Journal of Nutraceuticals and Herbal Medicine

Journal Homepage: http://journals.ums.ac.id/index.php/jnhm

The Influence of Zinc (Zn) Intake with Stunting Toddlers in Surakarta

Artia Happy Aprilitasari[1], Muwakhidah[2]

1. Nutrition Department, Faculty of Health Science, Universitas Muhammadiyah Surakarta
Surakarta, Central Java, Indonesia
artiahappyap@gmail.com
1. Nutrition Department, Faculty of Health Science, Universitas Muhammadiyah Surakarta
Surakarta, Central Java, Indonesia
muw151@ums.ac.id

Abstract

Stunted growth of toddlers is caused by the disturbance in the content, lack of micronutrients, less energy intake, and infectious diseases that are caused by stunting in children aged under five years old. Preliminary study results were conducted in the city of Surakarta the highest stunting prevalence in the work area Puskesmas Penumping. Based on data of weighing results in February 2016, the highest prevalence was in Kelurahan Panularan with very short children aged 12-36 months old as many as 22 (12.71%) toddlers and short toddlers as many as 29 (16.76%) toddlers. The purpose of this research is to know the intake of zinc and calcium in stunting toddlers in Surakarta City. The results of this quantitative study using a cross-sectional approach with the number of respondents 71 toddlers obtained by proportional random sampling technique. The data of food intake was obtained through 24-hour recall interviews for three consecutive days and nutritional status data was obtained from measurement of height and weighing children. Data analysis using Independent T-Test. From the result of research known that zinc (Zn) toddler stunting and non-stunting averaging 181,43 ± 197. According to the results of a bivariate analysis, there was no difference in zinc intake with stunting and non-stunting events in children aged 12-36 months (p = 0.223).

***Keywords**:* Zinc, Stunting, Toddlers

INTRODUCTION

Good nutrition as a determinant of the quality of human resources is one of the rights of children (WHO, 2010). Childhood deficiencies are always associated with specific vitamins and minerals (micronutrients) (Nasution, 2004). Malnutrition is closely related to the slow growth of the body (especially in children), low immune system, lack of intelligence, and low productivity (Almatsier, 2009).

Stunting is malnutrition characterized by age height (Height/Age) below standard deviation (<-2 SD) (WHO, 2005). Many factors cause stunting such as length of birth, food intake, disease and infection, genetic, and socioeconomic (Kusuma, 2013). Stunting in children is caused by several complex factors compared to adults, mainly due to micronutrient deficiency (Gibson, 2005).

According to the results of Basic Health Research (2013) the prevalence of stunting in Indonesia in 2013 was 37.2% (18% very short and 19.2% short), increasing to 2010 (35.6%) and 2007 (36.8%). The prevalence of stunting in Central Java was 33.9%. Based on the result of a simultaneous weighing survey conducted by Surakarta City Health Office, the prevalence of stunting in 2015 in Surakarta was 12.7%. The highest prevalence in PuskesmasPenumping16,69%, PuskesmasGilingan 16,7%, and PuskesmasStabelan 12,93%.

Deficiency of nutrients in children (1-3 years) can affect the process of growth in children called the "golden age" (MOH RI, 2009). According to Bahmat*et al.* (2012). Lack of macronutrients and micronutrients such as zinc and calcium can cause stunting.

Research conducted by Hidayati, *et al.* (2010) showed that zinc deficiency has a 2.67% greater risk of stunting events. This is reinforced by the results of Agustina research, *et al.* (2014) states that there is a correlation between zinc intake with stunting incidence in children aged 24-59 months in Palembang Social Health Center. The results of the study in Bogor, states that in children aged 6-12 months experienced growth disorders caused by a single deficiency or a combination of micronutrients such as zinc and calcium. This is reinforced by the results of Mikhail *et al.* (2013) research that lack of micronutrient intakes such as calcium, zinc, magnesium, and vitamin A can inhibit growth causing stunting in children aged 0-4 years in Egypt.

Preliminary study results conducted in Surakarta City obtained the highest prevalence of stunting events in the working area of PenumpingPuskesmas. Based on data obtained from the weighing done by PuskesmasPenumping in February 2016, the highest prevalence of 4 urban villages in the work area of PuskesmasPenumping is in KelurahanPanularan with the number of children aged 12-36 months is very short as many as 22 toddlers or 12.71 % and short toddlers as many as 29 toddlers or 16.76%.

METHODS

Subjects

This research used observational research with the cross-sectional approach. The subjects were selected based on preliminary and research surveys conducted from October to November 2016. They were recruited from Panularan Village Laweyan District Surakarta. Inclusion criteria were healthy children aged 12-36 months. Mother criteria can read, see, and communicated well. They have to live in the same home as the subject. Exclusion criteria were sick children, not present, resign and moved home when data collection was not completed. The number of randomized subject sampling was 71 children under 5 years old.

Anthropometry and Food Recall

The weight and height of the subjects were measured. The weight of the subject was determined using microtoise. The height of the subject was determined using the scales.

The intake of Zinc (Zn) was obtained through 3x24-hour food consumption by face-to-face interview with the mother's subject. The food consumption was recalled 24 hours ago and interviewed mother to remember it. The research instruments used the respondent's characteristic form, 24-hour recall form, URT (Household Size), and Food Model. The data collected questionnaire's identity of the respondents

Statistical Analysis

The data was analyzed using the SPSS application program 1.6 version. The data distribution was analyzed for its normality using one-sample Kolmogorov-Smirnov test because of the number of samples ≥ 30 samples. Differences were considered significant at $P < 0.05$. The intake of zinc (Zn) was analyzed using the Mann-Whitney U test because the data were not normally distributed.

RESULT

Overview

KelurahanPanularan is located in Laweyan, Surakarta, Jawa Tengah. The population in kelurahan panularan was 9.473 people (October 2016) consists of 4.656 male, and 4.817 females. The number of families was 2.885 households. The average household aged 30-39 years old. The average children aged 0-4 years old. It showed there were many people with productive aged.

Subject Description by Age

Subjects were categorized into three categories 12-19, 20-29, and 30-36 months. The distribution of subjects could be seen in Table 1.

Table 1. Subject Distribution by Aged

Age (Month)	*Stunting*		*Non-Stunting*	
	N	%	N	%
12-19	12	34,3	11	30,6
20-29	17	48,6	19	52,8
30-36	6	17,1	6	16,7
Total	35	100	36	100

The highest distribution according to stunting and non-stunting was 20-29 months. There was 17 (48.6%) stunting subjects and 19 (52.8%) non-stunting subjects. Children under five years need an intake of adequate nutrients. Subjects who get balanced nutrition will achieve good growth. The children did not have enough nutrition, tend to be slow (Octasari, 2007).

Subject Distribution by Gender

Subjects were aged 12-36 months. The distribution of subjects by gender could be seen in Table 2.

Table 2. Subject Distribution by Gender

Gender	***Stunting***		***Non-Stunting***	
	N	**%**	**N**	**%**
Male	21	60	16	44,4
Female	14	40	20	55,6
Total	35	100	36	100

The number of stunting subjects were male 21 (60%). while the number of non-stunting subjects was female (20.6%). Female subjects had a more significant improvement compared to male subjects. The progress was the period of birth until the puberty period ends (Marmi and Rahardjo, 2012).

Distribution of Nutritional Status

The assessment of nutritional status in this study used the Height/Age index. The nutritional status of children under five can be seen in Table 3.

Table 3. Distribution of Nutritional StatusBalita

Nutrition status	N	%
Stunting	35	49,3
Non-*stunting*	36	50,7
Total	71	100

Nutritional status was stunting subjects 35 (49.3%) and non-stunting subjects 36 (50.7%). The number of subjects in the study used the Lemeshow formula.

Distribution of Zinc (Zn) Consumption Level

The food consumption was recalled with a 3 x 24 hours food recall. Based on data collected 35 subject stunting and 36 subject non-stunting. The consumption level could be seen in Table 4.

Table 4. Distribution of Zinc (Zn) Consumption Level

Zinc (Zn) Consumption Level	*Stunting*		Non-*Stunting*	
	N	%	N	%
Deficit	4	11,4	4	11,1
Less	2	5,7	0	0
Light	4	11,4	5	13,9
Normal	9	25,7	4	11,1
More	16	45,7	23	63,9
Total	35	100	36	100

The level of zinc consumption (Zn) in deficit and less category were stunting subjects 6 (17.1%), and non-stunting subjects 4 (11.1%). The level of zinc consumption (Zn) in more categories were stunting subjects 16 (45.7%), and non-stunting subjects 23 (63.9%).

Based on Dietary Reference Intake (DRI), we concluded that the intake of zinc (Zn) for children under 12-36 months was 4 mg/day. Low levels of zinc intake were caused by a lack of food intake containing zinc (Zn) (Mardewi, 2014). According to Brown (2005), The food sources that containing zinc (Zn) included oysters, crabs, lobsters, shrimp, baronang, skipjack, cork, beef, chicken, chicken liver, chicken eggs, potatoes, mushrooms, and pumpkins.

Bivariate Analysis

Zn (Zn) test for 12–36-month subjects using the normality test of Kolmogorov-Smirnov. Data obtained normal not distributed data (p = 0,003), then the analysis continued using Mann-Whitney U test (p = 0,000) Ho is rejected. The difference in zinc

intake with the incidence of stunting and non-stunting in children aged under 12-36 months can be seen in table 5. Based on Table 4 it can be seen that the level of zinc (Zn) consumption in the deficit category and less in the stunting subject was 6 (17.1 %), and non-stunting was 4 (11.1%). Zinc (Zn) consumption in the more category in stunting subjects was 16 (45,7%), and non-stunting subjects were 23 (63,9%).

Tabel 5. The Difference Analysis of Zinc (Zn) Intake (Stunting and Non-Stunting Subjects)

Zinc (Zn) Intake (%)	*Nutrition Status*		Sig p
	Stunting	*Non-Stunting*	
Minimum Value	35	50	0,223*
Maximum Value	1460	617,00	
SD	238,470	150,108	
Average	181,17	197,67	

*) *Result from the p-value of Mann-Whitney*

Based on the results, the average zinc (Zn) intake for stunting subjects aged 12-36 months was 181.17%. The average zinc (Zn) intake for non-stunting subjects was 197.67%. Mann-Whitney U test results in this study obtained significant values (p = 0.223) is Ho accepted which means there is no difference in zinc intake with the incidence of stunting and non-stunting in subjects aged under 12-36 months. In the process of growth, zinc (Zn) plays a role in protein synthesis required for the formation of new tissue, growth, and normal bone repair. The provision of zinc supplementation (Zn) in children has a positive effect on growth (Agustian, 2009). The result of 24-hour recall performed for three days was not consecutive showed that there was a difference in protein intake between stunting and non-stunting subjects. Protein intake consumed by non-stunting children derived from animal side dishes and vegetable side dishes is more varied than the intake of protein consumed by subjects stunting. This study is in line with the results of research conducted by Taufiqurrahman *et al.* (2009) on 360 children aged 6-59 months in West Nusa Tenggara, which states that there is no significant difference between the stunting of toddler zinc stunting and normal. Dewi (2015) conducted using Chi-Square test showed that the influence of zinc mineral consumption in PAUD children who stunted with non-stunted in Denpasar with value (p <0,05).

In the growth process, zinc (Zn) plays a role in protein synthesis required for the formation of new tissue, growth, and normal bone development. Providing zinc supplementation in infants and children has a positive effect on growth (Agustian, 2009). According to Anindita (2012) that protein is very important for the development of every cell in the body and also to keep the body immune. Protein is one of the most important nutrients in its infancy.

CONCLUSION

1. Stunting toddlers aged 12-36 months had a higher percentage of zinc intake category (181.17%) while non-stunting toddlers aged 12-36 months had a higher intake of zinc (197.67%).
2. Stunting toddlers aged 12-36 months had more calcium intake category (136.52%) while non-stunting toddlers aged 12-36 months had more calcium intake category (193.90%).

3. There was no significant difference in zinc intake from stunting or non-stunting toddlers aged under 12-36 months.

REFERENCES

Agustian L, Sembiring T and Arianai A. 2009. *Peran Zinkum Terhadap Pertumbuhan Anak. SP*. Vol (11): 4-9

Agustina, A. 2015. *Faktor-Faktor Risiko Kejadian Stunting Pada Balita (24-59 Bulan) di Wilayah Kerja Puskesmas Sosial Palembang Tahun 2014*. Palembang: Fakultas Kesehatan Masyarakat Universitas Sriwijaya

Almatsier, S. 2009. *Prinsip Dasar Ilmu Gizi*. Jakarta: PT Gramedia Pustaka Utama

Anindita, P. 2012. Hubungan Tingkat PendidikanIbu, PendapatanKeluarga, Kecukupan Protein danSengdengan*Stunting* (Pendek) PadaBalitaUsia 6-35 Bulan di KecamatanTembalang Kota Sematang. JurnalKesehatanMasayarakat. Vol: 1 (2)

Bahmat, DO, Bahar, H., andJus'at, I. 2010. *Hubungan Asupan Seng, Vitamin A, Zat Besi Dan Kejadian Pada Balita (24-59 Bulan) Dan Kejadian Stunting Di Kepulauan Nusa Tenggara (Riskesdas 2010)*. Nusa Tenggara: Departement of Nutrition Faculty of Healthy Science Esa Unggul University

Brown, KH., Peerson JM., Rivera J., and Allen LH. 2002. Effect Of Supplemental Seng On The Growth and Serum Seng Concentrations OfPrepubertal Children: A Metal-analysis Of Randomized Controlled Trials. Am J Clin Nutr. 75:1062-71

Departemen Kesehatan RI. 2009. *Sistem Kesehatan Nasional*. Jakarta: Depkes RI

Gibson, R. S. 2005. *Principles of Nutritional Assessment*. *Second Edition*. Oxford University Press Inc, New York

Gobinathan P, Murali PV, and Panneerselvam R. 2009. Interactive Effects of Calcium Chloride on Salinity-Induced Proline Metabolism in *Pennisetum typifies.Advances in Biological Research* 3(5-6):168-173.

Goulding A, Rockell JEP, Black RE, Grant AM, Jones IE., and Williams SM. 2004. Children Who Avoid Drinking Cow's Milk Are at Increased Risk for Prepubertal Bone Fractures. *Journal of The American Dietetic Association*. Vol: 104 (2): 250-253

Hidayati, L, Hadi, H., andKumara, A. 2010. *Kekurangan Energi dan Zat Gizi Merupakan Faktor Risiko Kejadian Stunted Pada Anak Usia 1-3 Tahun yang Tinggal di Wilayah Kumuh Perkotaan Surakarta.* Jurnal Kesehatan. Vol: 3: 89-104

Kusuma, KE. 2013*. Faktor Risiko Kejadian Stunting Pada Anak Usia 2-3 Tahun (Studi di Kecamatan Semarang Timur).* Artikel Penelitian. Semarang: Program Studi Ilmu Gizi Fakultas Kedokteran Universitas Ponorogo

Marmi and Rahardjom, K. 2012. Asuhan Neonatus, Bayi, Balita, dan Anak Pra Sekolah. Yogyakarta: Pustaka Pelajar

Mikhail, WZA, Sobhy HM, El-Sayed HH, Khairy SA, Salem HYA., and Samy MA. 2013. Effect of Nutritional Status on Growth Pattern of Stunted Preschool Children in Egypt. Academic Journal of Nutrition 2 (1): 01-09

Nasution, E. 2004. *Efek Suplementasi Seng dan Besi Pada Pertumbuhan Anak*. Sumatra: Fakultas Kesehatan Masyarakat Universitas Sumatra Utara

Nieves JW. 2005. O*steoporosis: the role of micronutrient*s. *The American Journal of Clinical Nutrition.* Vol:81 (1232-1239)

Octasari, W. 2007. Hubungan Status Gizi Terhadap Status Perkembangan Motorik Anak Usia 0-3 Tahun (Batita) Di Kecamatan Kabupaten Pasuruan. Universitas Muhammadiyah Surakarta

Rahmawati, DP.,Anggita, SAD., Siti, Z., and Listyani, H. 2017. Tingkat Kecukupan Protein, Seng, Kalsium, Vitamin D, ZatBesi (Fe), dan Kadar HbPadaRemajaPutri Stunting dan Non Stunting di SMPN 1 NguterKabupatenSukoharjo. Jurnal Seminar NasionalGizi. Program StudiIlmuGizi UMS

Riset Kesehatan Dasar. 2013. Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI.

Taufiqurrahman, Haman H., Madarina J., andSusilowati H. 2009. Defisiensi Vitamin A danSengSebagaiFaktorTerjadinya Stunting PadaBalita di Nusa Tenggara Barat.MediaPenelitiandanPengembanganKesehatan. Nusa Tenggara Barat. Volume XIX Tahun 2009, Suplemen II

World Health Organization. 2010. *Nutrition Landscape Information System: Country profile indicators*. Geneva, Switzerland: World Health Organization