

# Functional biscuit, a supplementary food in accelerating the improvement of body weight among undernourished under-five children

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## INTRODUCTION

- Protein Energy Malnutrition (PEM) is not a new problem, yet still actual in Indonesia.
- PEM can be caused by inadequate dietary intake, ill health (infection disease because of low immunity), or both. According to Roux et al (2003), amino acid deficiency is important factors which contribute to PEM.
- PEM is also a major contributing factor facilitating infection in malnourished young children. PEM may increase atrophy of mucosa, abnormal development of mucin, involution of thymus and weak secretion of sIgA (Sullivan et al 1993).
- Until recently, the existing supplementary food for PEM only considers macro-nutrient content of the food, without considering functional component.
- According to Hasler (2001), beside have potential content of convention nutrition (energy, protein, etc), functional food also have function on immunity stimulation. Supplementation of probiotic *Enterococcus faecium* IS-27526 in low fat milk for 3 months may increase mucosa immune system (Koestomo 2004). They play a vital symbiotic in digestion, adhere to intestinal wall and enhance immunological function (Fuller & Perdigon 2003).
- Amino Acid is a component that have physiological function (BPOM, 2005), and can be found in several foods, mainly on soy and fish. Soy is the main common plant source protein for Indonesian (Harijono et al 2000), and fish is animal protein which also frequently consumed by the community (BKP & Unair, 2006). Clarias fish contains complete amino acid and becomes a potential commodity of aquaculture (Adawiyah, 2007).
- Conventional biscuits which high in fat and sugar and are associated to unhealthy diet can be modified as a functional product ( Boobier et al. 2006)
- Functional biscuits (combination of high protein quality and probiotics) as supplementary food, support nutritional intake (including amino acid) and may increase immunity, and therefore have potential to accelerate the increment of body weight among undernourished under-five children who are at high risk of infection disease.

## OBJECTIVE

This human intervention study was done to know the effect of 90 days supplementation of functional fish and soy protein isolate biscuit with cream containing probiotic *E. faecium* IS-

27526 at a dose of  $10^8$  cfu/day on the body weight of undernourished under-five children in Sukabumi District, West Java.

## **MATERIALS AND METHOD**

### **Design**

The study was a pre-post Randomized Double Blind Placebo Controlled Trial.

### **Location**

The study was done in 4 areas under responsibility of 4 Public Health Centers (PHCs) in Sukabumi District, West Java (Cikakak, Bantar Gadung, Warungkiara and Kedudampit)

### **Subject and materials**

**Subject.** The subject this study were 90 undernourished under-five children with WAZ  $< -2$  SD, which were divided into 5 groups of treatment (18 children in each group). At the final phase, 7 subjects were dropped out from the study.

**Product.** The Biscuits ingredients were fish flour *Clarias sp (lele dumbo)*, isolate of soy protein, wheat flour, chicken eggs, butter, margarine, sugar, and other additional ingredients. Cream containing microencapsulated probiotic *Enterococcus faecium IS 27526* at a dose of  $10^8$  cfu/day was added to the biscuits.

**Treatment.** Fifty (50) grams per day of functional biscuits were served to the children for 90 days. The groups of treatment were: P0 = control biscuit with control cream; P1 = fish and soy protein isolate biscuit with control cream; P2 = control biscuit with probiotic cream ; P3 = fish and soy protein isolate biscuit with probiotic cream (everyday) and P4 = fish and soy protein isolate biscuit with probiotic cream (every two days). The body weight of the subjects were measured at the beginning of the intervention, at the end of the first, second, and third month of intervention.

### **Data Analysis**

Paired T test, One-way Anova, and LSD test were used to analyze parameters of body weight and nutritional status in and between of treatment groups (before and after intervention).

### **Ethical consideration.**

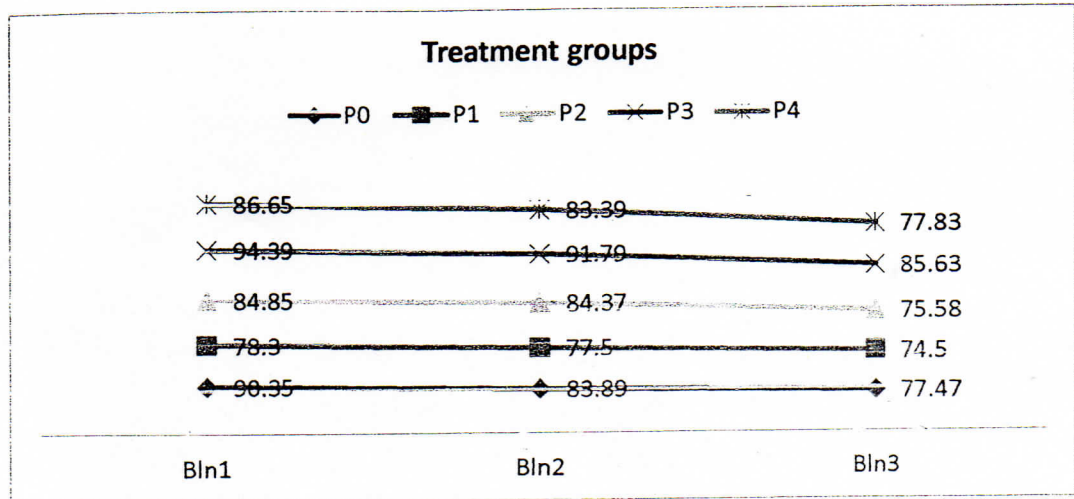
Ethical approval was obtained from Research and Development Board, Indonesian Ministry of Health

## **RESULTS**

### **1. Adherence to the consumption of functional biscuits**

The adherence level to the intervention (90 days or 3 month) was quite high on all treatment groups (P0, P1,P2,P3,P4), which ranged from 76,6% to 90,35%. Paired t-test analysis showed no significant difference ( $p > 0.05$ ) of adherence level before and after the intervention.





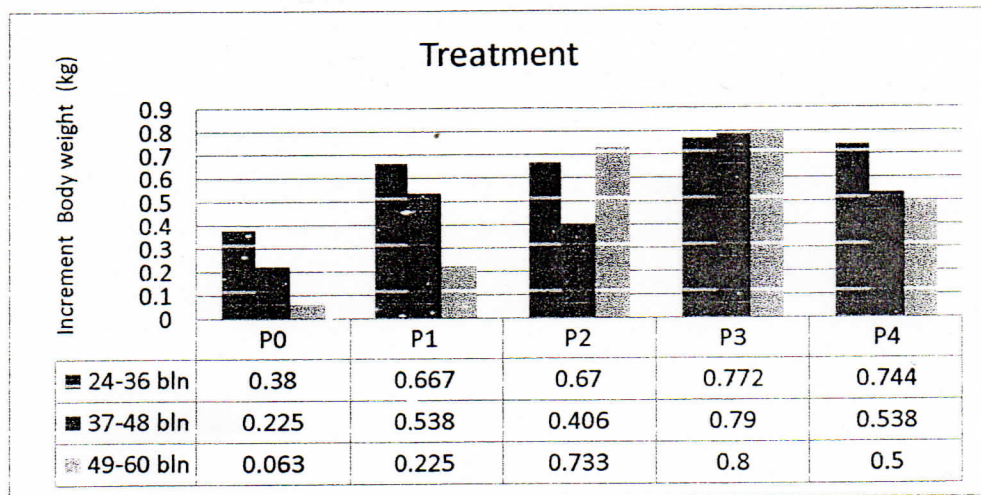
Picture 1. Adherence level to the consumption of functional biscuit before and after intervention

**2. Safety aspect of the functional biscuit**

No adverse effect on the under-five undernourished children was observed during 90 days of supplementation using functional biscuit (fish and soy protein isolate biscuit with cream containing probiotic *E. faecium* IS-27526 at a dose of  $10^8$  cfu/day).

**3. Increment of body weight among age groups**

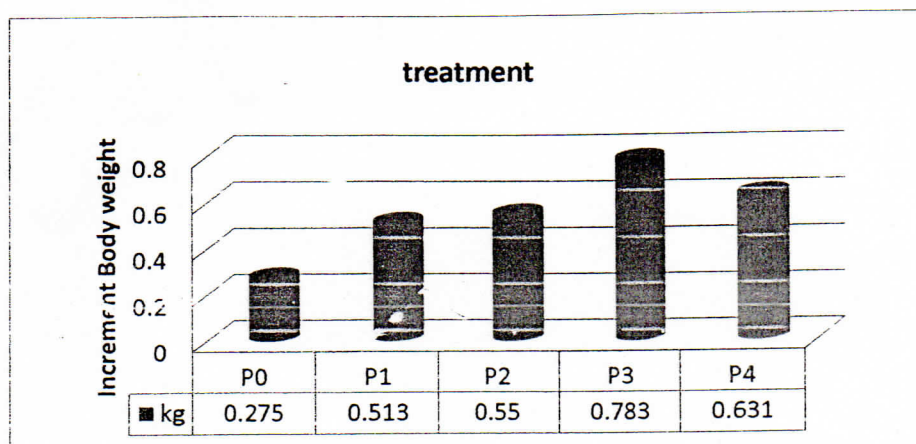
When the data on the increment of body weight were analyzed separately on 3 age groups, the results showed that the increment of body weight occurred in all age groups, not only in certain age group, which indicate that age did not influence the increment of body weight.



Picture 2. Increment Body weight according age and treatment

#### 4. Increment of body weight among treatment groups

The highest increment of body weight was observed in group P3 (0.783 kg), followed by P4 (0.631 kg), P2 (0.550 kg), and P0 (0.275 kg), respectively.



Picture 3. Increment of body weight among treatment groups

#### 5. Delta increment of body weight among treatment groups

The result of Anova test showed that after 90 days of supplementation, delta body weight of group P2, P3 and P4 were significantly higher than the control group (P0) ( $p < 0.01$ ).

Table 1 Delta increment of body weight among treatment groups

Increment Body weight (kg)	Treatment Groups				
	P0 (n=18)	P1 (n=15)	P2 (n=16)	P3 (n=18)	P4 (n=16)
Month 1	0.025 ± 0.36	0.457 ± 0.32	0.234 ± 0.49	0.386 ± 0.52	0.122 ± 0.49
Month 2	0.228 ± 0.54	0.093 ± 0.38	0.003 ± 0.42	0.042 ± 0.35	0.237 ± 0.40
Month 3	0.022 ± 0.39	-0.037 ± 0.28	0.313 ± 0.38	0.356 ± 0.35	0.272 ± 0.38
Month 0-3	0.275 ± 0.29	0.513 ± 0.46	0.550 ± 0.46*	0.783 ± 0.40**	0.631 ± 0.35*

Note: \* different significantly with P0 \*\* very different significantly with P0

#### CONCLUSION

As a conclusion, supplementation of functional biscuit is safe for young children and significantly accelerates the improvement of body weight. In addition, supplementation of control biscuit with probiotic cream as well as supplementation of fish and soy protein isolates biscuit with probiotic cream every two days were also significant in improving body weight of under-five children

#### RECOMENDATION

Functional biscuits (made from fish and soy protein isolate biscuit with probiotic *Enterococcus faecium* IS 27526 cream) can be used as a supplementary food for undernourished under-five children to accelerate the improvement of body weight.