DOI : 10.2473/amnt.v1i1.2017.31-37

RESEARCH STUDY Open Access

Suplementasi Biskuit Bekicot Selama 30 Hari Meningkatkan Tinggi Badan Menurut Umur (TB/U) pada Balita Gizi Kurang di Kawasan Kumuh Surabaya

Thirty Days Snail Biscuit Supplementation Improved Height-for-age Z-score (HAZ) of Malnourished Children in Slum Surabaya

Trias Mahmudiono*[1], Zeni Firginingtyas[1], Qonita Rachmah[1]

ABSTRAK

Latar belakang: Malnutrisi masih menjadi masalah gizi utama yang dialami di Indonesia. Dinas Kesehatan Kota Surabaya pada tahun 2009 melaporkan sebesar 1,888 (1.39%) dari 136,155 balita mengalami gizi buruk. Penyebab gizi buruk terdiri dari faktor langsung dan tidak langsung, dimana faktor langsung terdiri dari penyakit infeksi dan asupan makanan. Salah satu alternatif yang dapat digunakan adalah penggunaan tepung bekicot sebagai makanan pendamping. Bekicot diketahui sebagai salah satu sumber protein dengan kandungan asam amino esensial yang lengkap.
Tujuan: Penelitian ini bertujuan untuk mengetahui efek pemberian biskuit bekicot (*Achatina fulica*) pada perbaikan *z-score* berat badan menurut usia dan tinggi badan menurut usia balita gizi buruk di Kelurahan Ujung, Surabaya.
Metode: Penelitian ini menggunakan desain studi eksperimental dengan pembagian dua kelompok; kelompok intervensi yang diberikan biskuit bekicot selama 30 hari dan kelompok kontrol yang diberikan biskuit kelapa dalam jangka waktu yang sama. Uji statistik yang digunakan yaitu *paired t-test*.
Hasil: Hasil analisis menunjukkan tidak ada efek pemberian biskuit bekicot selama satu bulan pada indeks status gizi berat badan menurut umur (BB/U) (*p-value*>0,05). Namun, intervensi pemberian biskuit bekicot secara statistik mempengaruhi perbaikan status gizi tinggi badan menurut usia (TB/U) pada balita gizi buruk, sedangkan biskuit kelapa tidak mempengaruhi TB/U balita gizi buruk (*p-value*=0,84). Kekuatan pengaruh intervensi berdasarkan perhitungan Exp(B)=1,02, artinya bahwa balita gizi buruk yang mengonsumsi biskuit bekicot memiliki 1,02 kali perbaikan yang lebih baik pada status gizi TB/U dibandingkan balita yang mengonsumsi biskuit kelapa.
Kesimpulan: Dapat disimpulkan bahwa biskuit bekicot dapat menjadi alternatif perbaikan status gizi balita gizi buruk. Penelitian selanjutnya disarankan dapat memperpanjang durasi intervensi hingga 90 hari seperti anjuran pemerintah dalam pemberian makan tambahan.

Kata kunci: Indeks tinggi badan menurut usia (HAZ), gizi buruk, biskuit bekicot

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37

DOI : 10.2473/amnt.v1i1.2017.31-37

ABSTRACT

Background: Indonesia is now still suffering from malnutrition. It was reported that at least 1.39% out of 136,155 children under-five in Surabaya were severely. Severe malnutrition caused by direct factors including infectious diseases and food intake. Therefore, an alternative to overcome that problem is crucial, such as using snail flour for a weaning food. Snail is known as one of the good protein source with complete essential amino acid.
Objective: This research aims to determine the effect of snail biscuit (*Achatina fulica)* toward z-*score* improvement in severely malnourished children under five according weight for age and height for age index in Ujung sub-district, Surabaya.
Methods: This was an experimental research which divided into two groups; case group that given snail biscuit for a month and control group that given coconut biscuit in a same time period. *Paired t-test* was done to analyze the different between before and after treatment.
Results: The result showed that there was no effect of snail biscuit to weight-for-age *z-score* (WAZ) improvement in children under five (*p-value*>0.05). However, a month snail biscuit intervention improved height-for-age *z-score* (HAZ) in children under five (*p-value*=0.02); while the control group did not show significant result (*p-value*=0.84). The strength of intervention shown by Exp(B) value=1.02 means that children under five who consume snail biscuit for a month had 1.02 higher height-for-age *z-score* improvement compared to those who consumed coconut biscuit.
Conclusion: It can be concluded that snail biscuit give better improvement of nutritional status based on height-for-age *z-score* compared to coconut biscuit in malnourished children under five. It is suggested for the intervention study to expand intervention period to 90 days similar to government supplementary feeding intervention.

Keywords: *height for age index, severe malnutrition, snail biscuit*

*Koresponden: *trias-m@fkm.unair.ac.id*
[1,]Departemen Gizi Kesehatan, Fakultas Kesehatan Masyarakat, Universitas Airlangga, Surabaya
Jl. Mulyorejo Kampus C Surabaya 60115

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37

INTRODUCTION

The goal for Indonesia's national development is to increase human resource capacity in the continuous scheme[1]. Effort to increase the quality of human resources was begun from inception until such individuals reach young adult with focus on their development. The group age of 0 to 59 months is very prone to malnutrition with critical development period on the age of 6 to 23 months. Therefore, nutrition intervention towards malnourished children in the above mention age group should be taking seriously in order to prevent *growth failure*[2]. According to UNICEF, fetal development and child development is an important factor that determines future growth and development of individuals, including cognitive and physical deveopment[3]. Children with good growth and development will become a strong and smart generation. Nutrition intake is the major step to achieve these goals.

In Indonesia, the prevalence of severe malnutrition is still relatively high and showing an increasing trend[4,5,6]. Based on the data from Indonesian Ministry of Health in 2005, among 241,973,879 Indonesian citizens, nearly 14.5 million suffer from severe malnutrition[4]. According to research carried out by Surabaya District Health Office in 2008, there were 1.39% of under-five years old children that severely malnourished and 7.02% were malnourished[7]. High prevalence of malnutrition was also observed in Ujung district, one of slum area in Surabaya. Based on Indonesia Basic Health Research, the prevalence of severe malnutrition was 5.4% in 2007, 4.9% in 2010, and 5.7% in 2013[5,6].

Most of world children (80%) that suffer from malnutrition also live in area that has limited nutritious food especially in micronutrient content[8]. However, this case was not true for Indonesian setting that possesses abundance of nutritious food. Therefore, develop an alternative food based on local food to overcome the problem of severe malnutrition among children under five is needed. One of the alternatives is through powder based food, such as snail powder. Snail species of *Achatina fulica* was enter Indonesia back in 1942 during Japanese colonization[9]. Snail is a good source of protein because it contains complete essential amino acid[9.]

Kediri District is well known for its community that keen on eat and develop snail as food product[9], hence, snail for this research was taken from that particular district. The composition for trial of developing snail biscuit were addition of snail powder in the percentage of 12%, 15%, 17% and 20%[10]. The result of organoleptic test showed that addition of 15% snail biscuit was the most accepted formula for snail biscuit based on measurement of texture, color, taste and aroma score[10]. Based on the result of trial and preliminary research, the acceptance of snail biscuit was good and there also good social acceptance regarding the halal or haram among the targeted population, hence reduce *conflict of interest*[11].

According to the above mention data, this research aims to analyze the impact of snail biscuit intervention to improve the nutritional status of severely malnourished children in slum area of Ujung village, Semampir sub-district, Surabaya.

METHOD

This was a quasi-experimental research with pre-post control group design done in Ujung village, Semampir sub-district. The group classified as the intervention group and the control group. Intervention group was given snail biscuit while the control was given coconut biscuit that already available in the market. Treatment was done in 30 days. Each group was measured for its variables consist of age, weight, height, weight for age, and height for age index in before and after treatment[1].

The total numbers of children under-five were 1,997 children in 2008 with nutritional status from normal to severely malnourished, then sample collected was severely malnourished children under-five that have been screened and eligible for inclusion criteria. Children were drawn from group of households so called *Rukun Warga* (RW) 11, 13, and 14 in Ujung village and

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37

registered in *posyandu* (monthly growth monitoring group) from July to October 2009. The inclusion criteria were: 1) children aged 12 to 60 months, 2) no physical impairment or other physiological condition and not having serious disease proven by doctor's diagnosis 3) having informed consent from the parent. The number of sample was 40 children that randomly taken from the total population of 45 severely malnourished children. The sample was then allocated to two groups resulting 20 children to be followed up from each group.

RESULTS AND DISCUSION

Characteristics of Children Under-five

Sample in this research were severely malnourished children with height for age of <-3SD and aged 12 to 60 months. Most of children in the intervention group as well as the control group were aged between 2 years and below 3 years (47.5%). Severely malnourished children in the intervention group were 40% male while in the control group were accounted only 45% for male. Hence, the majority of sample in both intervention and control group were female.

Table 1 describes the distribution of children under-five pre-treatment weight during the screening phase. Either group has the majority weight of ≤ 8.5 kg accounted for 12 children (60%). While the height of children were mostly 71.1-90.0 cm, accounted for 60% in the intervention group and 75% in the control group. Table 2 describes the distribution of weight for age index among children under-five during the *screening.* In the intervention group, children with weight for age index < -3SD to -4 SD were 55% and in control group were 95%. In the intervention group, children with weight for age index < -4 SD were higher (25%) compare to the control group (5%).

Table 3 was the result of *Nutrisurvey* 2007 calculation for each piece of the biscuit. It is assumed that children under-five will have and intake of 684 kcal energy and 1.553 mg *zinc* per day from snail biscuit intervention while the control group will receive 660 kcal energy and 0.756 mg *zinc* from coconut biscuit. After production of the biscuit, both biscuit than tested their protein and carbohydrate content in Surabaya Main Health Laboratory or so called *Balai Besar Laboratorium Kesehatan* (BBLK) Surabaya with result can be found in Table 4. Result in Table 4 was tested per 100 gram biscuit. The protein content of snail biscuit is almost double than in coconut biscuit while the carbohydrate content was slightly higher in coconut biscuit.

The Impact of Snail Biscuit Intervention to Improve Severely Malnourished Under-five Children's Weight for age and Height for age *Z-Score*

Intervention to severely malnourished children was done for 30 days, weight for age *Z-score* was then measured to examine the increase or decrease result. To assess the impact of snail biscuit intervention, compared to control that given coconut biscuit, paired t-test was carried out. There was no significant impact of snail biscuit intervention to the improvement of weight-for-age z-score relatively compare to the coconut biscuit group (p-value=0.10). Height for age index is a better measure for past nutritional status. Our study showed the significance effect of 30 days snail biscuit intervention to the improvement of height-for-age *z-score* for severely malnourished under-five children (p-value=0.02). The strength of the impact was measured by the value of Exp(B) which accounted for 1.02. It means that children who consume 30 days intervention of snail biscuit will undergo an improvement of their height for age *z-score* 1.02 higher than those who did not consume snail biscuit.

Children aged under-five is prone to malnutrition because of their increase activity to explore new things. Other causes of malnutrition are improper food caregiver and diseases, mostly infection. Children aged 6 to 60 months need adequate intake of nutrient from food as they pass exclusive breastfeeding period[1]. If the requirement of nutrient was not adequately met, the body will use the reserve in the body. If this condition continues, some tissue or organ may change from its normal condition. According to Soeditama, under-five children are at the

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37

higher risk for protein energy malnutrition (PEM) and that is a critical period for human development[12]. This was the reason why sample in this research was under-five years' old children who are prone to severe malnutrition. Height for age index was used to assess past nutritional status[13].

Thirty days intervention was carried out for severely malnourished under-five children with weight for age < -3 SD. *Z-score* measurement was done in pre and post intervention to examine the impact of intervention. *Paired t-test* was used to determine the difference of snail biscuit intervention impact. Even though there was a better increase in the mean of weight gain, there was no significant improvement of weight for age *z-score* for either intervention and control group. It was previously stated that weight is one of parameter to describe body mass[14]. Body mass is sensitive to immediate change such as infectious disease, decrease of food appetite, or inadequate food intake[14].

The improvement of height for age *z-score* also measured using paired t-test. The result showed a significant increase in the intervention group. There was a significant improvement in the height for age *z-score* when severely malnourished under-five children were given 30 days snail biscuit intervention. Such improvement was not observed for those who were given coconut biscuit in the control group. The strength of impact was accounted for 1.019 times higher increase in height for age for those who consume 30 days snail biscuit intervention compare to those who did not consume it. Body height is influence by several nutrients, in this research; snail biscuit has higher zinc content. The result showed that under-five children's intake toward calorie, protein, and zinc in the intervention group were higher compare to the control. Zinc content in snail biscuit intervention was 1.553 mg higher than its content in coconut biscuit (0.756 mg). The proportion of zinc intake from snail biscuit in overall intervention group food intake was 36.204%. It was stated that body height of children is not easily increase[14], however, children's growth and height could increase faster by giving diet therapy or nutritional supplement[15].

Zinc usually found in the brain and is bounding with protein[15]. Zinc is an essential micronutrient that promotes human growth[16]. Zinc supplementation also correlated with the increase of appetite[17]. Several food rich in ascorbic acid (papaya, guava, mango, orange, apple, and pineapple), amino acid (lamb, pork, liver, chicken and fish), and also fermented product (ketchup) will increase zinc absorbtion[15]. In the intervention group, most of children ate banana and orange daily while in control group the majority of children never consume orange. Hence, the absorption of zinc from daily food as well as snail biscuit was assumed to be higher in intervention group compared to control group although serum zinc examination was not observed. Thus, serum zinc concentration need to be acknowledge for the future research to confirm the effect of zinc itself.

On the other hand, there are nutrient that inhibit zinc absorption such as phythate (rice, peanut and grain products)[10,] polyphenol (tea, coffee, spinach), calcium and phosphate (milk and cheese)[15]. This research showed that the consumption of milk formula in intervention group and control group was different. The frequency of milk formula consumption was higher in intervention group compared to control group. Consequently, the absorption of zinc in the intervention group is believed to be inhibited by the higher consumption of milk formula. According to literature review, even though milk formula inhibits zinc absorption, milk is a good source of protein[18]. While tea consumption that also inhibit zinc consumption[15] was higher in control group.

From this research, it is noted that not only higher nutrition content of snail biscuit that resulted in height-for-age *z-score* improvement among severely malnourished under-five children but also intake of food that have higher enhancing factor of zinc absorption. A meta-analysis study from 66 trials regarding zinc supplementation showed significant linear growth improvement in children up to 5 years and combat stunting problem[19].

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37

CONCLUSION

This research concluded that the effect of 30 days snail biscuit intervention was better than coconut biscuit intervention in improving height for age *z-score* in severe malnourished under-five children. For future research, it is suggested to conduct a longer duration of the intervention, up to 90 days based on government supplementary feeding program. Longer duration of intervention might give a better results and understanding related snail biscuit intervention.

ACKNOWLEDGEMENT

The authors would like to thank to all of the Children under-five mothers in Ujung sub-district of Semampir Surabaya who have participated in this research.

REFERENCES

1. Dinkes Purworejo, 2009. *Penanggulangan Gizi Buruk*. http://www.dinkespurworejo.go.id/index2.php?option=com_content&do_pdf=1&id=4 (Citation 12 January 2010).
2. Sujana, I. W, W. Bambang, dan Kuntoro, 2009. Efek Pemberian Entrasol dan Biskuit MP-ASI terhadap Peningkatan Berat Badan dan Panjang Badan Balita Gizi Kurang. *The Indonesian journal of Public Health.* Surabaya : Fakultas Kesehatan Masyarakat Universitas Airlangga
3. UNICEF Indonesia. 2012. Ringkasan kajian gizi Ibu dan Anak. https://www.unicef.org/indonesia/id/A6_-_B_Ringkasan_Kajian_Gizi.pdf (Citation 23 January 2017).
4. Wigati, T. R., 2009. Fenomena Gizi Buruk pada Keluarga dengan Status Ekonomi Baik Sebuah Studi Tentang Negative Deviance di Indonesia. The Indonesian Journal of Public Health. Surabaya : Fakultas Kesehatan Masyarakat Universitas Airlangga
5. Department of Health Republic of Indonesia. 2011. Riset Kesehatan Dasar 2010. Jakarta: Department of Health Republic of Indonesia.
6. Department of Health Republic of Indonesia. 2014. Riset Kesehatan Dasar 2013. Jakarta: Department of Health Republic of Indonesia.
7. Dinkes Kota Surabaya, 2008. *Efektifkan Pendampingan, Rangkul Berbagai Pihak.* http://www.surabaya-ehealth.org/dkksurabaya/berita/kiat-dinkes-kota-surabaya-atasi-gizi-buruk (Citation 19 December 2009)
8. Arisman, 2010. *Gizi Dalam Daur Kehidupan Edisi 2*. Jakarta : EGC
9. Prihatman, K., 2000. *Budidaya bekicot* (*Achanita spp.*). http://www.ristek.go.id (Citation 18 January 2009).
10. Mahmudiono, T., T. S. Nindya, dan S. R. Nadhiroh, 2009. Efektivitas dan Daya Terima Biskuit Bekicot untuk Mengatasi Balita Gizi Buruk dan Gizi Kurang. *Penelitian Strategis Nasional*. Surabaya ; Fakultas Kesehatan masyarakat, Universitas Airlangga
11. Mirzawati, I., 2008. Hubungan Antara Pola Makan dan Status Gizi Anak Balita di Desa Bulaksari Kecamatan Sragi kabupaten Pekalongan. *Skripsi*. Universitas Muhammadiyah Surakarta. http://etd.eprints.ums.ac.id/4039/1/J500040038.pdf (Citation 24 January 2010).
12. Sediaoetama, A. D., 2008. *Ilmu Gizi untuk Mahasiswa dan Profesi Jilid I.* Jakarta : Dian Rakyat
13. Soegianto, B., W. Djoko, dan Jawawi, 2007. *Penilaian Status Gizi dan Baku Antropometri WHO-NCHS*. Surabaya : Duta Prima Airlangga
14. Supariasa, I. D. N., B. Bakri, dan I. Fajar, 2002. *Penilaian Status Gizi*. Jakarta : EGC
15. Nasution, E., 2004. *Efek Suplementasi Zinc dan Besi pada Pertumbuhan Anak.* http://library.usu.ac.id/download/fkm/fk

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37

m-ernawati.pdf. (Citation 01 June 2010)

16. Dickinson, N., G. Marcpherson, A. S. Hursthouse, dan J. Atkinson, 2008. *Micronutrient Deficiencies in Maternity and Child Health: a Review of Environmental and Social Context and Implication for Malawi*.http://www.springerlink.com/content/y185303616171112/fulltext.pdf (Citation 16 June 2010).
17. Gegios, A., R. Amthor, B. M. Dixon, C. Egesi, S. Mallowa, R. Nungo, S. Gichuki, A. Mbanaso, dan M. J. Manary, 2010. *Children Consuming Cassava as a Staple Food are at Risk for Inadequate Zinc, Iron, and Vitamin A Intake. 4.* http://www.springerlink.com/content/j410361504732217/fulltext.pdf (Citation 15 June 2010).
18. Almatsier, S., 2003. *Prinsip Dasar Ilmu Gizi*. Jakarta : Gramedia Pustaka Utama
19. Pimpin L, Liu E, Shulkin M, Duggan C, Fawzi W, Mozaffarian D. The Effect of Zinc Supplementation during Pregnancy and Youth on Child Growth up to 5 Years: A Systematic Review and Meta-Analysis. The FASEB Journal. 2016 Apr 1;30(1 Supplement):671-7.

Received 10-2-2017, Accepted 14-7-2017, Published online: 21-7-2017.
doi: 10.20473/amnt.v1i1.2017.31-37