

Original article**Energy and Macronutrient Intake on Nutritional Status of Preschool Children***Rine Dhenok Ardianti¹, Harsono Salimo², Risyia Cilmiaty³***Abstract**

Objective: Improving the quality of Human Resources (HR) is an important thing to support the improving national development, one of which is by optimizing the nutritional status of children from an early age. The reason is nutritional problems in preschool children can reduce intelligence, productivity, and creativity which results in decreasing the quality of human resources. Besides, Preschool age is a golden period for a child for growing and developing, especially in language, cognitive, and emotional functions. **Materials and Methods:** This research was an observational study using a cross-sectional study design. The sample in this study was children aged 5-6 years in the Panti sub-district of Jember with the total number of samples was 138 children. The sampling method used the purposive sampling technique. Besides, the data analysis used the Spearman Rank, with a correlation test of $\alpha = 0.05$, which was to analyze the relationship between the level of macronutrient consumption on the nutritional status of preschool children. **Results and Discussion:** The results of the study showed that there was a correlation between energy ($p = <0.001$), protein ($p = <0.001$), fat ($p = <0.001$), carbohydrates ($p = <0.001$;) and maternal education ($p = 0.044$) on nutritional status. Besides, the results test showed that the strength of the relationship between energy were: moderate ($r = 0.506$), protein: moderate ($r = 0.495$), fat: moderate ($r = 0.429$), while carbohydrates: very strong ($r = 0.827$) and Mother's education: very weak ($r = 0.172$) with nutritional status. On the other hand, the father's profession, mother's profession, and total income had no relationship with nutritional status. **Conclusion:** There was a relationship between macronutrients (energy, protein, fat, and carbohydrates) and the nutritional status of preschool children. The indirect factor that had a relationship with nutritional status was maternal education.

Keywords: Consumption Level, Macronutrient, Nutritional Status and Preschool Age.

*International Journal of Human and Health Sciences Vol. 06 No. 01 January'22 Page : 55-60
DOI: <http://dx.doi.org/10.31344/ijhhs.v6i1.377>*

Introduction

The nutritional status of children is an important factor in the human life cycle because it is a period of development and growth, however it is susceptible to nutritional problems and other health problems¹. The number of nutritional problems at transitional age such as preschool age (3-6 years) is still becoming the main concern, especially because there are still many cases of malnutrition in several Indonesian regions. According to the data from 2018 Riskesdas showed that the malnutrition status at the national level was 13.8% and 3.9%².

Besides, National Nutritional Status Monitoring (NNSM) in 2017 showed that the prevalence of malnutrition in East Java Province was 12.6% and 2.9%, however, the high almost prevalence rate showed that the national prevalence caused special attention. Based on the monthly nutrition report data measured based on body weight for age (BW / U), showed that 158,762 children were examined at the health center, 1.1% of children were malnourished, and 4.3% of children were undernutrition, 94.1% of children were well nourished, and 0.5% of children were overweight³.

1. Nutrition Science Study Program, Faculty Of Postgraduate, Sebelas Maret University, Surakarta, Indonesia
2. Nutrition Science Program, Faculty Of Postgraduate, Sebelas Maret University, Surakarta, Indonesia
3. Medical Study Program, Faculty Of Medicine, Sebelas Maret University, Surakarta, Indonesia

Correspondence to: Rine Dhenok Ardianti, Nutrition Science Study Program, Faculty Of Postgraduate, Sebelas Maret University, Surakarta, Indonesia E-mail: rinedhenok@gmail.com

It is important to improve the human resources (HR) quality to support the acceleration of national development, one of which is by optimizing the nutritional status of children from an early age. The reason is nutritional problems in preschool children can reduce intelligence, productivity, and creativity which results in decreasing the quality of human resources⁴. Preschool age is a golden period for a child for growing and developing, especially in language, cognitive, and emotional functions⁵. To support this growth and development, nutritional intake from food is one of the factors that play an important role.

The cause of this nutritional problem is multifactorial with the direct causes being food intake and disease⁶. The state of public nutritional health depends on the level of consumption which is determined by the quality of food⁷. Nutritional status changes to be good or normal are influenced by adequate intake of energy and macronutrients⁸ which can be measured using the level of consumption. The level of good nutrients consumption must be directly proportional to the good nutrients intake so that all of the body's needs to grow are met and the child is in nutritional status⁹. Therefore, for these reasons, the writer wanted to do research on energy intake and macronutrients on the nutritional status of preschool children in Jember Regency, East Java.

Method

This research was an observational study using a cross-sectional study design. The population of this study was all children aged 5-6 years in the Panti sub-district of Jember with a total population of 138 people. The sample in this study was children aged 5-6 years in the Panti sub-district with the total number of samples was 138 children. In addition, the sampling method used the purposive sampling technique. Inclusion criteria: children aged 5-6 years, both male and female, biological children, living with family (with parents), healthy for at least the last 3 months, living in the study location for at least 6 months. Exclusion Criteria: moving house/area outside the research area, moving from the school where the sample is located, being sick at the time of the study, withdrawing from research participation. The dependent variable in this study was the nutritional status of preschool children, the independent variable in this study was the level of consumption of macronutrients. This study or research had obtained permission from the Ethics Commission of the Faculty of

Medicine, Sebelas Maret University number 146 / UN277.06.6.1 / KEPK / EC / 2020. Besides, the method of collecting the data was carried out in 2 stages: anthropometric data collection, In this case, anthropometric data were collected when collecting school assignments on Saturdays according to the schedule determined by the school and data collection used telephone interviews due to pandemic conditions. In this study, data were obtained and analyzed using SPSS version 25, the data analysis used the spearman rank, which was to analyze the relationship between the level of macronutrient consumption on the nutritional status of preschool children.

Results

The distribution of subject characteristics is shown in Table 1, whereas, the characteristics of children include gender characteristics, it consisted of 62 males (44.9%) and 76 females (55.1%). Age characteristics can determine the children's nutritional needs because when children get older, their nutritional needs will be increasing¹⁰. Based on the results of the study, it showed that the type of father profession was dominated by farmers/fishermen as many 49 respondents (35.5%), while the mother profession was dominated by housewives as many 20 respondents (housewife) (72.5%) with the majority level of income less than the regional minimum salary as many 133 respondents (Regional Minimum Salary/RMS) (96.4%) and (66.7%) with the majority of maternal education was middle category as many 74 respondents (53.6%).

Table 1 The Characteristics of Preschool Children Distribution in Panti District

Characteristic	Total of Respondents	
	n	%
Gender		
Male	62	44.9
Female	76	55.1
Total	138	100
Father Profession		
State Civil Apparatus/SCA	4	2.9
Private employees	42	30.4
Entrepreneur	41	29.7
Farmers / Fishermen	49	35.5
Honorary teacher	2	1.4
Mother Profession		
State Civil Apparatus/SCA	2	1.4
Private employees	20	14.5
Entrepreneur	9	6.5
Farmers / Fishermen	7	5.1
Housewife	100	72.5
Total Income		

<RMS	133	96.4
≥RMS	5	3.6
Mother Education		
Low	58	42.0
Intermediate	74	53.6
High	6	4.3

Table 2 The Characteristics of Nutritional Status Distribution of Preschool Children in Panti District

Nutritional Status	Total of Respondents	
	n	%
Malnutrition	36	26.1
Good Nutrition	92	66.7
More Nutrition	7	5.1
Obesity	3	2.2
Total	138	100

Table 2 shows the nutritional status distribution of the subjects based on the BMI/age indicator. As many as 66.7% of the subjects had a good nutritional status. Besides, children with good nutritional status could have good health and growth status according to their age. Good nutritional status in children has a positive effect on physical, cognitive development, growth, and otherwise. In addition, nutritional problems can also result in disability and mortality¹¹. The assessment of nutritional status based on the BMI/ age indicator can describe an indication of acute nutritional problems because of a lack of consumption levels¹². The level of consumption would affect the nutrients intake from the food eaten. Thus, it affects nutritional status. Another factor that affects the nutrients intakes besides the level of consumption is the condition of the body. In this case, the process of absorption in the body¹³. On the other hand, an adequate level of good macronutrients consumption can improve the nutritional children status¹⁴. Macro nutritional intake that is not balanced with human needs occurred continuously made unwanted weight loss⁷.

In Table 3, bivariate analysis results in this study aim to determine the relationship between the level of macronutrient consumption on the nutritional status of children using the spearman rank. The results of the study showed that there was a correlation between energy ($p = <0.001$), protein ($p = <0.001$), fat ($p = <0.001$), carbohydrates ($p = <0.001$;) and maternal education ($p = 0.044$) on nutritional status. Besides, the results test showed that the correlation coefficient of the relationship between energy were: moderate ($r = 0.506$), protein: moderate ($r = 0.495$), fat: moderate ($r = 0.429$),

while carbohydrates: very strong ($r = 0.827$) and Mother's education: very weak ($r = 0.172$) with nutritional status. On the other hand, the father's profession, mother's profession, and total income had no relationship with nutritional status.

Discussion

Public nutrition health condition depends on the consumption level which is determined by the food quality. Food quality indicates the presence of all nutrients that the body needs based on a meal composition and their ratio to one another¹⁵. However, lack of nutrition is closely related to decreasing in children's intelligence and causes low cognitive development. If malnutrition is not corrected, it will result in a decrease in physical and mental quality which will decrease learning achievement, creativity, and work productivity in the future. The risks of chronic disease in adulthood such as obesity, heart, and blood vessel disease, hypertension, stroke, and diabetes are one of the impacts of malnutrition nowadays^{16,17,18}.

On the other hand, the consumption level has a direct effect on nutritional status. The level of consumption with the less total number and low quality are the main causes of nutritional problems¹⁹. The level of consumption with nutritional status is not only related to the quantity aspect but also the quality aspect. Most children aged 2-6 years have a low-quality consumption level, usually due to bad eating habits²⁰. Besides, the eating habits that exist in the community differ from one region to another. Eating habits involve attitudes, beliefs, and food choices and are influenced by socio-cultural, demographic, and lifestyle factors so that it is related to indirect factors in the level of consumption that affects the macronutrient intake in children^{21,22}.

Energy obtained from food can be obtained from macronutrients such as carbohydrates, fats, and proteins for body metabolism and physical activity⁷. The level of energy adequacy with nutritional status has a significant relationship²³. The level of insufficient energy intake can increase the risk of 2.9 times when the occurrence of under-nutritional status is compared to toddlers whose energy intake levels are sufficient¹¹. Insufficient energy intake causes an energy imbalance, whereas, if it happens for a long time it will cause nutritional problems. Children with low energy intake levels affect brain function and structural development. Besides, it can result in stunted cognitive growth

Table 3 The Relationship between Macronutrient Consumption Levels on Nutritional Status of Preschool Age Children in Panti District

Consumption Rate	Status Gizi IMT/U				Value p	Value r
	Malnutrition	Good Nutrition	More Nutrition	Obesity		
Energy					0.000 ^a	0.506 ^{**}
Weight Deficit	17	9	0	0		
Moderate Deficit	9	3	0	0		
Mild Deficit	2	10	0	0		
Enough	6	65	6	3		
Advantages	2	5	1	0		
Protein					0.000 ^a	0.495 ^{**}
Weight Deficit	4	1	0	0		
Moderate Deficit	20	9	0	1		
Mild Deficit	7	28	2	0		
Enough	5	52	5	2		
Advantages	0	2	0	0		
Fat					0.000 ^a	0.429 ^{**}
Weight Deficit	3	3	0	0		
Moderate Deficit	20	6	1	0		
Mild Deficit	9	30	3	3		
Enough	4	52	3	0		
Advantages	0	1	0	0		
Carbohydrate					0.000 ^a	0.827 ^{**}
Weight Deficit	1	3	0	0		
Moderate Deficit	1	1	0	0		
Mild Deficit	16	3	0	0		
Enough	0	85	6	1		
Advantages	0	0	1	2		
Father Profession					0.362	-0.078
State Civil Apparatus/SCA	1	3	0	0		
Private employees	9	30	1	2		
Entrepreneur	10	27	3	1		
Farmers / Fishermen	16	30	3	0		
Honorary teacher	0	2	0	0		
Mother Profession					0.641	0.040
State Civil Apparatus/SCA	0	2	0	0		
Private employees	4	16	0	0		
Entrepreneur	4	4	1	0		
Farmers / Fishermen	3	3	1	0		
housewife	25	67	5	3		
Total Income					0.494	0.059
<RMS	36	87	7	3		
≥RMS	0	3	2	0		
Mother Education					0.044 ^a	0.172 [*]
Low						
Intermediate	22	31	5	0		
High	13	56	2	3		

and development. Energy has a function to support the growing process, body metabolism and play an important role in the physical activity process. Protein is a nutrient needed by the body for growing, building body structure, and replacing damaged systems²⁴. Protein is a macronutrient as a building block, maintains cells and systems, and helps a person's immune system metabolism. On the other hand, fat is a macronutrient that has the largest energy content compared to protein and carbohydrates. Fat is composed of micro

components, consists of fatty acids which are divided into 2; essential and non-essential fats, which become of one the important needed by the body to continuous growth and development process²⁵. Carbohydrates are most consumed because it is following the theory that it becomes the main energy supply and cheaper food source than other nutrients²⁴. Adequate carbohydrate intake is related to adequate energy¹⁴. The process of glycolysis produces energy that comes from food-related glucose²⁶. Less carbohydrate intake

can be stored in glycogen and fat, which can cause less weight or fat²⁷. On the other hand, the research conducted in Tolitoli Regency in 2017 gave the same results, whereas carbohydrate intake with nutritional status had a significant relationship²⁸.

Conclusion

There was a significant relationship between the level of consumption of macronutrients (energy, protein, fat, and carbohydrates) and the nutritional status of preschool children. The highest correlation coefficient is shown by carbohydrates among other macronutrient. The indirect factor that affects nutritional status was the mother's education, however, the correlation coefficient of the relationship was weak. While, mother's profession, father's profession, and the total income had no relationship.

Recommendations

Health workers cooperate with schools and parents of children to make serious and continuous efforts in increasing and maintaining macronutrient intake by providing and providing various types of nutritional sources at home and in school and school canteens, so that students are not only given knowledge but has been more directed to the practice of consuming various types of food.

Acknowledgments

The researcher would like to thank all parties who have been involved and helped carry out this research. both the Sebelas Maret University, the Jember District Education Office and all the staff and kindergarten teachers where the research is located.

Ethical Clearance: This study or research had obtained permission from the Ethics Commission of the Faculty of Medicine, Sebelas Maret University number 146 / UN277.06.6.1 / KEPK / EC / 2020

Source of Funding (if any):-

Conflicts of Interests: Authors state no conflict of interest

Contribution of Authors:

Data gathering and idea owner of this study: Rine Dhenok Ardianti

Study design: Harsono Salimo and Risya Cilmiaty

Data gathering: Rine Dhenok Ardianti

Writing and submission of manuscript: Rine Dhenok Ardianti

Editing and approval of final draft: Harsono Salimo and Risya Cilmiaty

References

1. Fidiatoro N & Setiadi T. Model penentuan status gizi balita di puskesmas. Sarj. Tek. Inform. 2013; 1: 367–373.
2. RI KK. 2018. *Laporan Hasil Riset Kesehatan Dasar (Riskesdas) | Badan Penelitian dan Pengembangan Kesehatan*. Available at: <https://www.litbang.kemkes.go.id/laporan-riset-kesehatan-dasar-riskesdas/> (Accessed: 10 March 2021)
3. Dinkes Jember. 2012. Data Status Gizi Anak Kabupaten Jember. Jember : Dinas Kesehatan Jember
4. Rochmawati, Marlenyati & Waliyo E. Gizi Kurus (Wasting) Pada Balita Di Wilayah Kerj Puskesmas Kota Pontianak. *Vokasi Kesehatan*. 2013; II: 1– 7.
5. Affrida EN. Strategi Ibu dengan Peran Ganda dalam Membentuk Kemandirian Anak Usia Pra Sekolah. *Jurnal Obsesi : Jurnal Pendidikan*. 2017; 1 (2): 124–130 Anak Usia Dini. DOI: 10.31004/obsesi.v1i2.24
6. FAO. Food Security Information for Action Practical Guides: An Introduction to the basic concepts of food security. FAO Food Security Programmes and European Commission; 2008 Available from: <http://www.fao.org/docrep/013/al936e/al936e00.pdf>.
7. Bitra Indonesia. (2010). Keanekaragaman Pangan Untuk Antisipasi Kekurangan Pangan. Available from <http://bitra.or.id/2012/2010/10/15/>
8. Lutviana E & Budiono I. Prevalensi dan Determinan Kejadian Gizi Kurang pada Balita. *Kesehat. Masy*. 2010; 5: 138–144.
9. Diniyyah SR & Nindya TS. Asupan Energi , Protein dan Lemak dengan Kejadian Gizi Kurang pada Balita Usia 24-59 Bulan di Desa Suci , Gresik. *Amerta Nutr*. 2017; 1: 341–350.
10. Arifin, Z. Gambaran Pola Makan Anak Usia 3-5 Tahun Dengan Gizi Kurang Di Pondok Bersalin Tri Sakti Balong Tani Kecamatan Jabon –Sidoarjo. *Midwifery*. 2016; 1; 16–29.
11. Rahim FK. Faktor Risiko Underweight Balita Umur 7-59 bulan. *Kesehat. Masy*. 2014; 9: 115–121
12. Judistiani TD, Fauziah A, Astuti S, Yuliani A & Sari P. Gangguan Gizi Balita Di Desa Mekargalih Kecamatan Jatinangor - Sumedang: Masalah Kesehatan Masyarakat. *J. Sist. Kesehat*. 2017; 1: 84–91.
13. Erni JM & Rialihanto MP. Pola makan, asupan zat gizi, dan status gizi anak balita suku anak dalam di Nyogan Kabupaten Muaro Jambi Provinsi Jambi. *J. gizi Klin. Indones*. 2008; 5: 43.
14. Regar E & Sekartini R. Hubungan Kecukupan Asupan Energi dan Makronutrien dengan Status Gizi Anak Usia 5-7 Tahun di Kelurahan Kampung Melayu , Jakarta Timur. *JKI*. 2012;1: 184–189.
15. Ariningsih E dan Handewi PSR. Strategi Peningkatan Ketahanan Pangan RumahTangga Rawan Pangan. *Analisis Kebijakan Pertanian*. 2008; 6 (3): 239 – 255
16. Aries M, Martianto D. Estimasi kerugian ekonomi akibat status gizi buruk dan biaya penanggulangannya pada balita di berbagai provinsi di Indonesia. *Jurnal Gizi dan Pangan*. 2006; 1(2): 26–33.
17. Badan Perencanaan Pembangunan Nasional (Bappenas). 2012. *Kerangka Kebijakan Gerakan Sadar Gizi Dalam Rangka Seribu Hari Pertama Kehidupan (1000 HPK)*. Jakarta: Bappenas.
18. Hanum NL, Khomsan A. Pola asuh makan, perkembangan bahasa, dan kognitif anak balita stunded dan normal di Kelurahan Sumur Batu, Bantar Gebang Bekasi. *Jurnal Gizi dan Pangan*. 2012; 7(2): 81–88.
19. Koletzko B, Brands B, Demmelmair H. The early nutrition programming project (earnest): 5 y of successful multidisciplinary collaborative research. *Am J Clin Nutr*. 2011; 94(6 Suppl), 1749S–1753S.
20. Prasetyo TJ, Hardinsyah, Sinaga T. Konsumsi pangan dan gizi serta skor pola pangan harapan (PPH) pada anak usia 2-6 tahun di Indonesia. *Jurnal Gizi dan Pangan*. 2013; 8(3): 159–166.
21. Park SY, Suzanne PM, Lynne RW, Jennifer FY, Sangita S, Jean HH, Brian EH, and Laurence NK. Dietary patterns using the food guide pyramid groups are associated with sociodemographic and lifestyle factors: the multiethnic cohort study. *J. Nutr*. 2005; 135(4): 843–849.
22. Khomsan A, Anwar F, Sukandar D, Riyadi H, Mudjajanto ES. Mother's nutrition knowledge and food habits of households in highland and coastal areas. *Jurnal Gizi dan Pangan*. 2006; 1(1): 23–28
23. Nagari RK. & Nindya TS. Tingkat Kecukupan Energi , Protein Dan Status Ketahanan Pangan Rumah Tangga Berhubungan Dengan Status Gizi Anak Usia 6-8 Tahun. *Amerta Nutr*. 2017; 1: 189–197.
24. Almtsier S. *Prinsip Dasar Ilmu Gizi*. Jakarta: PT. Gramedia pustaka utama. 2009
25. Sartika RAD. Pengaruh Asam Lemak Jenuh, Tidak Jenuhdan Asam Lemak Trans terhadap Kesehatan. *Jurnal Kesehatan Masyarakat Nasional*. 2008; 2 (4)
26. Primashanti DAD & Siarthadi IGL. Perbandingan asupan energi, karbohidrat, protein dan lemak dengan angka kecukupan gizi pada anak obesitas. *Medicina*. 2018;49: 173–178.
27. Kharismawati R. & Sunarto. Hubungan Tingkat Asupan Energi, Protein, Lemak, Karbohidrat, Dan Serat Dengan Status Obesitas Pada Siswa Sd. (Universitas Diponegoro Semarang). 2010
28. Baculu, EPH. Hubungan Pengetahuan Ibu Dan Asupan Karbohidrat Dengan Status Gizi Pada Anak Balita di Desa Kalangkangan Kecamatan Galang Kabupaten Tolitoli. *J. Kesehat. Masy*. 2017; 7:14.