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Effect of giving instant papeda with laor powder (*Eunice viridis*) on the increase in weight pregnant rats and birth weight

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Abstract— In order to preserve sound maternal health, nutrition plays a significant and definite role in the course of pregnancy. This study was aimed to analyze the effect of giving instant papeda with laor powder (*Eunice viridis*) on the increase in weight pregnant rats and birth weight. An experimental study with *Randomized Controlled Trial Post Test Design* was performed towards 24 pregnant rat categorized into 4 groups as follows: Control Group (K), Group P1 (instant papeda), Group P2 (instant papeda with laor powder (70:30%), and Group P3 (instant papeda with laor powder (60:40%). Instant papeda with laor powder was given starting from day 1 to day 18 of pregancy. On day 19, the surgery was performed and the infants were weighing with digital scale. *One Way Anova test* 95% CI was used for the statistical analysis. Anova test resulted in significant difference on the changing of body weight during pregnancy. The increase in body weight of rats in the control group was 47.3%, the P1 group was 44.3%, the P2 group was 49% and the P3 group was 60.5%. Instant papeda with laor powder *(Eunice viridis*) effected (P < 0,05) on fetal body weight. Consequesntly, further analysis resulted in the differences between fetal weight of the control group and P3 group. Fetal body weight in P1 group was different from P3 group. Instant papeda with laor powder substituted with 40% laor flour resulted in more fetal body weight than other groups.

Keywords: instant papeda with laor powder, weight of pregnant rats, birth weight

1. Introduction

The intake of macro and micro nutrients is recommended to prevent side effects on pregnant mothers and fetus (Paul et al., 2013) as pregnancy is a period of increasing the needs for metabolic changes which occured in the physiology of women and the growth of the fetus. Several studies have revealed that pregnant women generally do not consume enough food, especially staple foods, animal foods, and fruit-plant foods. Consequesntly, the needs of pregnant women for energy, protein, vitamins and minerals are inadequate (Maqbool et al., 2019). On the other hand, inadequate nutrition intake for pregnant women will not only harm the mothers' health, but also affect on stunting of fetal growth and development. Nutrient deficiency on pregnant women can be caused by malnutrition in a long period of time (World Bank, 2006).

Basic Health Research in 2018 revealed the percentage of women of childbearing age who are at risk of protein energy malnutrition (PEM) in Indonesia in 2013 was 24.2% and in 2018 was 17.3%. Pregnant women suffering from PEM are at risk of giving birth to babies with low birth weight (Ministry of Health, 2018; Zeng et al., 2008). Low-birth weight babies are global public health problem and associated with both short and long term consequences.

Adequacy of energy and protein in pregnant women is essential. Indonesia Individual Food Consumption Survey in 2014 revealed that 52.9% pregnant women in rural areas are considered in the level of less energy sufficiency (<70%), while in urban areas the percentage was 51.5%. Furthermore, 55.7% pregnant women in rural suffered with a very low level of protein adequacy (<80%), while the percentage of 49.6% was amounted in urban areas (Siswanto, 2014). In national level, the percentage of the adequacy of the energy consumption of pregnant women was 73,6 % and percentage of protein consumed was 86.4 %. The percentage of energy sufficiency of pregnant women nation-wide was amounted deficit by 53, 9% and so was the protein adequacy by 51.9% (Directorate of Community Nutrition, 2017). The poor condition of pregnant women's protein-energy malnutrition demanded the formulation of a policy to prevent low birth weight baby and *stunting* by having supplementary food to pregnant women that does not only focus on the micronutrients needs but also macro-nutrients (energy and protein) need (Siswanto, 2014).

The national program for overcoming malnutrition in pregnant women and reducing LBW in infant concurred with supplementary food and iron tablets. Supplementary Food Feeding for pregnant women can be given in the form of manufactured supplementary food feeding or local food-based supplementary food feeding . The types of food items selected as the supplementary food should be based on the availability, the affordability and it's similarity on the pregnant women's daily diet. Instant papeda with laor powder is formulated with sago, skipjack and laor fish which are rich in nutrition. In 100 grams of papeda, it produces 397.03 kcal of energy, 21.11 g protein, 5.343 mg Fe and 3.703 mg zinc (Ristanti, et al., 2019). This study was aimed to analyze impact of instant papeda with laor powder (*eunice viridis.*) on weight gain and birth weight of pregnant rat (*rattus norvegicus*)

2. Materials and Methods

An experimental study with *Randomized Controlled Trial Post Test Design* was asministered. 24 pregnant rats *(Rattus norvegicus)* were utilized as the research subject and were separated into 4 groups: control group (P0), fed standard; group 1 (P1), fed with instant papeda; group 2 (P2), fed with instant papeda substituted with 30% laor powder; and group 3 (P3), fed with instant papeda substituted with 40% laor powder. Instant papeda with laor powder was given starting from day 1 to day 18 of pregancy. On day 0 and 19 pregnancy, the weigth was measured. A daily measurement was also done to count the leftovers. A surgery was performed on day 19 for the possession of cannibalism of mice which is their nature. Mice tend to chew their disabled, died or dying offsprings when giving birth spontaneously. As a consequence, this condition will affect the data. Finally, the infants were weighing with digital scale and their length was measured with ruler. *One Way Anova test* 95% CI was used for the statistical analysis.

3. Result

3.1 Pregnant Rats (*Rattus norvegicus*) Feed Consumption

Table 1. The Pregnant Rats (*Rattus norvegicus*) Average Feed Consumption

Group	N	Mean ± SD (g)	Minimum (g)	Maximum (g)	P
Control	6	46.91 ± 0.49	46.34	47.70	0.124
P1	5	47.51 ± 0.97	46.27	48.92	
P2	6	48.02 ± 0.95	46.32	48.92	
P3	7	47.71 ± 0.66	46.81	48.48	

Table 1 shows the average feed consumption of the control group (46.91 g), treatment group 1 (47.51 g), treatment group 2 (48.02 g) and treatment group 3 (47.71 g). Statistical analysis showed that the rats average feed intake did not differ between groups.

3.2 The Effect of Instant Papeda with laor Powder on the Weight of Pregnant Rats (*Rattus norvegicus*)

Table 2. Average Weight of Pregnant Rats (*Rattus norvegicus*)

	Treatment	N	Mean ± SD (g)	Minimum (g)	Maximum (g)	P
baseline	Control	6	155.00 ± 10.49	140	170	0.395
	P1	5	158.00 ± 21.68	130	190	
	P2	6	173.33 ± 23.38	150	200	
	P3	7	162.86 ± 18.89	140	200	
After intervention	Control	6	228.33 ± 16.02 [a]	210	250	0.011 *
	P1	5	228.00 ± 27.75 [a]	200	260	
	P2	6	256.67 ± 13.66 [b]	230	270	

	P3	7	261.67 ± 17.22 [b]	240	280	
Change	Control	6	73.33 ± 12.11 [a]	60	90	0.028 *
	P1	5	70.00 ± 18, 71 [a]	50	100	
	P2	6	85.00 ± 21.68 [ab]	60	120	
	P3	7	98.57 ± 13.45 [b]	80	120	

Note: *significant p <0.05 Similar superscript on similar variable showed no difference

Table 2 shows that the average weight of pregnant rats (*Rattus norvegicus*) before treatment was not significantly different. The average weight of control group was 155 g and it increased at the 18th pregnancy to 228.33 g. The average weight of treatment group 1 before treatment was 158 g and it increased to 228 g at the 18th pregnancy. The average weight of treatment group 2 was 173.33 g and it increased to 256.67 g at the 18th pregnancy. The average weight of treatment group 3 was 162.86 g and it increased to 261.67 g at 18th pregnancy. ANOVA test results showed that there were significant differences on weight gain during pregnancy. The increase in body weight of rats in the control group was 47.3%, the P1 group was 44.3%, the P2 group was 49% and the P3 group was 60.5%.

3.3 The Effect of Instant Papeda with Laor Powder (*Eunice viridis*) on Fetus Weight

Tabel 3. Average Weight (g) of Fetus

Group	n	Mean ±SD	Minimum	Maximum	P
Control	6	4,74 ± 0,70[a]	3,96	5,49	0,033*
P1	5	4,54 ± 0,54[a]	3,72	5,22	
P2	6	5,06 ± 0,38[ab]	4,44	5,48	
P3	7	5,41 ± 0,33[b]	4,90	5,97	

Table 3 shows that the highest average weight of fetus is found in treatment group 3 (5.41 g), followed by treatment group 2 (5.06 g), control group (4.74 g) and the lowest was in treatment group 1 (4.54 g). Based on statistical analysis, there was an effect (P <0, 05) of instant papeda with laor powder *(Eunice viridis*) on fetal weight. The results of further analysis showed that fetal weight of control group was different from P3 group. Fetal weight in group P1 was different from group P3.

4. Discussion

Maternal nutrition and health are very essential on fetal growth regulation of human for healthy children were born from healthy mother. Infant mortality rate will grow higher if babies were born weak due to the inadequate food consumption of the mothers. Consequently, a woman's normal nutritional needs increase during pregnancy to meet the needs of the growing fetus and maternal tissue associated with pregnancy. A proper dietary balance is significant to ensure sufficient energy intake for sufficient fetal growth without using the mother's own tissues. Infant birth weight is a strong predictor of infant growth and survival, and it depends on maternal health and nutrient intake during pregnancy (Durrani & Rani, 2011).

There is a need for additional protein in pregnant women used for fetal growth, placental development, production of amniotic fluid, increase in maternal blood volume and support on tissue synthesis of mother and fetus. Protein requirements will increase during pregnancy and reach its maximum stage during the third trimester (Ritchie & King, 2008; Myatt & Powell, 2010).

The test results showed that the essential amino acids found in laor flour were histidine 0.98%, threonine 2.40%, arginine 19.39%, tryptophan and methionine 1.35%, valine 2.09%, phenylalanine 1.58%, isoleucine 1.84%, leucine 3.07%, and lysine 5.45%. Non-essential amino acids found in laor flour are aspartic 3.96%, glutamic 5.57%, asparagine 0.14%, serine 2.43%, glutamine <0.05, glycine 3.39%, alanine 3.08. %, and tyrosine 4.50% (Ristanti et al., 2019). Essential amino acids in laor flour is found higher than what it is found in eggs and milk .

Rettob, et al. (2013) reported that the unsaturated fatty acid on laor is *palmitoleic acid* (C16: 1, n-7): 16 mg, *oleic acid* (C18: 1 n-9): 56 mg, *linoleic acid* (C18: 2, n-6): 15 mg, *alpha-linolenic acid* (C18: 3, n-3): 14 mg, *11-eichosanoic acid* (C20: 1, n-9): 14 mg , *arachidonic acid* (C20: 4, n-6): 164 mg , EPA (C20: 5, n-3): 58 mg, DHA (C22: 6, n-3): 21 mg.

Maternal amino acid and protein concentrations in the third trimester of pregnancy correlate significantly with fetal growth and development. Amino acid is an essential nutrient for fetal life as they are the essential precursors for the development and growth of the fetus. Certain proteins or amino acids may be responsible for different developmental steps. The amino acids, glycine, lysine, and total amino acids have a positive correlation with birth weight. Glycine contributes significantly to the infant motor development and isoleucine positively correlated to mental development. Several amino acids such as glycine, lysine, and histidine at the end of pregnancy can be used as predictors of growth and fetal development (Avagliano, et al., 2012).

During pregnancy the need for omega-3 fatty acids increases more than normal to support fetal growth, especially the brain and eyes. Therefore, it is important to supply adequate amounts of omega-3 fatty acids to the fetus during pregnancy. To optimize pregnancy *outcome* and fetal health, it is recommended that pregnant women consume at least 200 mg of DHA per day (Coletta, et al., 2010).

Optimal pregnancy and fetal outcomes depend on adequate nutritional intake to meet the needs of both mother and fetus. The main nutrients required for fetal growth and development are glucose, amino acids, free fatty acids and cholesterol. Giving instant papeda with laor powder 60: 40% resulted in the highest body weight since it contains carbohydrates, protein and amino acids as well as essential fatty acids which are sufficient to meet the needs of pregnant rats and for fetal growth.

Fetal growth is directly related to the availability of maternal nutrients and the ability of the placenta to transfer these nutrients from the mother's circulation to the fetus and this system is very complex. There are two layers in the placental villi bringing the substrate, gas and water from the maternal circulation to cross to reach the fetus. The first layer covers the villi, closest to the maternal circulation, and consists of trophoblasts called *syncytiotrophoblasts* (SCTB). SCTB is a placental transport epithelium with two polarized membranes – a *microvillus membrane* (MVM) facing the maternal circulation and the *basal plasma membrane* (BM) facing the fetal capillaries. After passing through the membrane SCTB, the substrate must pass through the second layer, the epithelium capillary fetus, prior to entry into the fetal circulation (Brett, et al., 2014).

Glucose, the primary substrate for fetal growth – found in both the *microvillus membrane* (MVM) and the *basal plasma membrane* (BM), is transferred across the placenta via the glucose transporter (GLUT 1). Scholl, et al., (2001) stated that glucose is produced as a result of maternal metabolism, especially carbohydrates. The glucose transporter GLUT 1 is asymmetrically distributed, several times higher in the microvilli (facing the mother) than in the basement membrane (facing the fetus). There is strong evidence that the basement membrane is a step that limits the rate of transplacental glucose transfer, so that changes in glucose transporter expression on the basement membrane will have significant consequences for glucose transport from mother to fetus and for fetal growth. Thus, GLUT 1 is very important in fetal growth. Baumann et al., (2014), GLUT 1 expression increases during the last half of pregnancy, along with an increase in fetal growth rate in the third trimester.

Research by Zulaidah, et al., (2014) evidenced that giving supplementary food of 5 kinds of processed food made from tuna fish for 30 days in trimester pregnant women gave the average birth weight of babies in the treatment group was 3.248 g and in the control group was 2.974 g. Statistically, there is an effect of PMT on infant birth weight. Giving supplementary food for 30 days in the trimester increases the baby's birth weight by 274 g. Prameswari, et al., (2020) shows that protein-sourced supplementary foods had a similar effect with the government supplementary food (GSF) on fetal growth of pregnant women with Chronic Energy Deficiency (CED).

5. Conclusion

There is an impact of instant papeda with laor powder *(Eunice viridis*) on weight gain of rats during pregnancy and fetal body weight. Instant papeda with laor powder substituted with 40% laor flour resulted in more fetal body weight than other groups.

6. Reference

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