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Increasing of Nutrition Status of Pregnant Women after Supplementation of Moringa Leaf Extract (*Moringa Oliefera*) in the Coastal Area of Makassar, Indonesia

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ABSTRACT

Pregnant women are very susceptible to malnutrition, they risk for giving birth to low birth weight babies. Moringa leaves contain fairly complete nutrients such as protein, vitamins and minerals thatare quite high. This study used a Randomized Double Blind design, Pretest-PostestControlled using a sample of non-anemia pregnant women which divided into two groups, namely the intervention group given Moringa leaf extract and the control group given iron folic supplements. Nutritional status of pregnant women is assessed using a measure of Upper Arm Circumference (MUAC) weight gain during pregnancy. The average size of MUAC of pregnant women in the intervention group was 25.72±3.30 cm increasing to 26.42 + 3.24 cm (p = 0.006). The average MUAC in the control group was 25.13±3.03 cm increased to 26.08±3.27 cm (p = 0.000). There was no difference in the increase in MUAC size between the two study groups. The weight of pregnant women in the intervention group increased by 5.07 kg (8.91%) while the control group increased by 6.09 kg (10.85%) during the three months of intervention. Supplementation of Moringa leaf extract can improve maternal nutritional status, especially in the size of the upper arm circumference. Increased nutritional status in pregnant women who consume Moringa leaf extract is no different from pregnant women who take iron folic supplements.

Keywords: *Moringa leaves, nutritional status, pregnant women*

INTRODUCTION

Nutritional status of pregnant women affects maternal nutritional status and fetal growth. Malnutrition in pregnant women causes a decrease in blood flow from the placenta to the fetus thereby inhibiting fetal growth [(1)] Maternal nutritional status before pregnancy or during pregnancy greatly determines *outcomes* pregnancy. Pregnant women who have normal nutritional status and who gain weight during pregnancy are in accordance with the standard, the average birth weight of the baby is higher than those of mothers who are underweight [(2)] In contrast, women with BMI <18.5 kg / m^2 (underweight) tend to give birth to babies with a birth weight lower than women with normal BMI (> 18.5 kg / m^2). Nutritional deficiency experienced by the mother, especially during the first trimester, causes obstruction of placental formation so that the size of the placenta is not maximal. Nutritional supply to the fetus from KEK mothers cannot meet the need for fetal formation and growth resulting in IUGR or fetal growth retardation [(3)] Pregnant women who experience malnutrition have a risk of experiencing complications at the time of delivery by 2.63 times compared to mothers with normal nutritional status [(4)]

Therefore, to improve the nutritional status of pregnant women, several activities have been carried out through nutritional programs such as supplementation of blood booster tablets and supplementary feeding. However, these interventions haven't fully been able to overcome nutritional problems, especially in pregnant

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women. This is due to a lack of target compliance with the intervention provided and the lack of sustainability of the program. The approach to prevention of nutritional problems in pregnant women should increase the utilization of potential local resources, so that they are easily accessible to the community and sustainable. The potential of local foodstuffs that are rich in nutrients and widely available but not maximally utilized are (*Moringa Oleifera) leaves*.

Moringa leaves contain a number of essential nutrients, especially proteins that are high enough with a protein composition of 40% and have the highest protein ratio [5] Moringa leaves contain 10 types of essential amino acids (arginine, histidine, isoleucine, leucine, lysine, methionine, phenillanine, trionin, tryptophan and valine which are indispensable to support growth [6] Moringa plants are known for magic trees, their leaves contain quite high protein, reaching three times the protein of eggs and two times the protein of milk.The interventions flour Moringa leaves in the diet of children under five who was suffer from malnutrition in Senegal Africa can improve the nutritional status of individuals significantly [7] Likewise, the results of research in children under five in Burkina Faso using that intervention of Moringa leaves can increase the nutrition status on the subject of the target toddler. The provision of Moringa leaf flour in the diet of toddlers can increase the weight of children who are malnourished [8]

Moringa plants are easy to grow and cultivated in areas with tropical climates such as the province of South Sulawesi Indonesia. Moringa leaves have been used more as animal feed and for vegetables in a small proportion of the population, so it needs to be developed as an alternative to improving the nutritional status of the community.

This study aims to assess the effect of giving Moringa leaf extract to the nutritional status of pregnant women living around the coastal area of Makassar city.

RESEARCH METHOD

1. **Research Design:** This research was carried out through an experimental intervention in the form of Moringa extract in pregnant women using the *Randomized Double Blind Controlled design.* Pregnant women who meet the inclusion criteria are divided into two groups at random (*simple random sampling*). The*first*group received intervention from Moringa leaf extract (2 capsules x 800 mg) and the *second* group received iron folic supplements (60 mg Fe and 0.25 mg folic). Interventions in both groups were carried out every day (2 capsules every day) for 3 (three) months. The Capsules that have Moringa leaf extract and iron folic use the same color and size. The study sample was second trimester pregnant women. Sample selection is done using the following inclusion criteria, 5-6 months of gestational age, Hb level ≥ 10.5 g / dL (not anemia), and not smoking. Samples totaled 70 people, each of 35 people per group.
2. **Data collection:** Data collected includes general data, nutrient intake and nutritional status of pregnant women. Nutritional status of pregnant women is determined based on weight gain and Upper Arm Circumference (MUAC). Mother's body weight was measured 4 times before intervention, first month, second month and third month intervention. MUAC is measured at the beginning and end of the intervention. The Body weight measurement using "Seca" such a brand scales. The measurement of MUAC using a MUAC tape. Maternal nutrient intake during pregnancy is collected by 24-hour recall method.
3. **Data Analysis:** Data that has been collected is included in the SPSS for Windows program for statistical analysis. Data analysis was carried out in univariate and bivariate ways. Data analysis was carried out by comparing the mean BBL between treatment groups using two free samples t test.

RESULTS

Nutrient intake data in table 1 shows that energy and protein intake in both the intervention group and the control group had fulfilled the Nutrition Adequacy Rate (RDA) which recommended for pregnant women (> 80%).

Table 1: Intake of nutrients (before) intervention

Nutrient	Intake of nutrients (x ± SD)		Sig [b]	% RDA	
	Intervention	Control		Intervention	Control
Energy (kcal)	2096 ± 543	2077 ± 371	0.864	83.5	82.7
Protein (gram)	68 ± 19	71 ± 20	0.434	88.3	92.2
Vitamin A (ug)	1075 ± 690	1315 ± 1570	0.409	125.6	153.6
Vitamin D (ug)	10 ± 6.7	11 ± 8.2	0.450	66.7	73.3
Vitamin E (uq)	6.4 ± 2.7	6.0 ± 2.8	0.576	42.7	40
Vitamin B1 (mg)	0.64 ± 0.21	0.65 ± 0.15	0.860	45.7	46.4
Vitamin B2 (mg)	0.92 ± 0.21	0.88 ± 0.40	0.674	54.1	51.8
Vitamin B6 (mg)	1.23 ± 0.49	1.25 ± 0.42	0.854	76.9	78.1
Folic Acid (ug)	154.6 ± 71.0	173.1 ± 82.2	0.318	25.8	28.9
Vitamin B12 (ug)	3.23 ± 1.58	4.41 ± 7.23	0.393	124.2	169.6
Vitamin C (mg)	46.84±34.25	42.14±31.56	0.551	57.5	49.6
Calcium (mg)	385.1± 1	383.7 ± 275.5	0.983	30.1	30.0
Phosphor (mg)	948.7 ± 287	1032 ± 279	0.219	130.1	141.6
Iron (mg)	7.1 ± 2.9	8.7 ± 3.95	0.57	20.3	24.9
Zinc (mg)	6.75 ± 2.26	8.69 ± 3.96	0.185	64.5	83.1

[b] T Test Independent

Likewise, the intake of several micronutrients has met the RDA in both research groups such as vitamin A, vitamin B12 and phosphor. However, intake of vitamin C, vitamin E, iron and zinc in both groups was still very low. The level of intake of these four nutrients is still below the minimum adequacy of less than 70% of RDA.

Table 2: Changes in MUAC size of pregnant women between before and after supplementation

Group	Before (cm)	After (cm)	Sig [c]	Changes in	Sig [d]
Intervention	25.72 ± 3.30	26.42 ± 3.24	0,006	0,70 ± 1.41	0,418
Control	25.13 ± 3.03	26.08 ± 3.27	0,000	0,89 ± 1.19	

cPaired t-Test dMann-U Whitney

Table 2 shows that there was a significant change in the Upper Arm Circumference (MUAC) of pregnant women in both groups ($p < 0.05$), both in the intervention group and in the control group. Changes in LLA size were 0.19 cm higher in the control group, but the increase in LLA size in the two groups was not significantly different ($p > 0.05$).

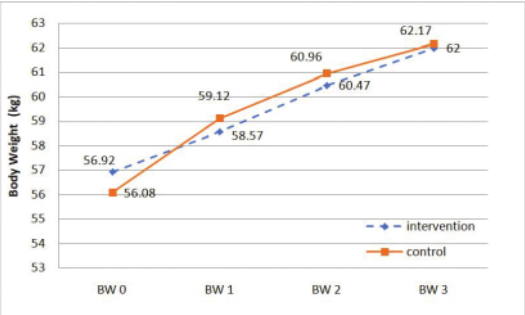

Figure 1: Weight gain of pregnant women during supplementation

Figure 1 shows that from the beginning of the study until the end of the study (3rd month) there was a consistent increase in body weight each month in both groups. However, the increase in body weight in the control group was greater, especially after one month of supplementation. The weight of pregnant women in the intervention group increased by 5.07 kg (8.91%) while the control group increased by 6.09 kg (10.85%) during the three months of intervention.

DISCUSSION

The weight gain of pregnant woman(second and third trimester) during the intervention only reached 5.08 kg in the intervention group and 6.09 kg in the control group. According to the *Institute of Medicine* (IOM) weight gain of pregnant women is based on the state of nutritional status (BMI) before pregnancy. The weight

gain for thin pregnant women should be higher than fat pregnant women. *TheInstitute of Medicine (IOM)* 1990 of American, advocated weight gain during pregnancy around 11.36-15.9 kg. Weight gain in pregnant women with normal BMI in Trimester II and III is around 0.4 kg per week [9][10] This means that the average increase in body weight of pregnant women in the two study groups still relatively normal. When viewed per week, the average increase in body weight of pregnant women in the second and third trimesters in this study reached 0.42 kg in the intervention group and 0.51 kg in the control group.

The size of MUAC in both of study groups hada good change. The addition of MUAC size to pregnant women who consumed Moringa leaf extract as much as 0.78 cm and pregnant women who received iron folic supplementation were 0.89 cm. The results of statistical analysis showed that there was a significant correlation between the size of MUAC in pregnant women during the intervention both in the group that consumed Moringa leaf extract and pregnant women who consumed iron folic supplements. These results indicate that the administration of Moringa leaf extract can improve the nutritional status of pregnant women, especially in the last three months of pregnancy.

Maternal nutritional status at conception and during pregnancy can affect the growth of the fetus being conceived. In addition, nutrition for pregnant women determines the weight of babies born. The results of the study in West Java showed that pregnant women with chronic energy deficiency (KEK) with a MUAC limit of 23 cm had a 7.9 times risk of giving birth to babies with low birth weight [11] The study *cross sectional* research in Daya Hospital of Makassar showed a strong correlation (r) = 0.611 between maternal nutritional status by size Upper Arm Circumference (MUAC) with birth weight infants [12] The weight gain during low pregnancy risks giving birth to low birth weight babies (RR = 2.04). The risk of giving birth to *macrosomia* babies (weight ≥4000 grams) is higher by increasing BMI before pregnancy and weight gain during pregnancy [13]

The results of statistical analysis showed that there were no differences in body weight gain between the two groups of pregnant women during the intervention (p = 0.160). Likewise, the MUAC indicator showed that there was no difference in the increase in MUAC during the intervention in the two study groups. That is, the intervention in the form of giving Moringa leaf extract has the same effect as iron folic supplementation in improving the nutritional status of pregnant women. Moringa leaves have a high composition of micro and macro nutrients. Previous publications have reported that moringa leaves have enough iron to prevent anemia and have the ability equivalent to iron folic supplements can prevent anemia [14]

Moringa leaves contain nutrients that are important for fetal growth and nutritional status of pregnant women. Moringa leaves contain Vitamin A, vitamin C and vitamin E as very strong antioxidants [15] Antioxidants in pregnant women are needed to prevent narrowing of the placental vessels that occur due to increased oxidative reactions during pregnancy, especially in the last trimester [16] This means that the intervention of Moringa leaf extract can facilitate the transportation of oxygen and nutrients from mother to fetus so as to increase fetal growth which is reflected in the nutritional status of the mother.

Moringa leaves contain a number of complete essential amino acids. Amino acids can increases metabolic transformation efficiency to improve muscle growth and quality [17] The derivatives of protein in the form of amino acids is a nutrient that has a very important role in tissue formation and fetal growth, it will affect changes in body weight and nutritional status during pregnancy. Protein and calcium supplementation and other micronutrients through the intervention of Moringa leaf extract capsules are important for the needs of nutrients during pregnancy, so that it can support fetal growth and maternal nutritional status during pregnancy. The results of this study are in line with the findings of a study of interventions carried out on humans both of children under five and pregnant women showed that giving flour or Moringa leaf extract can improve the nutritional status of the target. Likewise, research conducted on pregnant women informal workers showed that the administration of Moringa leaf extract can increase pregnant women MUAC [18]

CONCLUSION

Supplementation of Moringa leaf extract can improve maternal nutritional status, especially in the size of the upper arm circumference. Increased nutritional status in pregnant women who consume Moringa leaf extract is no different from Amil's mother who took iron folic supplements.

Conflict of Interest: In this study there is no conflict of interest, because the sample used has no kinship to the researcher

Source of Funding: The source of funding comes from the personal finance of the researcher which allocated for the researcher's final assignment

Ethical Clearance: Research ethics was obtained after the researcher made a presentation in front of the ethics Commission for Health Research Medical Faculty of Hasanuddin University

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