregnant Women at Working Area of UPTD Tinewati Public Health Centre Sub-district Singaparna Tasikmalaya Regency West Java 2022	Observational research type with Cross- Sectional design	Samples in This study totalled 61 respondents, all pregnant women. Retrieved from sample using incidental technique	*chi square*	Most pregnant women have a good diet and most are not anaemic.
13	Purba, A., Netti, M.S., Ronni, N.S., Linca, V. H (2023)(24)	Analysis of Supplementary Food Consumption on Chronic Energy Deficiency and Anaemia among Pregnant Women in the Working	This study used an observational analytic design with a cross sectional approach.	72 pregnant women in Trimester II and Trimester III.	*Chi Square*	There is a relationship between supplementary feeding and pregnant women with deficiency and anaemia

		Area of Labuhan Deli Health Centre, Deli Serdang Regency				
14	Abdullah, V. I and Mariana, I (2020)(25)	The Effect of Feeding Rebon Shrimp-based Koya Powder (Mysis relicta) on Changes in Haemoglobin Levels of Pregnant Women	This type of research is quantitative research with quasi experimental method using post-test control group design approach.	The study sample was 30 people divided into an intervention group of 15 people and a control group of 15 people, t	paired samples test	There is an effect of consumption of koya powder PMT made from rebon shrimp (Mysis relicta) on changes in haemoglobin levels of pregnant women .
15	Suzanna, Emilda, A.S, Fazdria, Silfia D and Nora V (2021)(26)	The Effectiveness Of Giving Beet Fruit Juice (Beta Vulgaric) And Green Bean Sari (Vigna Radiata) In Pregnant Mother Anaemia	The research design was Quasi Experiment, Two Group Pre-Test Post Test Design.	The number of samples in this study were 20 people obtained by total sampling	Paired T Test	The results showed that in the beta vulgaris group pretest 10.04 and postest 11.24 (p = 0.000), meaning that there was an effect of beta vulgaris on anaemic pregnant women. And in the mung beans group pretest 10.24 and postest 11.34 (p = 0.000), meaning that there is an effect of mung beans on anaemic pregnant women.
16	Naumi E.M, Jasmawati and Rivan F (2022)(27)	The Effect of Consumption of Mung Bean Extract on Increasing HB Levels of First Trimester Pregnant Women in the Working Area of Harapan Baru Health Centre in 2021	quasi experiment with pre-test and post-test approach	18 pregnant women	Paired t test	Consumption of mung bean extract can increase Hb levels in first trimester pregnant women
17	Utami, I.T (2022)(28)	Effect of mung bean juice on increasing HB levels in third trimester pregnant women	Quasi experiment nonequivalent design control group	20 pregnant women 3rd trimester	Univariate and Bivariate analysis using independent t-test	The results of the study of giving mung bean juice in the intervention group before was 10.3 and after 10.7. In the control group before was 10.07 and after was 10.14 and the average showed

						the effect of mung bean juice on increasing HB levels in pregnant women.
18	Heriyanti, Desi E.A and Nurul H (2023)(29)	Effect of Green Mung Beans on Increasing Haemoglobin in Pregnant Women in the Working Area of Sambau Health Centre, Batam City, 2023	This type of research is a quasi-experiment with a pre-test post-test design with control group design.	The sample was 32 pregnant women, 16 pregnant women in the intervention and 16 in the control group.	Independent T test	The mean difference between the intervention group and the control group is 0.86, which means that the average haemoglobin in the intervention group is greater than the average haemoglobin in the control group. And obtained sig data (2-tailed) 0.000 <0.05 which means there is an effect of giving green beans on increasing haemoglobin in pregnant women.
19	Mayasari, M., Riona, S. Yona D. S and Nopi, A.P (2021)(30)	The Effect of Mung Bean Juice on the Increase of Hb Levels in Mothers Pregnant	The research design used was Pre-experimental with a one group approach. pre test and post test design.	Third trimester pregnant women as many as 15 people	Paired T-Test	There is a significant effect of giving mung bean juice with an increase in the Hb level of pregnant women
20	Suheti, E., Triana, I. and Bunga, T. C (2020)(31)	Difference between Moringa (Moringa Oleifera) and Mung Bean (Vigna Radiata) Leaf Juice for Anaemic Pregnant Women	Type of quasi-experimental research pre post test with control group	The sample of 40 pregnant women consisted of 20 people in the intervention group and 20 people in the control group.	Independent test	there is a difference in the effect on haemoglobin before and after giving Moringa Leaf Juice and Mung Bean Juice.
21	Marniati, and Nuzulul, R (2022)(32)	The Differences Of Giving Green Nuts And Vegetables To Hemoglobin (Hb) Levels In Trimester Iii Pregnant Women: A Study From Two Group Posttest Design Approach	This type of research is experimental design with a two group post-test design approach.	The population and sample in this study were all pregnant women with anaemia, amounting to 217 people, while the sample taken in this study amounted to	The data processing was carried out using statistical tests paired sample t test.	The results of statistical analysis showed that there were differences in the pretest and posttest in group A which were given mung bean juice to third trimester pregnant women with a p-value of 0.000. Then there were

				30 people consisting of two groups.		differences in the pretest and posttest in group B who were given spinach to pregnant women in the third trimester with the statistical result of p value 0.000.
22	Puspita, N.L.M., Fauzia, L., Lindha, S.K., Sa'adah, and Yuli, A (2021)(33)	The Effect of Green Bean Side Effects on Changes in Haemoglobin Levels in Pregnant Women with Anaemia	The research design used was pre experimental research.	The population in detail is all Pregnant Women, with incidental sampling technique in obtaining a sample of 16 people	T-test	The result of research of haemoglobin level before giving of green bean has average value (mean) is 10.494 and haemoglobin level after giving of green bean has average value (mean) is 11.238 this indicates an increase of haemoglobin level in students the result of research done shows that there is an increase of Hb level in get p value 0.756 and 0.89. Then the T.Test data distribution test can be concluded p value <0.05 which means H0 rejected and H1 accepted " The Effect Of Green Bean Side Effects On Changes In Haemoglobin Levels In Pregnant Women With Anaemia".
23	Nua, E. N., Regina, O.A and Rosania E.B.C (2021)(34)	Effectiveness of Moringa Biscuits (Bi-Kelor) on Increasing Haemoglobin Levels in Pregnant Women with Anaemia	The type of research is quasi-experimental research design	20 pregnant women	Paired T Test	There is an effect of giving Moringa Biscuits (Bi-kelor) on changes in Hb levels in anaemic pregnant women.

24	Rachim, F.R., Wisaniyasa, N.W. and Sri Wiadnyani (2020)(35)	Study of Nutrient Digestibility and Antioxidant Activity of Mung Bean (Phaseolus radiatus L.) Sprout Flour	Experiment with 2 treatments		T test	Mung bean sprout flour has a moisture content of 6.74%, ash content of 3.39%, protein content of 32.13%, fat content of 11.33%, carbohydrate content of 46.41%, protein digestibility of 46.80%, starch digestibility of 93.45%, total phenols of 22.02 mg/100 g, and antioxidant activity (IC50) of 454.50 ppm.
25	Umanailo, R. and Linda, S (2023)(36)	Effect of Giving Fe Tablets and Mung Bean Porridge to Increase Haemoglobin Level in Third Trimester Pregnant Women	Using one group pretest-posttest design,	a study on 23 third trimester pregnant women in the working area of Kalumata Health Centre South Ternate District.	Paired T Test	The average of Hb level before intervention was 8.4 gr/dl, and the average of Hb level after intervention was 11.4 gr/dl. The results of statistical analysis showed that there was an increase in haemoglobin levels before and after administration of Fe tablest and mung bean porridge with a p-value of 0.000.
26	Rofiah, M., Maryam, R. and Suwita I, K (2019)(37)	Substitution of mung bean *(Vigna radiata)* flour and tuna fish flour as pregnant women PMT biscuits (*Thunnus sp*) as PMT biscuits for pregnant women on the proximate proximate, energy value, iron content, and organoleptic quality.	This research This research uses a type of laboratory experimental research with a research design Completely Randomized Design (CRD) using 3 levels of treatment, totalling 9 experimental units. experiment. Treatment level P1 with the	mung bean flour *(Vigna radiata)* and tuna fish meal (*Thunnus sp*)	Proximate and organoleptic analysis	Substitution of mung bean flour and tuna fish meal gives a significant effect on water content, ash content, protein content, fat content. significant effect on moisture content, ash content, protein content, fat content, iron content, biscuit aroma. However, it did

			proportion of wheat flour: mung bean flour: tuna flour (75:15:10), P2 (65:29:6), and P3 (55:41:4).			not have a significant effect on carbohydrate content, colour, taste, and texture. Treatment level P2 is the the best treatment
27	Duda, R., Yoyanda, B and Lisna, A (2023)(38)	Substitution of Green Bean Sprout Flour (Phaseolus radiatus L) in an Effort to Increase the Nutritional Value of Wapili (Waffle) Products	This research design uses a single-factor Completely Randomized Design (CRD), with 5 treatments namely: P0 (100% wheat flour :0% mung bean sprout flour), P1 (90% wheat flour :10% mung bean sprout flour), P2 (80% wheat flour :20% mung bean sprout flour), P3 (70% wheat flour :30% mung bean sprout flour), and P4 (60% wheat flour :40% mung bean sprout flour).		Data analysis of variance (ANOVA) followed by Duncan Multiple Rangetest (DMRT) test at 95% confidence level α=0.05 y	The results showed that 40% mung bean sprout flour) was the treatment that produced the highest proximate components as well as antioxidant activity and preferred organoleptic parameters, namely protein content (15.04%), ash content (1.80%), moisture content (31.47%) and fat content (4.81%), carbohydrate content (45.80%), antioxidant activity (215.82 ppm), as well as organoleptic tests in terms of colour (like), aroma (somewhat like), taste (like) and texture (somewhat like).
28	Ponelo, S.S., Yoyanda, B., Lisna, B (2022)(39)	Effect of Annealling Modified Mung Bean Flour Addition on Physical, Chemical and Organoleptic Characteristics of French Baquette Bread	This study used a single-factor Completely Randomized Design (CRD) consisting of 4 treatments		ANOVA was followed by using Duncan Multiple Range Test (DMRT).	
29	Pratiwi, Aulya, Y., Fitria, Mona, Sulaeman, Agus, Agung, Fred, Moviana, and Yenny	Quality Analysis of Moringna Biscuits as an Alternative for Anaemia in Adolescent Girls	Experimental research with formulation ratio F1 75%: 25%, F2 50% : 50% and F3 25%: 75%		Data analysis using Kruskal Wallis test, followed by Mann	Biscuits that have the highest score are formulation F1 with a ratio of moringa flour and mung bean flour 75%: 25%. One

	(2023)(40)				Whitney test method.	serving size is 60 grams and can meet 24% of the iron requirement. The results of statistical tests found a value of (p (0.000) < α (0.05)) which means that there is an effect of moringa flour and mung bean flour formulations on the taste of biscuits, and there is an influence on the aspects of taste, aroma, and texture of biscuits.
30	Dianzhi Hou, Laraib Yousaf, Yong Xue, Jinrong Hu, Jihong Wu, Xiaosong Hu, Naihong Feng, Q. S. (2019)(41)	Mung Bean (Vigna radiata L.): Bioactive Polyphenols, Polysaccharides, Peptides, and Health Benefits	Qualitative	Mung Bean (Vigna radiata L.):	Univariate	The mungbean contains abundant nutrients and bioactive compounds, especially polyphenols, polysaccharides, and polypeptides, and it possesses various pharmacological properties. The in vitro and in vivo studies presented in this review have been provided to support the theory that the mung The bean has been associated with health benefits, such as hypoglycaemic and hypolipidemic effects and antihypertensive, anticancer, anti-melanogenesis, hepatoprotective, and and immunomodulatory activities

4. DISCUSSION

Anaemia is defined as a condition where the *haemoglobin* (Hb) level in the body is less than normal(42) , which is <11.0 g/dL in the first and third trimesters and haemoglobin level <10.5 g/dL in the second trimester(15) . The most common anaemia is iron deficiency anaemia. The average iron intake requirement for women in pregnancy is 27 mg/day. The

physiological need for iron is three times greater during pregnancy, and a total of 1000-1200 mg of iron is required overall. This physiological need for iron increases from the second trimester and peaks in the third trimester(43) . The incidence of anaemia in pregnant women is influenced by several factors (multifactor).

Suparyanto(14) , states that there is a relationship between zinc administration, lifestyle, and protein intake with Ferritin levels in pregnant women. Ferritin levels are measured through laboratory tests with units of µg/L. Zinc administration in pregnant women is explained based on behavioral theory, including indicators of accepting, responding, and implementing. Zinc is consumed as a daily nutrient that is easily complexioned into amino acids, peptides, proteins, and nucleotide. Zinc tablets support amino acid metabolism, which is important during third trimester pregnancy as nutrient requirements, particularly protein and iron, increase. Low Ferritin levels in pregnant women can cause anaemia, which is dangerous in the third trimester. Iron metabolism is influenced by proteins which play a role in providing organic iron (haem) from foods such as red meat and binding iron to prevent toxicity through Haemoproteins and Ferritin. Ferritin, an iron storage protein, is a clinical marker of the body's iron storage status.

Sopiah(23) shows that diet affects the incidence of anaemia in pregnant women. Out of 26 pregnant women with a good diet, only 1 person (3.8%) had anaemia, while out of 10 mothers with a deficient diet, 7 people (70%) had anaemia, and all mothers with a deficit diet (8 people) suffered from anaemia. Ernawati's research(12) , states that anaemia in pregnant women generally occurs in those who have low nutritional knowledge and are not compliant with taking iron tablets. Finasari(13) found a significant relationship between iron intake ($p = 0.019$) and haemoglobin levels of pregnant women, with an average iron intake of 16.4 mg per day, far below the daily requirement of pregnant women of 27 mg based on AKG 2019. Low iron intake is often caused by infrequent consumption of heme iron sources (animals) and high consumption of sweet tea to reduce nausea. Tea contains Tannins that inhibit the absorption of iron and calcium by forming complex chemical bonds, making it difficult for the body to absorb. Tea drinking increases the risk of anaemia in pregnant women by 2.785 times compared to non-tea drinkers.

Apriliana(16) states that the determinants of anaemia in pregnant women include parity, spacing of pregnancies, employment, income, compliance with consumption of blood supplement tablets (TTD), and frequency of pregnancy. Arnianti's research(15) shows the influence of age, parity, pregnancy distance, education, Fe tablet consumption compliance, and Upper arm circumference status on anaemia. Ariendha(17) added that age, knowledge, and nutritional status were associated with anaemia. Harahap(19) found differences in energy, carbohydrate, and iron consumption between anaemic and non-anemic pregnant women, but no difference in protein intake. Asmin(18) stated there was no significant relationship between knowledge about TTD and anaemia. Srimulyawati(20) found an association of Fe tablet consumption with anaemia, but no association of pregnancy spacing and income with anaemia. Hariati(21) showed the association of nutrition knowledge level, food intake, and Fe tablet consumption with anaemia, where lack of food intake led to metabolic imbalance and hindrance of Haemoglobin formation. Sjahriani(22) found an association of maternal age, birth spacing, gestational age, and knowledge with anaemia, but no association between parity and anaemia. The level of maternal knowledge about the benefits of Fe tablets affects compliance in taking them, which plays an important role in anaemia prevention.

During pregnancy, the body's increased oxygen demand triggers the production of Erythtrophoietin, which causes plasma and erythrocyte volumes to increase. However, the increase in plasma volume is greater than that of erythrocytes, so Haemoglobin (Hb) concentration decreases due to Haemodilution. This expansion of plasma volume is the cause of physiological anaemia in pregnancy. Blood Hb is used as a parameter to determine the prevalence of anaemia, with an average normal value of 12.5 g/dL in late pregnancy. Haemoglobin below 11.0 g/dL is considered abnormal and is usually caused by iron deficiency rather than hypervolemia of pregnancy. In the third trimester, iron requirements increase with gestational age, while body iron stores are often insufficient, so iron deficiency anaemia becomes common unless pregnant women get iron supplements(44)

Decreased *haemoglobin* concentration in anaemic pregnant women results in less oxygen being transported to the fetus, resulting in a *hypoxic* state. Iron deficiency anaemia can increase serum norepinephrine concentrations, causing stress to the mother and fetus, which can trigger the release of *corticotropin releasing hormone (CRH).* Increased CRH results in increased production of *Adrenocorticotropic Hormone* (ACTH) by the pituitary causing an increase in cortisol hormone which inhibits progesterone function. Inhibition of progesterone, which plays a role in maintaining pregnancy by keeping the uterus quiet, can result in premature labour. ACTH secretion also increases oestrogen hormones, which can stimulate the production of prostaglandins and oxytoxins, triggering myometrial muscle contractions that can lead to preterm labour. During pregnancy, there is an increase in blood volume (*hypervolemia*) as a normal physiological response to meet the needs of the fetus and support the mother's changing body(45) . Despite the increased blood volume, red blood cell concentration may decrease due to haemodilution, which is the dilution of blood due to increased plasma volume. The principle of haemodilution states that with an increase in plasma volume, the concentration of substances in the blood, particularly haemoglobin concentration, will decrease(46)

Supplementary feeding (PMT) for anaemic pregnant women has been shown to give positive results. Purba's research(24) showed that pregnant women with SEZ and anaemia who routinely consumed PMT mostly managed to achieve normal

nutritional status without SEZ or anaemia, while those who did not routinely consume PMT continued to experience SEZ and anaemia. Nua(34) found that consumption of biscuits as PMT can increaseHaemoglobin levels in anaemic pregnant women. Abdullah(25) also found that PMT in the form of koya powder made from rebon shrimp (Mysis relicta) had a significant effect on increasing the haemoglobin levels of pregnant women.

Prevention of anaemia in pregnant women can be done by fulfilling iron needs. In addition, a balanced diet is very important for pregnant women.(47) Iron-rich foods include red meat, green leafy vegetables, cereals with iron content needed by the body, nuts and eggs. One of the foods that can prevent iron deficiency is mung beans. Mung beans are one of the foods that contain substances necessary for the formation of blood cells so that they can overcome the effects of decreased *haemoglobin*. Mung beans can play a role in the formation of red blood cells and prevent anaemia because the phytochemical content in mung beans is very complete so that it can help the *hematopoiesis* process.(48) Mung beans also contain vitamins and minerals. Minerals such as calcium, phosphorus, iron, sodium, and potassium(33) . Mung beans are one type of legume that is rich in iron. Most of the iron in mung beans is located in the embryo and seed coat, with an iron content of 6.7 mg/100 gr of mung beans, this content helps the process of blood Hb formation. In addition, mung beans contain 5.9-7.8% iron, 19.7-24.2% protein, 0.326 mg phosphorus, 0.124 g calcium.(49) Consuming mung beans is useful for daily nutritional intake. These nutrients are beneficial not only to meet the needs of the mother, but also for the growth and development of the foetus in the womb. Mung beans contain complete nutrients, including complex carbohydrates, which can be the mother's largest source of energy for daily activities during pregnancy(50)

Mung beans can significantly increase blood Hb levels because contains iron, vitamin C and zinc, and vitamin A which has many functions in the body, including the growth and differentiation of progenitor cellserythrocytes, the body's resistance to mobilization of iron reserves throughout the tissue and infection(51) . Consuming mung beans which can help produce red blood cells and stimulate the production of haemoglobin in the blood in anaemia sufferers, mung beans contain substances necessary for the formation of blood cells so as to overcome the effects of decreased haemoglobin. The amount of iron content in mung beans is 6.7 mg per 100 grams, mung beans. Vitamin C in mung beans can increase the absorption of nonheme iron up to four times. Vitamin C with iron has a complex iron ascorbate compound that is soluble and easily absorbed. The role of vitamin C in the process of iron absorption is by reducing ferric iron (Fe3 +) to ferrous (Fe2 +) in the small intestine so that it is easily absorbed, the reduction process will become greater if the pH in the stomach increases so that it can increase iron absorption by 30%(30)

Vitamin C inhibits the formation of haemosiderin which is difficult to mobilise to free iron when needed. The amino acid content in mung beans is quite complete consisting of essential amino acids namely isoleucine, leucine, lysine, methionine, phenylalanine, threonine, valine, and also non-essential amino acids namely alanine, arginine, aspartic acid, glutamic acid, glycine, tryptophan and tyrosine. The protein, carbohydrate and fat content of mung beans support the haemoglobin synthesis process. Carbohydrates and fats form succinyl-CoA which together with glycine will form protoporphyrin through a series of porphyrinogen processes. Protoporphyrin is then formed together with heme molecules and globin proteins to form haemoglobin. The glycine content is 0.9% of the 22% total amino acids in mung beans, so that mung beans are not only able to help heme synthesis but also as a material for forming heme synthesis(30)

Based on the above literature, research(26,27,29,52) shows that mung bean consumption has a positive effect on increasing Haemoglobin (Hb) levels in pregnant women in various trimesters. Marniati's research(32) found that third trimester pregnant women who consumed mung bean juice experienced a greater increase in Haemoglobin compared to those who consumed spinach. Puspita's research(33) also stated that consumption of mung bean juice effectively increases Hb levels, with 2 glasses of mung bean juice can fulfil 50% of daily iron needs and 80% of vitamin C needs and other vitamins such as thiamine, riboflavin, and niacin. Suheti's research(31) found that moringa and mung bean juices both increase the Hb levels of anaemic pregnant women, but moringa leaf juice produces a higher Haemoglobinincrease (0.46 mg/dL) than mung bean juice (0.34 mg/dL), because moringa leaves are rich in iron (25 times higher than spinach), vitamins, and minerals that are easily absorbed by the body.(53)

5. CONCLUSIONS

Anaemia in pregnancy can have a serious impact on delivery outcomes, such as preterm birth and low birth weight babies. This condition occurs because anaemia interferes with uteroplacental oxygenation, potentially inhibiting fetal growth and development. Consumption of mung beans has been shown to significantly increase blood Haemoglobin (Hb) levels. This is due to the iron, vitamin C, zinc and vitamin A content in mung beans, which play important roles in the body, including supporting the growth and differentiation of erythrocyte progenitor cells, increasing endurance, and helping mobilize iron reserves to all tissues and fight infection.

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