

*Full Length Research Paper*

## Tempeh–dates biscuits effect on the gained weight of moderate underweight children

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Underweight status may cause growth disturbance, laziness in conducting daily physical activities, and decreased intellectual capacities due to impaired brain development. The study examined the effect of tempeh-date biscuits on the nutritional status of moderate underweight children. A single blind quasi experimental pre - post study design undertaken at Depok City, West Java Province within 4 weeks. Underfives children in intervention group (n = 13), control group I (n=16), and control group II (n=18) participated in the study. Independent t-test and ANOVA used to analyze the nutritional status difference, final height and weight. Mean nutritional status and differences assessed by paired t-test. The results showed that there was a significant increase in mean weight of  $1.3 \pm 0.4$  kg in the intervention group ( $p = 0.001$ ) and of  $0.4 \pm 0.5$  in the control group ( $p=0.008$ ). Increasing mean height in the control group was higher ( $1.8 \pm 1.7$  cm) than intervention group ( $1.5 \pm 1.7$  cm). There was correlation between weight and supplementary feeding in the control and intervention groups. Nutritional status can be improved by tempeh-date biscuits.

**Key words:** moderate underweight children, tempeh-date biscuit, nutritional status, weight, height

### INTRODUCTION

Energy and protein deficiencies in children under 5 years of age (underfives) continue to be a major public health problem in developing countries such as Indonesia. Underweight status may cause growth disturbance, laziness in conducting daily physical activities, and decreased intellectual capacities due to impaired brain development (Almatsier, 2001). Approximately 57% of annual deaths in developing countries occur because of severe underweight in underfives. The relative risks of mortality in infants with severe and mild underweight status are respectively 8.4- and 4.6 times those of normal weight underfives.(WHO, 2002). The proportion of

underfives with moderate underweight status i.e. Weight for Age from -3.00 to -2.01 standard deviation of Z-score) in West Java was 11.3% and of those with severe underweight status 3.7%, which was below the national figures of 13% and 5.4%, respectively (Indonesian Basic Health Research Survey, 2007). The Depok municipality of Jakarta Province still faces the problem of underweight in the underfives, although the percentage of underfives with underweight status in Depok is already below the national figure, with a slight reduction from 8.8% in 2005 to 6.28% in 2009 (Depok District Health Office, 2009). The proportion of severe underweight among underfives in the same time period also showed a tendency to decrease (from 1.03% in 2005 to .21% in 2009), thus being far below the national figure. In spite of the substantial improvement in nutritional status of

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underfives, the problem of mild and severe underweight in the Depok municipality has to be monitored constantly to prevent future increases. The causes of underweight among underfives in Depok are poor feeding patterns (99.2%), poor environment or lack of hygiene and sanitation (71%), poverty (52.9%), and concomitant diseases such as tuberculosis (44.9%) (Depok District Health Office, 2009). To solve the underweight problem, the Depok Municipal Health Service has implemented several programs, such as routine nutrition education, nutrition counseling at the nutrition clinics of the health centers (*puskesmas*), tracking and surveillance, the Family Nutritional Awareness program, administration of supplementary feeding for recovery, supplementary foods for breastfeeding, home management of severe underweight, referral of underfives with severe underweight status to health centers and hospitals, nutritional positive deviance approach, and therapeutic feeding centers. Recovery for underfives with mild and severe underweight status may be accomplished by administration of biscuits as a nutritious snack, these being well liked by underfives (Kurnia et al, 2010; Mervina, 2009; Clara et al, 2009). However, commonly available biscuits are made from cow's milk and thus unaffordable to the lower socioeconomic groups with their limited buying power. Thus it is not surprising that the problem of severe underweight is most acute in these groups. Therefore, there is a need for the fabrication of a supplementary food in the form of biscuits made from tempeh flour and date jam to improve the nutritional status of underfives. Tempeh is a functional food containing high protein which is higher than beef and also high carbohydrate. Dates are high in carbohydrates (such as glucose and fructose), vitamins, minerals, and fiber (Ferreira et al, 2011). Dates can increase body weight because of their high energy content and thus may stimulate the growth of the underfives (Badwilan, 2008). Combination or mixed tempeh powder and dates biscuits with high calories and protein can increase weight and height of moderate underweight children, and it is faster than tempeh biscuits only. Therefore, there is a need for conducting an efficacy study to evaluate the impact of tempeh-date biscuits on the nutritional status of underfives with moderate underweight status.

## **SUBJECT AND METHODS**

### **STUDY DESIGN**

This study used a quasi-experimental pre-post test design, where initial observations formed the basis for evaluating the changes occurring during the implementation of the program. The study population had a substantially high level of homogeneity, as the samples

came from poor families with mild underweight status, thus minimizing the effect of confounding variables. This study also performed time-serial observations for 4 weeks through weekly assessment of nutritional status, thus enhancing its validity. The detailed activities drawn in Figure 1. Ethical clearance was obtained from the Ethics Commission of the Research and Development Board of the Ministry of Health of the Republic of Indonesia.

### **SELECTION OF SAMPLE**

Sixty underfives with moderate underweight status i.e. WAZ (Weight for Age) Height -3.00 to -2.01 standard deviation (SD) and Weight for Height is less than -2 SD (WHO 1995) were screened as candidate respondents by trained college student. There were minimal nine samples needed for each group in the study for intervention and control groups (Lemeshow et al, 1997).

The location in the villages of Ratu Jaya and Mampang were selected on the basis of weight/age indicator obtained from the 2009 Depok Municipal Health Service data. Names of underfives with moderate underweight status were obtained from Cipayung and Depok Jaya health centers based on monthly reports of the *posyandu* (integrated health post). The inclusion criteria were underfive children aged 12 to 59 years, having moderate underweight status on the basis of weight/age and weight for height, healthy condition (sample did not suffer from infectious diseases such as tuberculosis, diarrhea, etc) were examined by community health centers doctors, resident in the two villages, never participated and/or not participated in a supplementary feeding for recovery program conducted by government or private institutions as well as non-governmental organizations (NGO), and whose mothers agreed to sign the informed consent form provided by our research team. Samples were recruited using Purposive Sampling without randomization between 3 groups. Sixty samples enrolled at the first study, but there were 13 samples who dropped out in the middle of the study due to boredom, illness, and going home without further notice to the research team.

### **MATERIALS AND SPECIFIC INSTRUMENTS**

The ingredients for the tempeh-date biscuits were wheat flour, maizena, refined sugar, butter, essences or pastes of strawberries/bananas/pineapples/pandanus leaves/cocoa powder, egg yolk, tempeh flour, and date jam made by CV Tamurindo, Depok, West Java Province. Placebo biscuits were made of the same ingredients, but without the tempeh flour and date jam. The biscuits were in the form of cookies, made from soft dough, of high fat content,

crispy and less dense at the center. The instruments used in this study were Seca balances, microtoise, questionnaires, food record form, and food recall form. Mothers knowledge on nutrition were assessed using questionnaire at the pre and post intervention by trained students. Cadres distributed the biscuits to underfives' home every day in the three groups. While the research team including students supervised and monitored the samples by visiting home three times a week.

## DATA COLLECTION

**Screening of samples.** List of underfives children who met the criterion of moderate underweight were obtained from the *puskesmas* monthly report for August 2010. All of them were invited by research team to validate their nutritional status using weight and height measurement by students and cadres at *puskesmas* building.

**Formulation of tempeh-date biscuits and placebo.** Our team was assisted by two students from the Faculty of Public Health, University of Indonesia and two laboratory technicians of the Nutrition Laboratory of the above Faculty. Formulation of the biscuit composition was repeated up to 4 times from 16 September 2010 to 3 October 2010, to obtain a type of biscuit that was crispy and tasty, and attractive in form.

**Organoleptic test.** An organoleptic test to evaluate acceptance of the biscuits by the underfives and their mothers was performed in October 2010 on 17 respondents, comprising 10 mothers and 7 children aged 3-8 years from outside the study location at Mampang Village. The organoleptic test used placebo biscuits and tempeh-date jam biscuits. Of the latter there were two variations, one with a middle layer of date jam and the other made of a homogeneous mix of tempeh and date jam. Among the three types of biscuit evaluated, the most favored type of biscuit was the layered tempeh-date biscuit, with the placebo biscuit ranking second. The respondents did not like the biscuits made of a mixture of tempeh and date jam, because of their dark brown color and sour taste. Revision of the biscuits was done according to acceptance rank and suggestions from respondents for more varied flavors and forms of the biscuits, and crispier and softer texture.

**Anthropometric measurements.** Validation of underfives' nutritional status was performed through anthropometric assessment of weight and height, to obtain the most recent nutritional status. Baseline data were collected using structured interviews on the mothers of the underfives comprising demographic data (gender,

age), mothers' knowledge of nutrition, past history of disease, educational level of the mothers, and occupation and income of the parents. Data on height, weight, and food consumption (using 24-hours food recall and semi-quantitative food frequency) were also collected during the study before and after intervention.

**Efficacy study.** The study was conducted for 4 weeks from November until December 2010. Before the implementation, all mothers and cadres gathered in the *puskesmas* receiving how to give the biscuits to their children. The meeting carried out at once with the nutritional status validation. At the meeting, they informed that the biscuits could be mixed with warm plain water and or milk in the morning, daytime, and or in the night. Each underfive child received 50 grams of biscuits per day in each group within 4 weeks. Intervention group received tempeh-dates biscuit and another two control groups received tempeh biscuit and placebo biscuit respectively. Four weeks defined as time duration of study due to increased mean weight and height had appeared at the four weeks as well as their boredom consuming biscuits everyday. The difference number of biscuits in the two groups was because of the higher weight of the tempeh-date biscuits, as they consisted of a pair of tempeh biscuits with a middle layer of date jam. The biscuits were delivered weekly by the investigators themselves to the home of the cadre who was the contact person in each of the study areas. The numbers of biscuits delivered each week were changed according to the current number of recipients. Subsequently the cadres would distribute 2 bags of biscuits for two days' consumption among the underfive recipients. Compliance level of biscuit consumption was monitored by the cadres every other day at home visits, concurrently with biscuit distribution. At the home visits, the cadres used forms for recording observations on acceptance level of biscuit consumption by the underfives, the numbers of biscuits consumed and remaining, and field findings such as sick underfives or feelings of being fed-up. In addition, the mothers were required to fill in the 24-hour food recall forms during the 30 days of the study. The filling-in of the forms had been explained by the research team to all mothers at the previous socialization event. Examination of the food recall forms and conduct of field observations at the homes of the underfive biscuit recipients was also performed by our students twice weekly. Each week the mothers of the underfives returned the empty plastic wrappers to the cadres, to be ultimately collected by both the students and the research team at the time of field monitoring. Assessment of weight and height and the nutrition education of the biscuit recipients was performed weekly by our research team at the *posyandu* and the home of the involved cadre. Compliance level of biscuit consumption was confirmed by the weekly increase in

**Table 1:** Nutrient composition of each biscuits (per 100 gram)

Biscuit	Nutrient					Fe (mg)	Zn (mg)	Vit. B1 (mg)
	Energy (calorie)	Carbohydrate (gram)	Protein (gram)	Fat (mg)	NaCa (mg)			
Tempeh-date	488.60	59.11	23.12	3.3	136.36	1.26	2.08	0.27
Tempeh	500.61	38.02	24.8	15.0	33.0	0.46	1.65	0.26
Placebo	463.72	45.60	16.8	11.3	17.6			

Source: Biochemical test in Bogor Food Laboratory, 2010

**Table 2:** Mean of sociodemography and biscuits consumption for intervention and two control groups (n = 47)

Variable	Type of Group			p
	Tempeh dates (n = 13)	Tempeh (n = 18)	Placebo (n = 16)	
Age of children	31.85 ± 11.86	24.89 ± 13.65	35.94 ± 10.30	*0.035
Mothers' age	28.23 ± 6.31	34.33 ± 6.23	31.94 ± 6.55	*0.004
Biscuits consumption	35.62 ± 15.40	76.39 ± 31.34	103.03 ± 32.18	*0.001
Mothers' knowledge	13.00 ± 4.51	9.40 ± 3.50	12.90 ± 2.06	*0.006

\* significant ( $p < 0.05$ ) using independent t-test

weight and height of the underfives, and also by records on their health and acceptance level of biscuit consumption. All problems encountered in the field were recorded by the research team together with the students and the local *posyandu* cadres, to be used for improving biscuit production for the following week.

## DATA ANALYSIS

Analysis of baseline data on sociodemographic frequency distribution (gender, child's age, age of mother, educational level of mother) was performed by means of the SPSS program version 13 (SPSS Inc., Chicago, IL, USA). Independent t-test was used to analysis weight and height differences between intervention group and control group before and after study. Weight for age and weight for height differences pre-post intervention in each group analyzed with paired-t test. ANOVA used for testing difference mean gained weight inter group. Multiple regression analysis used to control confounding variables on gained weight differences in the intervention and control groups.

## RESULTS

Table 1 shows the macronutrient and micronutrient

content of both types of biscuit. Tempeh-date biscuits had the highest protein content (9.11 gram), in comparison with placebo biscuits. According to the Indonesian Recommended Daily Allowances (IRDA) for 2004, the daily energy and protein requirements of underfives are 1550 calories and 39 gram protein, respectively. From these IRDA values, the proportions of energy and protein for each 100 gram of tempeh-date biscuits are 31.5% and 23.4% of IRDA, respectively. Daily consumption of 100 gram placebo biscuits meets 29.9% of energy and 14.4% of protein requirements. Underweight children was most frequently found in the intervention group (92%) in comparison with the control group (69%). After intervention for 4 weeks there was a two-fold reduction in underweight cases in the intervention group (69%), in comparison with the control group (30.1%). Basic characteristics of the sample are presented in Table 2 and Table 3. The majority of respondents in both groups were between 24 and 59 months old, with a preponderance of males in the intervention group and of females in the control group. Most of the mothers in the intervention group were under 30 years old and had a high level of education. During the administration of the biscuits, mean energy and protein intakes of the intervention group were lower than those in the control groups. Mean increased in weight of

**Table 3:** Distribution of sex of children and mothers' education

Variable	Type of Group						p
	Tempeh dates		Tempeh		Placebo		
	n	%	n	%	n	%	
Sex:							**0.390
Male	9	69.2	10	55.6	7	43.8	
Female	4	30.8	8	44.8	9	56.2	
Mothers' education							** 0.227
Less than 15 years of schooling	4	30.8	8	44,4	10	62,5	
More than 15 years of schooling	9	69,2	10	55.6	6	37,5	

\*\* not significant ( $p > 0.05$ ) with Chi square test

**Table 4:** Mean of weight at pre and post intervention, gained weight

Variable	Placebo		Tempeh		Tempeh dates		p
Weight at pre –intervention	11.03	± 0.99	10.24	± 2.67	9.25	± 1.37	**0.052
Weight at post-intervention	11.33	± 1.04	10.55	± 2.71	10.45	± 1.32	**0.385
Gained weight	0.30	± 0.22	0.31	± 0.18	1.21	± 0.33	*0.001

^Mean ± SD

\*significant ( $p < 0.05$ ) using ANOVA test

\*\*not significant ( $p > 0.05$ ) using ANOVA test

the underfives before and after the intervention in both groups are presented in Table 4. The highest increase weight of 1.3 kg was recorded in underfives receiving tempeh-date biscuits, followed by those receiving placebo biscuits. Statistical testing demonstrated a difference in weight increase between interventions with both types of biscuit (at  $p < 0.008$  and  $p < 0.001$ , respectively). Mean nutritional status based on the weight/age indicator in the intervention (tempeh-date biscuit) group increased by 1 point after the intervention. Similarly, an increase in weight of 1 kg was found in the intervention group at the end of the study. Thus, there was a significant increase in nutritional status of the intervention group ( $p = 0.00$ ), but none in the control group at the end of the intervention ( $p = 0.054$ ). There were, however, significant weight increases with both types of biscuit (respectively at  $p = 0.008$  and  $p = 0.001$ ). Using the multiple comparison test, a significant difference in weight increase was found

between samples consuming placebo biscuits and those consuming tempeh-date biscuits (Table 4). With regard to height, each group had a significant increase in height, which was slightly higher in the control group (1.8 cm) than in the intervention group (1.5 cm) (Table 5). However, there was no significant difference in height increases between the group consuming placebo biscuits and the group consuming tempeh-date biscuits. Multiple regression analysis showed that tempeh date biscuit consumption had effect on the gained weight. However, confounding variables such as age of children, sex, mothers' knowledge on nutrition, mothers' age and education, and biscuits consumption did not affect the gained weight (Table 6).

## DISCUSSION

Acceptance of both types of biscuit at the start of the

**Table 5:** Mean of WAZ and WHZ

Variable	Placebo			Tempeh			Tempeh dates			p
WAZ at pre-intervention	-1.89	±	0.65	-1.35	±	0.77	-3.09	±	0.84	*0.001
WAZ at post-intervention	-1.69	±	0.73	-1.34	±	0.75	-2.11	±	0.70	*0.022
	***p=0.054			***p=0.943			****p=0.001			
WHZ at pre-intervention	-0.83	±	0.60	-0.26	±	0.99	-2.47	±	1.10	*0.001
WHZ at post-intervention	-0.87	±	0.59	-0.86	±	1.21	-1.20	±	0.79	**0.542
	***p=0.835			***p=0.018			****p=0.001			

^Mean ± SD

\*significant(p&lt;0.05) using independent ttest

\*\* not significant (p&gt;0.05) using independent t-test

\*\*\* not significant (p&gt;0.05) using paired t-test

\*\*\*\* not significant (p&gt;0.05) using paired t-test

**Table 6:** Effect of tempeh dates biscuits consumption after intervention

Variable	B	β	95% CI		p value
Placebo- Tempeh	-0.011	-0.011	0.205	- 0.184	0.913
Placebo – Tempeh dates	1.078	1.034	0.815	- 1.341	0.001
Age of children (month)	0.000	-0.009	0.007	- 0.006	0.921
Sex	0.059	0.063	0.092	- 0.210	0.436
Biscuit consumption	0.002	0.131	0.001	- 0.004	0.243
Mothers' age	0.006	0.085	0.006	- 0.018	0.328
Mothers education	-0.074	-0.079	0.221	- 0.074	0.317
Mothers knowledge on nutrition	-0.018	-0.143	0.041	- 0.005	0.120
Constanta	0.181		0.409	- 0.770	0.539

study was relatively good, as indicated by the preference of the underfives for the biscuits as a breakfast substitute, with the addition of hot water or hot milk and/or to be consumed as a snack during play. It is important to adapt food supplements to the preferences of the recipients, since the development of food supplements is concerned with both biological values and a consideration of the dietary habits of the local community (Indonesian Ministry of Health, 2004). To evaluate the nutritional adequacy of

underfives, in this study 24-hour food recall was performed weekly on 3 non-consecutive days, for 4 weeks. Several studies showed that a minimum of two 24-hour recalls was capable of yielding an optimal picture of the nutritional intake and a larger variation in daily intakes in underfives (Soenaryo E., 2004). The present study has two limitations, one being that the study results cannot be generalized to underfives with severe underweight status or those with mild underweight status

and concomitant infections such as tuberculosis. Infectious disease may impair absorption and metabolism of nutrients, resulting in reduced appetite and converting mild underweight status into severe underweight status (Supariasa, 2002). The second limitation is that the intervention was conducted for 4 weeks only, whereas some interventions may be more effective if administered for a longer period. Energy and protein intakes in the placebo biscuit group were higher compared with the tempeh-date biscuit group, because the majority of the sample preferred the placebo biscuits with their more attractive flavor without the unpleasant odor of tempeh flour. The level of compliance in consuming tempeh-date biscuits was lower (38.5%) than that in consuming placebo biscuits (50%). At the end of the study, in the control group receiving placebo biscuits, 3 underfives were found with weight loss. One of the three underfives had just recovered from diarrhea contracted 3 days previously and did not want to consume more than a few biscuits. Another underfive child was ill during the previous week and refused to consume any biscuits at all. In the placebo biscuit control group, one underfive dropped out after participating for 2 weeks, as this child did not want to consume the placebo biscuits because they were too hard and the child was fed-up. The change in weight showed a significant difference between the intervention group and the control group. One possible influencing factor is the increased energy intake during the conduct of the study, that also occurred in the intervention group. In addition, tempeh may increase body weight if given in underfives with severe underweight status (Sjahmien, 2003). The increase in weight and height in the intervention group of our study was in agreement with two studies. First study about the effect of tempeh biscuits consumption on the anemic children in Surakarta (Kurnia et al, 2010) showed that mean weight of intervention group increased 0.6 kg in the 3 months of study. Second study, The Indian intervention study using high protein biscuits, conducted on underfives with mild underweight status in 1972. There was a mean weight increase of 1.2 kg and a mean increase in height of 6.2 cm in the intervention group, with corresponding values of 4 kg and 5.2 cm in the control group. However, there was no mention of the duration of the intervention and the sample size (Gsianturi, 2003). A similar type of study on 40 underfives in 4 groups also found increases in weight and height after administration of potato biscuits, corn biscuits, and mung bean biscuits for 3 months. Underfives in the intervention group receiving potato biscuits had the greatest increase in body weight and height, with mean values of 1.8 kg and 2.16 cm, respectively. The next in ranking were underfives receiving mung bean biscuits, with mean values of 1.05 kg and 2 cm, while the lowest ranking were underfives

receiving corn biscuits, with mean values of .8 kg and 1.82 cm (Nazni P., Subramaniam A., Subramaniam P., 2009). From these two intervention studies it may be concluded that administration of high-calorie and high-protein biscuits may increase weight and height of underfives. However, the results of the present study using tempeh-date biscuits are in contrast with an intervention study using fish floss (*abon ikan*) in underfives with mild underweight status for 3 weeks in the Pangkep Residency, South Sulawesi. The results of the latter study indicated that there was no change in nutritional status of the underfives post-intervention. The differing results may have been caused by a difference in the daily energy and protein intakes of the underfives, since tempeh-date biscuits have a higher energy and protein content than does fish floss (Suriani R., 2007). Our study results demonstrated that the largest increase in weight occurred in the tempeh-date biscuit group. This may have been caused by the high energy, fat, and protein content of the tempeh-date biscuits (Table 1). One hundred gram of dried dates contains 300 calories, while 100 gram of fresh dates contains 160 calories. Dates are capable of increasing the weight of underfives and older children (Khuzaim, 2010). The fresh and dried fruits also contain glucose, fructose, and sucrose, which are readily absorbed by the body. Tempeh-date biscuits may have increased the weight of the underfives in the intervention group, because of the high glucose and fructose content of dates, which are directly digested by the body and converted into energy. Tempeh-date biscuits as supplementary food are effective in increasing the nutritional status (based on weight/age) and actual weight of underfives. Brief, dates contributed to increase weight due to high glucose contents. This result is inconsistent with the result of a study in Indramayu indicated there was no association between supplementary feeding and nutritional status of underfives (Agustine, 2010). Another study which in line with our study was in underweight children Malawi. The study found that supplementary feeding significantly increased weight of underfives, but not height (Phuka et al, 2009). Our study did not succeed in demonstrating an effect of tempeh-date biscuit consumption on height, both in the intervention group as well as the control group. This finding is consistent with the second study in Malawi on 61 underfives with mild underweight status and short stature who received maize and soy flours within 12 weeks. There was an increase in weight in the intervention and control groups, but not height. There were length rapid growth from infancy to age 2 (about 14 inches per year). Then slowing, from age 2 to puberty, steady growth at about 2½ inches or equal to 6.125 cm per year. Rapid increase height could be not obtained within 4 weeks, except in the six months or one year (Shmerling 2012). The results of this efficacy study

demonstrated that consumption of tempeh-date biscuits may increase the weight of underfives with moderate underweight status even with an administration of 4 weeks only. This intervention study may be extended with weight for age (W/H) and or height for age (H/A) indicators, and similar types of studies may be performed on underfives with tuberculosis, on pregnant mothers, and on older persons at risk of chronic energy imbalance, for a period of 8 weeks. Tempeh-date biscuits may be recommended to the Depok Municipal Health Service as a food in the supplementary feeding program, and possibly also for underfives with severe underweight status, with a larger variation in form, taste, flavor, and color, and of more crispy texture. It is hoped that biscuit manufacturers will produce tempeh-date biscuits with an even more attractive appearance and wrapping, such as chocolate-coated tempeh-date biscuits packaged in attractive plastic wrappings, for sale in small shops, school canteens, or small supermarkets in Depok as highly nutritious snacks for underfives, or in supplementary feeding programs for underfives at *posyandus*. One of the constraints encountered in the field during the conduct of this study was the limited time and the number of personnel required to monitor the implementation of the intervention, as the study was conducted at two substantially distant locations and not centralized at one location. Other constraints were that during the intervention many children became fed-up, because they had to consume biscuits every day, although they liked the taste, flavor and form of the biscuits, while the mothers were poorly motivated to encourage their children to consume the biscuits, and also because of the poor motivation and commitment of the *posyandu* cadres in the intervention group to conduct home visits for monitoring the compliance of biscuit consumption by the underfives. Acceptance of the types of biscuit by the underfives as study subjects at the start of the study was extremely favorable. Field observations indicated that the underfives consumed the biscuits as a breakfast replacement with the addition of hot water or hot milk and/or as snacks during play. The development of a food supplement adapted to the dietary habits of children is important, as it is associated with their preferences. As stated by Soenaryo (2004), the development of food supplements is concerned with both biological values and a consideration of the dietary habits of the local community. Biscuits are light snacks commonly consumed between meals and do not induce satiety. To evaluate the nutritional adequacy of underfives, in this study 24-hour food recall was performed weekly on 3 non-consecutive days, for 4 weeks. Several studies showed that a minimum of two 24-hour recalls was capable of yielding an optimal picture of the nutritional intake and a larger variation in daily intakes in underfives (Soenaryo E., 2004). In conclusions,

mean increase in weight in the tempeh-date biscuit group was higher than that in the group receiving placebo biscuits, presumably because of the higher level of compliance in consuming the tempeh-date biscuits and the lower numbers of children who were ill in the tempeh-date biscuit group during the study. There were differences between weight increases in the tempeh-date biscuit group and placebo biscuit group, but there was no difference in increases in height between the tempeh-date biscuit group and placebo biscuit group. Tempeh-date biscuits can be recommended to Depok District Health Office as an alternative food for moderate underweight children supplementary feeding program, but not for severe underweight children.

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#### Data collection (baseline)

Validation of underweight underfives using anthropometric reassessment & Z score calculation (n = 60)

#### Intervention study

Collection of food records from

Intervention group (n=13)

Control group 1 underfives' mothers (n=18)

Control group 2 (n=16)

#### Students Anthropometric assessment

(day 30)

Cadres

(Daily)

(Twice weekly)

Anthropometric assessment (day 30)