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ORIGINAL

Socio-Demographics, Mid Upper-arm Circumference (MUAC), Counseling and Compliance to Multiple Micronutrient Supplement (MMS) Consumption as Determinants of Anemia among Premaried Women in Surabaya

Factores sociodemográficos, circunferencia media del brazo (CMB), asesoramiento nutricional y adherencia a suplementos de micronutrientes múltiples (SMM) en relación con la anemia en mujeres embarazadas en Surabaya

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ABSTRACT

Introduction: anemia impacts maternal and fetal health during pregnancy. To prevent risks during the preconception period, risk factors such as nutritional status, compliance to Multiple Micronutrient Supplement (MMS) consumption, and nutrition counseling are crucial. This study investigated how sociodemographic factors, Mid-Upper Arm Circumference (MUAC), counseling, and compliance to Multiple Micronutrient Supplements (MMS) influenced the prevalence of anemia among premarried women in Surabaya.
Method: this cross-sectional study analyzed the predictors of anemia among 282 premarried women in Surabaya to support preconception risk prevention. Data were collected via questionnaires, Mid-Upper Arm Circumference (MUAC) measurements, and hemoglobin levels (samples obtained in November 2024). The data were analyzed using logistic regression.
Results: the significant factors identified were: age (p=0,032; OR=3,207; 95 % CI=0,267 – 6,147), MUAC (p=0,001; OR=4,606; 95 % CI=1,817 – 7,395), MMS compliance (p=0,018; OR=3,817; 95 % CI=2,907 – 4,727), and nutrition counseling (p=0,002; OR=4,103; 95 % CI=2,802 – 5,404). Meanwhile, occupation and education level did not show a significant effect (p>0,05). Women with a MUAC <23,5 cm had a 4,6-fold higher risk of anemia.
Conclusion: these findings highlighted that nutritional status (MUAC), counseling, MMS compliance, and age significantly influenced the risk of anemia in this population. Strengthening promotive and preventive interventions, particularly targeted nutrition education programs and monitoring, is essential to reduce preconception anemia among premarried women in Surabaya.

Keywords: Anemia; MMS Consumption Compliance; Mid-Upper Arm Circumference (MUAC); Nutrition Counseling; Premarried Women.

RESUMEN

Introducción: la anemia afecta la salud materna y fetal durante el embarazo. Para prevenir riesgos durante la concepción, es crucial considerar factores como el estado nutricional, la adherencia al consumo de suplementos de micronutrientes múltiples (SMM) y el asesoramiento nutricional. Este estudio investigó cómo los factores sociodemográficos, la circunferencia media del brazo (CMB), el asesoramiento nutricional y la adherencia a suplementos de micronutrientes múltiples (SMM) influyen en la prevalencia de anemia en mujeres embarazadas en Surabaya.

Método: se realizó un estudio transversal para analizar los predictores de anemia en mujeres embarazadas en Surabaya con el fin de apoyar la prevención de riesgos durante la concepción. Se utilizó un muestreo aleatorio simple y se reclutaron 282 mujeres embarazadas. Los datos se recopilaron mediante cuestionarios, la medición de la circunferencia media del brazo (CMB) y los niveles de hemoglobina. La recopilación de datos se realizó en noviembre de 2024 y se analizaron mediante regresión logística multivariante.
Resultados: los factores significativos encontrados fueron: edad (p=0,032; OR=3,207; IC del 95 %: 0,267-6,147), MUAC (p=0,001; OR=4,606; IC del 95 %: 1,817-7,395), adherencia a la suplementación con MMS (p=0,018; OR=3,817; IC del 95 %: 2,907-4,727) y asesoramiento nutricional (p=0,002; OR=4,103; IC del 95 %: 2,802-5,404). La ocupación y el nivel educativo no mostraron un efecto significativo (p>0,05). Las mujeres con un perímetro braquial <23,5 cm presentaron un riesgo 4,6 veces mayor de anemia.
Conclusión: estos hallazgos resaltan que el estado nutricional (perímetro braquial), el asesoramiento nutricional, la adherencia a la suplementación con MMS y la edad influyen significativamente en el riesgo de anemia en esta población. El fortalecimiento de las intervenciones de promoción y prevención, especialmente los programas de educación nutricional específicos y el seguimiento, es crucial para reducir la anemia preconcepcional entre las mujeres que planean contraer matrimonio en Surabaya.

Palabras clave: Anemia; Cumplimiento del Consumo de MMS; Circunferencia Media del Brazo (CMB); Asesoramiento Nutricional; Mujeres antes del Matrimonio.

INTRODUCTION

Prospective brides can be associated with preconception women, because after marriage women will immediately undergo the conception process. The preconception period is the period before pregnancy.[1] The preconception period is a phase in the life cycle that requires special attention, especially in terms of adequate energy and nutritional needs. The health of the premarried women is very important because it will affect the outcome of pregnancy.[2] The health condition of women in early pregnancy will affect the health of the pregnancy and the condition of the health status of the prospective baby who is still in the womb, so that during the preconception period it is recommended that prospective brides can maintain a healthy lifestyle and fulfill nutritional adequacy.[3]

Fulfillment of nutritional adequacy for prospective brides is very important because good nutrition will support the optimal functioning of reproductive organs such as the smooth process of egg maturation, the production of eggs with good quality, and the perfect fertilization process. Nutritional intake plays a very important role in providing nutritional reserves for fetal growth and development.[1]

A common nutritional problem among premarried women is malnutrition, both macro and micronutrient deficiencies manifested in Chronic Energy Deficiency (CED) and anemia (iron deficiency). These nutritional deficiencies generally occur over a long period of time even before pregnancy. A commonly used indicator for early detection of chronic energy deficiency problems in premarried women is the risk of CED, which is characterized by low energy reserves for a long period of time and can be measured by Upper Arm Circumference (MUAC) less than 23,5 cm.[4]

Based on the results of the Basic Health Research (Riskesdas) in 2018, it shows that the prevalence of CED risk in pregnant women (15-49 years) is still quite high at 17,3 %, decreasing in 2021 to 14,5 %, decreasing again in 2022 to 8,7 %. Even though each year has decreased, the prevalence of CED among pregnant women in the 15-19 years and 20-24 years groups is still high respectively 33,5 % and 23,3 %.[4] This period is prone to anemia due to diet, activity and blood loss during menstruation. Usually anemia is characterized by a decrease in hemoglobin levels of less than 13,5 g/dL in adult men and less than 11,5 g/dL in adult women.[5]

Factors that affect nutritional problems in premarried women are divided into two, namely direct factors and indirect factors. Factors causing nutritional problems in premarried women include an imbalance in nutritional intake, infection or bleeding. The prevalence of anorexia and the presence of infectious diseases in adolescents causes a lack of energy intake and nutrients needed by the body, triggering nutritional problems. The direct causative factor of nutritional problems is the lack of nutritional intake and the indirect cause is nutritional knowledge with physical activity. According to Proctor (2006), preconception nutritional knowledge is an important factor in preparing for pregnancy, which can prevent nutritional deficiencies during pregnancy.[6] As this is proven by research conducted Wulandari, Yolandia and Mardiya that there is a significant relationship between knowledge and the occurrence of CED.[7] Nutrition education in the form of counseling can increase knowledge, change attitudes and behavior related to eating and nutrition.[8]

Nutritional problems in premarried women, especially anemia, in addition to the above factors, nutritional problems can also be influenced by compliance to taking blood supplement tablets, the age of premarried women, the level of knowledge and the socio-economic level of the family.[9] WHO recommends efforts to prevent, control, and treat nutritional problems of anemia, including iron and folic acid supplementation

in women of childbearing age, giving multi-micronutrient supplements to pregnant women that have been formulated by UNIMMAP (United Nations Multiple Micronutrient Preparation) and consumption of adequate iron source foods and consumption of foods that help iron absorption.[10]

Several studies have shown that multiple micronutrient supplement (MMS) is better than blood supplement tablets in increasing hemoglobin levels.[11] MMS contains more micronutrients (15 types) than IFA, which only contains 2 micronutrients (iron and folic acid).

There are still few studies on the effectiveness of MMS in premarried women, especially on the problem of anemia and the lack of massive promotive and preventive measures such as education and mentoring, giving multi vitamins to premarried brides, so based on this, the purpose of this study is to determine the effect of socio-cultural, MUAC, counseling and compliance with drinking MMS on the prevalence of anemia in premarried women.

METHOD

Study Design

This study used a cross-sectional design with a sample of pre-married women in Surabaya to determine the factors affecting anemia in premarried women.

Population and Samples

The population consisted of all premarried women in Surabaya. The inclusion criteria for this study were premarried women who got health exam back in November 2024. The population of premarried women in Surabaya on November 2024 is 1058. To obtain the sample size, the Lemeshow formula was used with a margin of error (d) of 5 %. This resulted in a sample size of 282. Sampling was done by simple random sampling by taking respondents randomly according to inclusion criteria. Premarried women throughout Surabaya's community health centers were randomly selected, and those selected became the research sample.

Data Collection

Data on the characteristics of respondents were age, education, occupation, nutritional status (MUAC), Hb level, compliance and counseling. All variables were collected through interviews using a standardized questionnaire. Age is categorised into three groups: under 20 years old, which is considered a high-risk age group, 20–35 years old, which is considered a low-risk age group, and over 35 years old, which is considered a high-risk age group. The education category was divided into three groups. The low category was defined as no schooling, elementary school, or junior high school. The medium category was high school graduate, and the high category was diploma or bachelor's degree. The nutritional status of the respondents in this study was measured by measuring their Mid-Upper Arm Circumference (MUAC). MUAC was measured using a measuring tape, made of fiber tape with an accuracy of 0,1cm, with categories: <23,5 cm (at risk of chronic energy deficiency/CED) and ≥23,5 cm (normal). The person measuring MUAC was trained before data collection. Counseling was categorized into counseled and non-counseled. The consumption of MMS by the premarried women is determined by the remaining MMS in the bottle and how long she has been consuming MMS. MMS consumption compliance was categorized into compliant (consuming ≥30 tablets/2 months) and non-compliant (consuming <30 tablets/2 months). Anemia was categorized as anemia (Hb <12 g/dL) and normal (Hb ≥12 g/dL).

Data Analysis

Descriptive analysis was used to describe the characteristics of the respondents. This study used bivariate logistic regression (OR) at a 95 % significance level. Factors found to be associated with anemia in premarried women were subsequently included in a multivariate logistic regression model to identify factors that were significantly related to anemia. Data were analyzed using IBM SPSS Statistics for Windows, Version 20.0. This study received ethical approval from the Health Research Ethics Committee of the Faculty of Public Health, Universitas Airlangga (No. 66/EA/KEPK/2025).

RESULTS

Table 1 showed that the group of premarried women with anemia had a much higher proportion of age risk factors (≥35 years) (27,6 %) compared to the group of normal premarried women (18,1 %).

Table 1. Comparison of Age Factors in Groups of Premarried Women with Anemia and Normal

Age	Anemia		Normal	
	n	%	n	%
At risk (<20 years or >35 years)	32	27,6	30	18,1
Not at risk (20 – 30 years old)	84	72,4	136	81,9
Total	116	100	166	100

Table 2 showed that the group of premarried women with secondary education experienced the most anemia (69,83 %), prospective brides with higher education were 24,14 %, while premarried women with lower education experienced less anemia, namely 6,03 %.

Table 2. Comparison of Educational Factors in Groups of Premarried Women with Anemia and Normal

Education	Anemia		Normal	
	n	%	n	%
Low	7	6,03	11	6,6
Medium	81	69,83	101	60,8
High	28	24,14	54	32,5
Total	116	100	166	100

Based on a comparison of jobs factors with the prevalence of anemia and non-anemia in prospective brides, it can be seen that premarried women with private employee jobs of 50 % experience anemia, brides who do not work as much as 33,6 % experience anemia, as many as 14,6 % of premarried women who work as self-employed experience anemia, while premarried women work as government employee as much as 1,7 % experience anemia (table 3).

Table 3. Comparison of Jobs Factors in Groups of Premarried Women with Anemia and Normal

Jobs	Anemia		Normal	
	n	%	n	%
Not working	39	33,6	42	25,3
Private employee	58	50	88	53,01
Government Employee	2	1,7	4	2,4
Self-employed	17	14,6	32	19,3
Total	116	100	166	100

It showed that the group of premarried women with anemia had a higher proportion of risk factors for nutritional status (CED) (60,3 %) than the group of premarried women with anemia, which was 41,6 % (table 4).

Table 4. Comparison of Nutritional Factors in Groups of Premarried Women with Anemia and Normal

Nutritional	Anemia		Normal	
	n	%	n	%
CED	70	60,3	69	41,6
Normal	46	39,7	97	58,4
Total	116	100	166	100

It showed that the group of premarried women who were not given counseling experienced more anemia (83,6 %), than the group of normal brides who were 20,5 % (table 5).

Table 5. Comparison of Counseling Factors in Groups of Premarried Women with Anemia and Normal

Counseling	Anemia		Normal	
	n	%	n	%
Counseled	19	16,4	132	79,5
Non-counseled	97	83,6	34	20,5
Total	116	100	166	100

Table 6 presents a comparison of compliance factors between the anemia (n=116) and normal (n=166) groups of premarried women. The data reveals a strong association between compliance status and the prevalence of anemia. Within the anemia group, a significant majority (75,9 %, n=88) were found to be non-compliant,

whereas only 24,1 % (n=28) were compliant. Conversely, this trend was reversed in the normal (non-anemia) group, where an overwhelming majority (90,4 %; n=150) were compliant, and only a small fraction (9,6 %; n=16) were non-compliant. These findings strongly suggest that non-compliance is a dominant characteristic among women diagnosed with anemia, while compliance is highly prevalent among those with normal hemoglobin levels.

Table 6. Comparison of Compliance Factors in Groups of Premarried Women with Anemia and Normal

Compliance	Anemia		Normal	
	n	%	n	%
Compliant	28	24,1	150	90,4
Non-compliant	88	75,9	16	9,6
Total	116	100	166	100

Influence of MUAC, Counseling, and Compliance with MMS Consumption on the Prevalence of Anemia in Premarried Women at Surabaya

Table 7. Influence of MUAC, Counseling, and Compliance with MMS Consumption on the Prevalence of Anemia in Premarried Women at Surabaya

Variables	p	Exp (B) OR	95 % CI	
			Lower	Upper
Age				
<20 tahun atau > 35 tahun	0,032*	3,207	0,267	6,147
20 – 35 tahun[R]		1,000	1,000	1,000
MUAC				
CED (MUAC <23,5 cm)	0,001*	4,606	1,817	7,395
Normal (MUAC ≥23,5 cm)[R]		1,000	1,000	1,000
Compliance				
Non-Compliant	0,018*	3,817	2,907	4,727
Compliant[R]		1,000	1,000	1,000
Counseling				
Non-Counseled	0,002*	4,103	2,802	5,404
Counseled[R]		1,000	1,000	1,000

Note: OR = odds ratio
CI = convidence interval
R = reference
*Statistically significant at p<0,005

The results of the multivariate logistic regression analysis (table 7) showed that the four variables tested had a statistically significant influence on the prevalence of anemia among premarried women in Surabaya. The factor with the strongest association was MUAC (Mid-Upper Arm Circumference) (p=0,001; OR=4,606; 95 % CI=1,817 – 7,395). This analysis indicated that premarried women with CED (Chronic Energy Deficiency) were 4,6 times more likely to experience anemia compared to those with a normal MUAC. The second significant factor was counseling (p=0,002; OR=4,103; 95 % CI=2,802 – 5,404), showing that premarried women who did not receive counseling were 4,1 times more likely to suffer from anemia. Furthermore, compliance with MMS (Multiple Micronutrient Supplements) consumption also had a significant association (p=0,018; OR=3,817; 95 % CI=2,907 – 4,727), indicating that non-compliant premarried women were 3,8 times more likely to experience anemia. The age variable also showed a significant influence (p=0,032; OR=3,207; 95 % CI=0,267 – 6,147), suggesting that premarried women in the at-risk age groups (< 20 years or > 35 years) were 3,2 times more likely to have anemia.

DISCUSSION

Age Factors on the Prevalence of Anemia

Premarried women with higher risk factors for anemia compared to the group of premarried women without risk factors for anemia. These risk factors ranged between 20 and 35 years. The results of a study conducted by Syariena et al. showed that age is the main cause of anemia, with an odds ratio (OR) of 13 162.[2] Due to

unstable iron metabolism and increased nutritional requirements, the extreme age of preconception women increases the risk of anemia. Due to unstable iron metabolism and increased nutritional requirements, the extreme age of preconception women increases the risk of anemia. Young women have low iron reserves due to irregular menstruation and an unhealthy diet, while at older ages, the risk of anemia increases due to decreased physiological function and other possible comorbidities. This is in line with the WHO theory that adolescents and old age are prone to anemia because the maturation process of reproductive organs is not perfect at a young age, and the body's metabolism decreases in old age, which has an impact on iron absorption.[12]

Factors of Nutritional Status (MUAC) on the Prevalence of Anemia

One important factor that increases the likelihood of a premarried women developing anemia is poor nutritional status. One method to determine the risk of chronic energy deficiency in premarried women is the measurement of upper arm circumference (MUAC). Measurement of upper arm circumference (MUAC), which uses muscle mass, which is a sensitive index to change, can give an idea of the state of muscle stores and the fat layer under the skin. Under conditions of KEK, the body's energy and protein reserves decrease, which stops hemoglobin synthesis. The absorption and utilization of iron and other micronutrients necessary for red blood cell formation are also affected by protein and energy deficiencies.[13] The function of protein to produce glucose will be prioritized when energy intake is reduced. This weakening of muscle due to protein breakdown will lead to muscle mass depletion. MUAC below 23,5 cm indicates decreased muscle mass due to protein deficiency in the body and indicates the risk of long-term energy deficiency.[14] Women with chronic energy deficiency (MUAC <23,5 cm) have higher risk factors for anemia. On the other hand, women who do not have chronic energy deficiency have lower risk factors. In a study conducted by Hubu, Nuryani, and Hano on preconception women, it was found that there was an association between the likelihood of CED in preconception women and energy and protein intake.[6] CED in the pre-pregnancy period can cause an unbalanced supply of fetal nutrients, which has an impact on fetal growth and development.[15] Therefore, the prevalence of CED should be prevented from the preconception period.

Nutrition Counseling Factors on the Prevalence of Anemia

Nutrition counseling is an important method to improve a person's knowledge, attitude, and behavior about nutrition. Brides-to-be who did not receive counseling (83,6 %) experienced anemia more often than those who received counseling (20,5 %). The statistical test results showed that nutrition counseling and the prevalence of anemia had a significant effect (p=0,002). The results of a study conducted by Ahmad et al. showed that nutrition counseling can improve a person's knowledge, perceptions, and actions about the consumption of iron-containing foods and healthy eating patterns, which can increase hemoglobin levels and reduce the risk of anemia.[16] One important way to prevent anemia is through education and counseling, which can increase supplement compliance and improve daily diet.[2] In research, Wulandari et al. said that nutrition counseling helps people understand the importance of supplements and a healthy diet to avoid anemia, especially during the premarried period. Preconception counseling is very important to prepare for pregnancy.[17]

Factors of MMS Consumption Compliance on Anemia Prevalence

Multiple Micronutrient Supplementation (MMS) contain fifteen types of micronutrients that are important for preventing anemia, such as zinc, folic acid, vitamins A, B12, and iron, among others. The results of this study showed that compliance to MMS had a significant influence on the number of anemia cases that occurred in women who were getting married (p=0,018). In a study conducted by Khoirunnabila et al., the researchers found that compliance to MMS can reduce the risk of anemia to 7,6 times lower in individuals who do so. Individual factors, such as knowledge, motivation, and side effects, as well as support from health workers, influence patient compliance.[18] Improving compliance can be achieved by providing clear and easy-to-understand instructions, reducing side effects by using appropriate formulations and administration methods, and providing assistance and supervision during the supplementation period.

Strengths and Limitations of the Study

This study about what causes anemia in women getting married in Surabaya presents a few good points, or strengths. First, the research uses a cross-sectional design and looks at a fairly large and specific group of 282 premarried women, chosen by simple random sampling. This helps make the results relevant to this specific group in Surabaya. The research is also successful in finding four factors that significantly affect anemia: Age, MUAC (Upper Arm Measurement), sticking to MMS supplement consumption, and Nutrition Counseling. These findings offer clear information for planning targeted health programs before women get pregnant. Also, the study uses both subjective data (like questionnaires about compliance and counseling) and objective data (measuring MUAC and hemoglobin levels) to figure out nutritional status and how common anemia is. However, the study also has some limitations. Since it is a cross-sectional study, it only collects data at one moment in

time. This means it only shows a connection (association) between the factors and anemia, but it cannot prove a direct cause-and-effect relationship. Furthermore, the study only describes the situation for premarried women in Surabaya as a whole; it would be better to provide details by region within Surabaya. This way, researchers can compare the factors causing anemia in different areas of Surabaya. Although compliance is measured, relying on the leftover MMS tablets and self-reported consumption via questionnaires might lead to inaccurate memory or measurement errors. Lastly, the results are very specific to premarried women in Surabaya, which limits their direct use in other geographical areas or with different backgrounds.

CONCLUSIONS

The findings of this study indicate that age, nutritional status (measured by MUAC), nutritional counseling, and compliance to MMS consumption significantly influence anemia in premarried women in Surabaya. Anemia is more prevalent among those with MUAC <23,5 cm. The prevalence of anemia is influenced by chronic energy deficiency (CED), inadequate counseling, and non-compliance with MMS consumption. Jobs and education do not show significant effects. Therefore, preventive and promotional efforts need enhancement through nutrition education, early nutritional risk screening via MUAC, and improved compliance with preconception supplements.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

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Methodology: Sri Redjeki, Sri Sumarmi.
Supervision: Sri Sumarmi.
Writing - original draft: Kartika Sri Redjeki.
Writing - proofreading and editing: Kartika Sri Redjeki, Sri Sumarmi.