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Does Give Malnourished Pregnant Mothers with Supplementary Feeding Biscuit Can affect Pregnancy Outcomes?

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Abstract

Objective: Malnutrition in pregnancy is still problematic in the majority of developing countries. Malnourished pregnant women may result in fetal growth restriction and adverse pregnancy outcomes. This study examined the impact of nutrition intervention in the forms of biscuit on pregnancy outcomes.

Method: This study was an evaluative study on the supplementation program implemented in Pare-pare city, Indonesia. Each package of supplementary feeding biscuit consists of two biscuits (50g) containing 260 kcal of energy, 13g of fat, 8g of protein, 28g of carbs, nine vitamins, and ten minerals. The variables measured were placental weight and diameter, umbilical cord length and Hb, birth weight and length, head circumference, and chest circumference. All measurements were done by trained health workers in the Community Health Service. The analysis of this study was t-test, ANOVA, and regression linear using SPSS v. 24.

Result: The result of the study shows no effect of the biscuit dose on pregnancy Hb, MUAC, and gestational weight among malnourished mother. In comparison between malnourished and healthy mothers, there are no differences in the pregnancy outcomes. The effect of biscuit dose on the outcomes of pregnancy in malnourished mother demonstrated no significant difference among doses given on placental weight and diameter, umbilical cord length and Hb, birth weight and length, head circumference, and chest circumference.

Conclusion: In conclusion, this study demonstrated that given malnourished with a supplementary biscuit will not provide any improvements on the pregnancy outcomes. A clinical trial design study is necessary to examine the beneficial effect of complementary foods.

Keywords: *Pregnancy, complementary feeding, pregnancy outcome.*

Introduction

Malnutrition in pregnancy strongly associated with adverse pregnancy outcomes and can affect the health of the child early in life. Malnutrition is mainly caused by low dietary intake before and during pregnancy influencing the mother's capacity of storing, utilizing, and circulating the nutrients to the fetus[1]. Therefore, maternal nutritional status is the key to supporting fetal growth and development, along with other factors, such as placental, fetal, and genetic factors (Sharma et al., 2016). Women with acute malnutrition are likely to have stunted children compared to healthy pregnant women[2] and this associated with the increase of noncommunicable diseases risk[3]. However, recent reports illustrate that majority of children affected by stunting were in developing countries where the population is predominantly with low socio-economic status and exacerbated by intergenerational effects (short or malnourished mother)[1,4]. Several dietary interventions have been implemented to prevent the negative effect

of nutrient deficiency experienced by many pregnant women, especially in developing countries. However, there was no effect of nutrition interventions on pregnancy outcomes and only a small effect on the reduction in the incidence of preterm birth[5,6]. The result of intervention might be varied accordingly the specific problem in the population. For instance, the population with chronic energy malnutrition may be inappropriately given with micronutrient interventions.

A recent survey in 2018 shows that the number of chronic malnourished pregnant women in Indonesia, defined as mid-upper arm circumference less than 23.5cm, reached 17.3% [7]. In Pare-pare city, located in South Sulawesi, the prevalence of malnourished mother was 23.2% [8].Nutritional status before and during early pregnancy is critical, although the result is inconsistent in terms of its effect on pregnancy and pregnancy outcomes. A prospective cohort shows that maternal BMI was not associated with a gestational weight gain of the mother[9]. However, the limitation of this study was the malnourished participants were small. A systematic review indicated that maternal nutrition is associated with neurocognitive function during childhood, implicating that health pregnancy states may be beneficial in supporting fetal growth and development and child outcomes[10]. Another study shows that the nutritional status of the pregnancy was positively associated with birth weight. Thus, the nutritional status of pregnancy should be improved[11].

In improving maternal nutritional status during pregnancy, many supplementation programs have been implemented. To date, a supplementation of nutrient-rich biscuit, called complementary feeding program or PMT, has been implemented by the government in Pare-pare with an intended to support nutrients for the pregnant mothers and their fetus. However, it is not known yet to what extent the effect of this supplementation program on the pregnancy outcomes, specifically for those with chronic malnutrition. This study aimed to examine the impact of supplementation program given to malnourished pregnant women on the pregnancy outcomes.

Material and Method

This study was an evaluation program observing the pregnancy outcomes of the mother received complementary feeding program in the form of a biscuit. The design of the study has been described in the previous publication[8]. This study has been done in Pare-Pare City, Indonesia.Malnourished mother was defined as the mother with MUAC measurement at enrolment <23.5cm and healthy mother was otherwise. Each package of supplementary food consists of two biscuits (50g) containing 260 kcal of energy, 13g of fat, 8g of protein, 28g of carbs, nine vitamins, and ten minerals (Table 1).

Table 1: Nutrient contents of each biscuit package (50g; 260 kcal)

Nutrients (g or% RDA)	Nutrients (g or% RDA)
Fat (13g)	Vitamin C (50%)
Protein (8g)	Natrium (16%)
Carbohydrate (28g)	Folic acid (50%)
Vitamin A (50%)	Pantothenate acid (55%)
Vitamin D (60%)	Selenium (55%)
Vitamin E (55%)	Fluor (60%)
Vitamin B1 (60%)	Iodine (25%)
Vitamin B2 (55%)	Zinc (25%)
Vitamin B6 (60%)	Iron (25%)
Vitamin B12(60%)	Phosphor (15%)
Vitamin B3 (55%)	Calcium (15%)

The variables measured were placental weight and diameter, umbilical cord length and Hb, birth weight and length, head circumference, and chest circumference. The measurement of the umbilical cord Hb was performed at birth using HemoCue (Hb 201+ systems).Placenta and baby were weighed using baby scale meter provided in Community Health Services. Placental diameter, umbilical cord, head circumference and chest circumference were measured using tape. All measurements were done by trained health workers in the Community Health Service. The analysis of this study was t-test, ANOVA, and regression linear. All data analysis was performed using SPSS v. 24 (IBM Corp.).

Results

The results of the changes of hemoglobin, MUAC, and gestational weight gain of pregnant women after given supplementation have been previously published, but the effect of biscuit dose is still presented. **Table 2** shows no effect of the biscuit dose on pregnancy Hb, MUAC, and gestational weight among malnourished mother.

Table 2: Dose effect of complementary biscuit on Hb, gestational weight, and MUAC changes during pregnancy

Changes (n=49)	Dose			p
	≤ 1 biscuit (n=33)	> 1–2 biscuits (n=13)	≥ 3 biscuits (n=3)	
DHb1 – Hb2	-0,25±1,82	-0,54±1,31	-0,63±0,40	0.776
DHb1 – Hb3	-0,25±1,80	-0,16±1,68	-0,73±1,90	0.865
DHb2 – Hb3	-0,01±1,24	0,38±1,92	-0,10±1,80	0.431
DGestational weight	5,03±1,46	5,00±1,83	5,83±1,89	0.875
DMaternal MUAC	1,84±0,89	1,82±1,00	2,67±1,04	0.297

Table 3 shows the difference in the pregnancy outcomes between malnourished and healthy pregnant women. Between the two groups, there are no differences in the outcomes.

Table 3: Differences of pregnancy outcomes between malnourished and healthy pregnant women

Variables	Malnourished (n=49)	Healthy (n=162)	Total (N=211)	p
Placental weight	541.53±175.01	542.685±187.22	542.42±184.05	0.969
Placental diameter	19.13±2.23	19.41±2.12	19.35±2.14	0.429
Umbilical cord length	43.71±9.70	45.25±8.81	44.89±9.02	0.298
Umbilical cord Hb	13.42±2.87	13.37±2.35	13.38±2.47	0.890
Birth weight	3,033.04±367.47	3,036.17±367.26	3,035.45±366.44	0.958
Birth length	47.74±2.00	47.85±1.69	47.82±1.76	0.700
Birth head circumference	32.74±1.34	32.56±1.72	32.60±1.64	0.518
Birth chest circumference	31.96±1.44	31.80±1.68	31.84±1.62	0.544

The effect of biscuit dose on the outcomes of pregnancy in malnourished mother is demonstrated in **Table 4**. There was no significant difference among doses given on placental weight and diameter, umbilical cord length and Hb, birth weight and length, head circumference, and chest circumference.

Table 4: Dose effect of biscuit supplementation on various outcomes of pregnancy among malnourished women

Variable (n=49)	Biscuit Dose			p
	<1 Biscuit (n=33)	>1–2 Biscuits (n=13)	>2 Biscuit (n=3)	
Placental weight	559.39±200.67	495.77±105.10	543.33±75.06	0.547
Placental diameter	19.52±2.41	18.12±1.58	19.33±1.53	0.119
Umbilical cord length	43.76±10.08	43.92±9.72	42.33±8.02	0.991
Umbilical cord Hb	13.72±2.99	13.12±2.14	11.50±4.35	0.310
Birth weight	3,029.52±406.05	3,053.08±313.38	2,985.00±85.00	0.935
Birth length	47.58±2.28	48.15±1.34	47.68±0.58	0.813
Birth head circumference	32.67±1.25	33.08±1.61	32.00±1.00	0.483
Birth chest circumference	31.89±1.41	32.15±1.48	32.00±2.00	0.877

Discussion

The main finding of this study reveals that there was no difference in terms of pregnancy outcomes of malnourished women by the dose of energy-dense biscuits. The complexity of the metabolic process during pregnancy mainly affects fetal growth and developments, determining pregnancy outcomes. Intrauterine growth retardation (IUGR),one of the common forms of complications during pregnancy,is associated with the oxidative stress caused by exceeding of pregnancy complexity end products, called reactive oxygen species (ROS)[12]. However, to what extent the impact of oxidative stress on the specific outcome of pregnancy is poorly understood. A prospective cohort study shows that oxidative stress biomarker is associated with adverse pregnancy outcomes, although the age of participants of the study was in the risk (>30 years) that probably affect the metabolic process during pregnancy[13].

Most studies correlate oxidative stress during pregnancy to antioxidant-functioned micronutrients, such as iron, copper, zinc, and manganese[14,15].Casanueva and Viteri suggested that iron intake is critical determining balance oxidative stress in thehuman body. A proper dose and timing of iron supplementation potentially cause the reduction of oxidative stress. Conversely, iron overload may induce oxidative stress[15]. In the present study, malnourished participants received iron-folic acid supplementation. This supplementation may correct the nutrient status of the participants, resulting in a positive result in fetal growth which is manifested in pregnancy outcomes. Energy-dense biscuits supplement given to the participants may successfully support the nutrient supply for the mother and fetus and complement the role of iron-folic acid supplement in various metabolic mechanisms during pregnancy. Hence, the dose of the biscuits could not be seen explicitly in this study. This finding is supported by the result in which the outcomes of pregnancy between malnourished and healthy pregnant women were not statistically different. Supported by a previous study[8], it can be assumedthat the nutrients status in the malnourished body, both macro and micronutrients, potentially resemble those healthy pregnant women.

The interesting finding of this study was that the placenta and birth weight outcomes in malnourished women are similar to health pregnancy women. Given that this finding implicates for the potential treatment of minimizing the risk factor of stunting. Low birth weight is one of the determinant factors causing stunting in children under five[16]. Whereas the placenta is the supportive feature for maternal-fetal oxygen transport and nutrient exchange which affects birth weight. Placental weight is the manifestation of fetal growth in utero characterized by many dimensions of growth[17]. One of the dimensions is umbilical cord length. In this study, malnourished women have similar cord length to healthy pregnant women (43.71±9.70 vs 45.25±8.81, p=0.298), indicating that the growth of fetus established. Therefore, it can be fairly stated that the supplementation of biscuit along with iron-folic acid may be effective in reducing the risk of adverse pregnancy outcomes in malnourished women. However, this study did not measure the impact of biscuit supplementation in healthy pregnant women which may reveal other mechanisms involved in metabolic pathways during pregnancy.

The limitation of this study was that the dietary intakes were not observed. Dietary intake can potentially justify the explanation to what extent the contribution of those supplementations to meet the nutrient requirements of malnourished pregnancy. Second, the number of pregnant women who consumedbiscuits as recommended (two biscuits per day) was underestimated (only three mothers). However, since this is a study which was observed nutritional program of the government, it then describedthe real setting that a real challenge in the population. Hence, the government understands which has to be improved in order to support maternal and child health.This study also did not measure the impact of the biscuit supplementation on the healthy pregnancy as the program only be given to those malnourished women. The strength of this study was in the outcomes of the pregnancy measured. Measuring placenta, umbilical cord, and birth weight may give a comprehensive explanation of the supplementation effect during pregnancy.

Conclusion

In conclusion, this study demonstrated that given malnourished with a supplementary biscuit will not provide any improvements on the pregnancy outcomes. The government should review the program of biscuit supplementation in order to improve pregnancy outcomes. Further research is necessary using clinical trial design to examine the beneficial effect of complementary foods.

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