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The Effect of Local Snacks Enriched with Shell Flour on The Nutritional Status of Stunting Children

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Abstract
The research objectives were to determine the effect of hawker given local snack with the shell flour addition for nutritional status and the growth of stunting children. The study was conducted by used by Randomized pretest-posttest controlled trial design, where the sample of children divided in two groups: the first group was given a local snack enriched flour shells(LSF+SF= Local Snack Food fortified with Shell Flour),and the second group as the intervened control with local snacks (LSF = local Snack Food). Results of research showed the mean nutrient intake of stunting children under five less than 70% RDA, except for protein, vitamin A and calcium. The mean HAZ group LSF+SF (before vs. after) is (-2.44 vs -2.47 ± 1.12 ± 1.30), did not differ significantly (p = 0.827). The mean HAZ LSF+SF group increased significance (p = 0.027) between before and after treatment (-3.00 ± 1.30 vs. -2.64 ± 0.95). The mean WHZ LSF+SF group (before vs. after) is (-1.02 ± 1.39 vs. -1.25 ± 1.85) did not differ significantly (p = 0.740). Provision local snacks enriched shells flour can improve the nutritional status of HAZ. Concentration of shells flour for local snacks should not exceed 10% in order to maintain power received toddlers.

Keywords: *Local snacks, Acceptability, Nutritional status*

I. INTRODUCTION

UNICEF reported that about 7.8 million children aged under five in Indonesia suffered *stunting*, in order of five countries most suffer stunting (Bahmat, 2010). Result of Health Research (Riskesdas) in 2013 reported the number of infants *stunting* reaches 37.2%. South Sulawesi has a higher number *of stunting* (40.9%), while placing South Sulawesi in 13th ranked as a province that most children under five *stunting* (Kemenkes, 2013).

Based on the Results Micro Study of nutrient problem in Indonesia in 2007 showed the consumption of micronutrients children included in South Sulawesi for every age group was very low, below 30% RDA (Herman S, 2009). The data is reinforced by Riskesdas in 2010 which reported the average intake of zinc among children 24-59 months only reached 46.8% RDA (2.34 mg), where by 63.5% of children are not met the zinc intake experience stunting Bahmat DO, et al, 2010. the children who deficiency zinc consume have an increased risk for stunting by 9.94 times compared to children who fulfilled their zinc intake (Dewi, 2014).

Results of previous studies show that the use of local food products are proven to improve the nutritional status of malnutrition children under five are. Supplementary feeding for 2 months give effect to changes the nutritional status of malnutrition children (Fitriyanti F, 2012). Supplementary feeding catfish flour biscuit can increase the z-score W/A of children reducing child malnutrition and malnutrition by 47.9% (Nugraha 2012). Local supplementary feeding enriched of animal and vegetable protein for malnutrition children may increase nutritional status.

South Sulawesi is known to have a wide variety of favored local snacks by the local community (Pakhri A., et al, 1999; Harini S., et al, 2000). Local snacks generally made from flour, sugar and fat, making it less micro-nutrients containing, such as zinc and iron, so it needs to be combined with the other local foodstuffs in order to have a balanced nutrient composition as a food supplement toddlers. In the other hand, South Sulawesi also has potential resources "shells" that can be used to improve the nutritional quality of food / local snacks. Shellfish contain a number of essential nutrients that are very high. Shellfish for example, contains nine essential amino acids and unsaturated fatty acids considerable potential for growth (Abdullah A, 2013). Extract meat shells / oysterstypes *Crassostren cucullata* contain proteinas much as 34.1%, and Zn 66.02 mg / kg (Hasani R, 2015). Development of local hawker food with the addition of shells flour will complement and enrich the composition and nutritional value of these snacks.

II. METHODS

This study used *pretest-posttest randomized controlled trial design*, which was initiated by screening under five suffering from stunting used anthropometric methods, namely the index height for age (H/A). Samples that meet of the criteria of measurement baseline (pretest) to height, weight and nutrient intake. The sample was then

divided in two groups by method *simple random sampling*. The first group intervened with *Local Snack Food fortified with Shell Flour* (LSF + SF), and the second group as a control intervention with local street food without flour shells (LSF = *Local Snack Food).* The intervention is done every day for one month (30 days eating). On day 31 post-test done. Samples are children patients stunting (HAZ <-2 SD) with the following criteria: (1) the age of 24-59 months, (2) not suffering from marasmus or kwashiorkor, and (3) not being suffering from acute or chronic infectious disease. The number of samples is 25 people per group.

Data collected includes nutrient consumption and nutritional status assessed by anthropometry data. Nutrient consumption was measured used 24-hour recall. Assessment of nutritional status using the index weight for age (W/A), hight for age (H/A) and weight for hight (W/H). Body weight was measured used a digital bathroom scales with a scale of 0.1 kg. Height measurements used *microtoise*. Age of children is determined by date of birth was asked of parents. Anthropometric data are then calculated the value of the z-score of each index W/A, H/A and W/H used application *WHO Anthro* program.

The data were analyzed used univariate through assessment the value of the average (mean) and standard deviation (SD) of the Z-score Weight for Age (WAZ), Z-score Hight for Age (HAZ), Z-score Weight for Hight (WHZ). Bivariate analysis to assess the changes in the nutritional status of children under five between before and after the intervention in each treatment group using statistical tests*"Paired T test".*

III. RESULTS

A. Characteristics of parents

Mothers and fathers of children under five participants of this research mostly has graduated from junior high education level and graduated from high school. Most of the mothers of children under five only worked as a housewife, either in groups LSF+SF or LSF. The type of work that most fathers in both study groups are workers and private employees, as well as the driver.

Table 1. Education and Employment of Parents

Variable	LSF+SF		LSF		p-value
	n	%	n	%	
Education of mother					
Did not finish primary school	0	0	2	8.3	
Primary school	6	26.1	5	20.8	0.370
Elementary school	8	34.8	11	45.6	
Junior high school	9	39.1	6	25.0	
Education of father					
Did not finish primary school	0	0	4	16.7	
Primary school	10	43.5	8	33.3	
Elementary school	4	17.4	5	20.8	0.252
Did not finish high school	0	0	1	4.2	
High school	8	34.8	6	29.8	
College	1	4.3	0	0	
Employment of mother:					
Civil servant/army/police	0	0	1	4.2	
Private employees	1	4.3	1	4.2	
Trader/employer	0	0	3	12.5	0.371
Laborers	0	0	1	4.2	
Housewives	22	95.7	18.0	75.0	
Employment of father:					
Private employees	5	21.7	5	20.8	
Trader/employer	1	4.3	4	16.7	
Farmers	3	13.0	4	16.7	0.402
Laborers	8	34.8	7	29.2	
Drivers	6	26.1	2	8.3	
Pensioners	0	0	2	8.3	

B. Characteristics of Children

Table 2. Characteristics of Children

Variable	LSF+SF n=23 (%)	LSF n=24 (%)	p-value
Sex			
male	12 (52.2)	16 (66.7)	0.238
female	11 (47.8)	8 (33.3)	
Age (month)			
24 – 35	9 (42.9)	7 (31.8)	0.685
36 - 47	5 (23.8)	5 (22.7)	
48 – 60	7 (33.3)	10 (45.5)	

C. Nutrients Intake

Table 3. Intake of Nutrients Toddlers

Nutrien	group	Before		After	
		Mean±SD	% AKG	Mean±SD	% RDA
Energy	LSF+SF	787±300	60.63	720±273	55.38
	LSF	775±218	58.07	654±359	50.31
Protein	LSF+SF	39±21	162.5	32±14	133.33
	LSF	31±12	129.16	29±15	120.08
Lipid	LSF+SF	28±14	56.00	24±13	48.00
	LSF	26±15	52.00	21±15	42.00
Carbohidrat	LSF+SF	92±32	51.83	91±39	51.23
	LSF	105±56	95.15	87±56	49.00
Vitamin A	LSF+SF	484±343	113.88	415±374	97.62
	LSF	488±404	114.82	290±286	62.23
Vitamin C	LSF+SF	14±15	32.94	26±76	61.17
	LSF	30±58	70.58	16±29	37.65
Calsium	LSF+SF	238±233	28.84	132±144	16.00
	LSF	220±247	26.67	227±355	27.51
Phospor	LSF+SF	529±307	105.80	431±215±	86.20
	LSF	465±220	93.00	451±285	90.20
Iron	LSF+SF	3.45±2.82	40.59	2.82±2.13	33.18
	LSF	3.52±2.23	41.41	2.66±2.97	31.29
Zink	LSF+SF	3.72±1.93	82.67	2.81±1.27	62.44
	LSF	3.02±1.16	73.37	2.58±1.73	57.33

Table 3 shows the nutrient intake of children in the both groups were common under the RDA. Only energy intake ranged from 50% to 60% of the RDA. Decreased energy intake between before and after the intervention, either in groups LSF+SF or LSF. Generally, children who were subjected in this study have exceeded protein conumption than the RDA, either in groups LSF+SF or LSF. Despite the downward trend between before and after the study, the intake of both groups exceeded 120% RDA.

Intake of vitamins before the study more than 100% RDA but after the research tends to downward. Greater decline occurred in the group LSF, which is only 62%. In contrast to vitamin A, vitamin C only between 32% to 70%. Iron intake before the study by 40% in the LSF+SF and 41% in the LSF. Iron intake in both of groups also decreased between before and after the study. Zing intake before the study on LSF+SF group reached 82% and 73% LSF group. After the study, the intake of both groups have decreased.

D. Changes in nutritional status before and after intervention

Table 4.Changes in nutritional status

Nutritional status	group	before	after	Sig (p)
WAZ	LSF+SF (n=23)	-2.44±1.12	-2.47±1.30	0.827
	LSF (n=24)	-2.28±0.59	-2.28±1.06	0.990
HAZ	LSF+SF (n=23)	-3.00±1.30	-2.64±0.95	0.027
	LSF (n=24)	-2.70±0.69	-2.50±1.09	0.316
WHZ	LSF+SF (n=23)	-1.02±1.39	-1.25±1.85	0.740
	LSF (n=24)	-1.23±0.96	-1.22±1.45	0.630

Table 4 above shows that changes in nutritional status based on the value of Z-score on every index used. Based on the index of W/A seen nothing difference in the nutritional status of the Z-score between before and after the intervention both in the LSF+SF group (p = 0827) and the LSF group (p = 0990).

Based on the index H/A seen there a change in the value of the Z-scores before and after intervention in the intervention group by 0.36 points. Results of statistical analysis show the value of p = 0.027. This means that there is improving the nutritional status of children according to the index H/A on LSF+SF group after eating local snacks enriched shells flour. In contrast, the LSF groups showed no difference in the value of HAZ between before and after the study (p = 0316).

Based on the index of H/W showed noting difference in the value of Z-score between before and after the intervention, both in the LSF group (p = 0.740) and the LSF (p = 0.630). That means, there is no significant change in nutritional status before and after the study, both in the group that consumed local snacks enriched shells flour or local snacks without shells flour.

IV. DISCUSSION

Stunting is a state of disorder height growth so that short or very short stature (Black, *et al*., 2008). Stunting children impaired physical growth so that it has a shorter body size and tend to have a lower body weight than children like his age (Sareen, 2009; Astari, 2006). These circumstances make the stunting children tend to experience malnutrition or poor nutrition. The results of this study prove that the majority of stunting children suffering from undernourishment and malnutrition (70.2%).

Interventions in the form of provision local snacks enriched shell flour were able to improve the nutritional status of stunting children. Interestingly, that the provision of local snacks enriched shells flour can decrease the proportion of stunting and very stunting children at 17.4% in the intervention only to last one month. This intervention model is able to increase HAZ at 0:36 points. The results of statistical analysis showed that provision of local snacks enriched shells flour can increase HAZ stunting children. Provision of local snack enriched shells flour can increase the intake of essential nutrients children every day. Each child gets additional nutrients from local snacks, the energy is 220 kcal, 5 grams protein, 50 mg calcium, iron and zinc as 6 mg 1 mg.

The provision of fortified foods (fortification) zinc can improve linear growth, there by reducing the number of infants that impaired growth in Bangladesh (Christian P, 2016). Besides to containing zinc (Zn), local snacks enriched shells flour also contain vitamin A are also important for growing children. Although vitamin A generally is not reputed as a major nutrient for growth but enough vitamin A can help restore growth with other psychological functions that should be normalized to allow for the rapid increase in weak network (Dewey, 2011).

Supplementary feeding in the form of local snacks may improve linear growth (Huybregts, 2012). The children who received the supplement local snacks enriched shells flour showed an average increase of simple linear but statistically significant (as indicated by HAZ). These results are consistent with some previous findings, such as programs that use the *ready-to-use supplementary food* (RUSF) is a supplementary food for children 6 to 36 months to in old Nigeria (Isanaka, 2010). Although the effect is small, it should be noted because supplementation only lasted 1 month. This finding is also consistent with previous research. A significant reduction in severe stunting reported in Malawi people aged 6 to 28 months after the intervention 12 months (Phuka, 2008). Advantages of significant length reported in Nigeria after children aged 6-36 months during the 6 month intervention with *ready-to-use therapeutic food*/RUTF (Isanaka, 2009), on the Ghana 6 to 12 months after the 6-month intervention with *lipid-Based Nutrient supplement* /LNS (Afarwuah, 2007).

The obtained results in this research are similar to the Yuniritha findings (2015) who intervened used by zinc supplements in the form of a syrup made from extracts of bilih fish *"Bilihzinc". S*upplementation bilihzinc for 82 days among children under the age of 12-36 who suffer from stunting can improve height of 3.53 cm (Yuniritha, 2015).

Not optimal improvement nutritional status of children in this study due to the number period of intervention are very short only one month and the low intake of nutrients from the daily diet, especially energy and the number of micronutrients (Hidayati, 2010; Dewi, 2014). The intake of substances also decreased nutrient intake indicated by the post-intervention which mostly fall below 70% of the RDA, especially on micro-nutrients.

Zinc intake of children in this study is relatively very low so the risk of stunting (Dewi, 2014). Zinc is a nutrient that is needed in the production of growth hormone (Susilo MT, 2013). Zinc is required for the metabolism of

bone, interacts with an important hormone that is involved in bone growth such as somatomedin, osteocalcin, testeron, thyroid and insulin (Dewi, 2014). Formation of low growth hormone which causes disturbances in the linear growth is a drag on increasing of the length / height (SG Sareen, 2009; Astari LD 2006). Zinc is also an essential substance for the formation of a number nutrients that contribute to metabolism and synthesis of energy. Zinc is known to play an important role in biological processes including cell of growth, differentiation and metabolism and deficiencies micronutrient restrict the child's growth and lowered resistance to infection, there by increasing morbidity and mortality in children (Brown KH, 2009).

V. CONCLUSION

Providing local snacks enriched shells flour can improve the nutritional status of stunted children. Need additional time so that interventions can be seen a noticeable impact on growth.

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