AL-KAUNIYAH: Jurnal Biologi, 18(2), 2025, 341-2348
Website: http://journal.uinjkt.ac.id/index.php/kauniyah
P-ISSN: 1978-3736, E-ISSN: 2502-6720

NUTRITIONAL STATUS OF ELEMENTARY SCHOOL-AGE CHILDREN IN ORANSBARI ABOUT COGNITIVE AND MOTORIC ABILITY

STATUS NUTRISI ANAK USIA TINGKAT SEKOLAH DASAR DI ORANSBARI DALAM KAITANNYA DENGAN KEMAMPUAN KOGNITIF DAN MOTORIK

Yeni Aulia Pratiwi, Muhammad Ramadhan Bedjo, Hazwia, Daniela Ijie, Elda Irma Jeanne Joice Kawulur*

Biology Department Papua University, Gunung Salju St, Amban, 98314 Manokwari, Papua
**Corresponding author:* e.kawulur@unipa.ac.id

Submitted: 29 July 2024; Revised: 2 October 2024; Accepted: 28 February 2025

Abstract

One of the phenotypic variations in humans to adapt to environmental conditions is physical growth. One of the impacts of environmental pressure on children's growth is malnutrition. This research aims to assess the association of nutritional status with cognitive abilities and motor skills in elementary school-age children in Oransbari, South Manokwari, West Papua. Cross-sectional design research was carried out on children aged 6–12 years from two primary schools in January- June 2023. Semistructured interviews guided by a questionnaire were carried out to collect data on cognitive and motoric abilities. Body height and body weight were measured to assess the nutritional status. Our research showed that nutritional status was mostly a normal category, while stunting, severe stunting, and thinness which refers to undernutrition were quite low. Undernutrition tendency in Papuan children was higher than in non-Papuan children, with the severely stunted 2.44%:0.83% between Papuan and non-Papuan and thinness at 7.32%:5.83%. Expectably stunted category non-Papuan showed quite high than Papuan (3.33%:2.44%). In contrast, the percentages of thinness and obesity which refer to overnutrition were quite high in non-Papuan with values of 14.0% and 16.6% respectively. The chi-square test showed that the malnutrition category was not related to cognitive and motor skills (P-value <0.05).

Keywords*:* Cognitive abilities; Motoric abilities; Nutritional status; Papua

Abstrak

Salah satu variasi fenotipik manusia dalam upaya menyesuaikan diri dengan kondisi lingkungan adalah pertumbuhan fisik. Salah satu dampak tekanan lingkungan terhadap pertumbuhan anak adalah kekurangan gizi. Tujuan penelitian ini adalah melihat hubungan status gizi dengan kemampuan kognitif, motorik, dan pola makan pada anak usia tingkat sekolah dasar di Oransbari, Manokwari Selatan, Papua Barat. Design cross sectional studi telah dilakukan pada 161 anak usia 6–12 tahun dari dua sekolah dasar pada bulan Januari-September 2023. Wawancara semistruktural dengan panduan kuesioner dilakukan untuk mengumpulkan data kemampuan kognitif dan motorik. Pengukuran tinggi dan berat badan dilakukan untuk menilai status gizi. Penelitian menunjukkan sebagian besar persentase status gizi adalah normal, sedangkan kategori pendek, sangat pendek, dan gizi kurang ditemukan cukup rendah. Kecenderungan kurang gizi pada anak Papua lebih tinggi terjadi dibandingkan anak non-Papua, dengan persentase sangat pendek 2,44%:0,83% antara anak Papua versus non-Papua dan gizi kurang 7,32%:5,83%. Kecuali kategori pendek non-Papua lebih tinggi dibandingkan Papua yaitu 3,33%:2,44%. Sebaliknya, persentase kelebihan berat badan dan obesitas yang mengacu pada gizi lebih lebih, pada anak non-Papua lebih tinggi dengan nilai masing-masing sebesar 14.0% dan 16.6%. Uji Chi Square menunjukkan status gizi dengan kategori malnutrisi tidak berkaitan dengan kemampuan kognitif dan motorik (P-value <0,05).

Kata kunci*: Kemampuan kognitif; Kemampuan motorik; Status gizi; Papua*

Permalink/DOI: http://dx.doi.org/10.15408/kauniyah.v18i2.40608

INTRODUCTION

Each person has different abilities to respond to internal and external environmental conditions and adapt to environmental changes. One of the phenotypic variations in humans to adapt to environmental conditions is physical growth, such as body height, body weight, and body fat.

Standards for the national assessment of growth and nutrition of Indonesian children reference based on World Health Organization (WHO) anthropometric measurements. In several previous studies relating to the growth patterns of Indonesian children, the ethnic groups showed variations (Widiyani et al., 2011; Kawulur et al., 2012; Artiningrum et al., 2014; Rohmatullayaly et al., 2017), and below normal when compared with a growth reference standard curve. This variation in growth is related to environmental conditions such as food, disease, and socio-economic conditions. From an evolutionary perspective, the smaller and lighter body size than normal standards are related to body plasticity and growth strategies in the face of environmental stress. However, other perspectives reveal that growth and nutrition that are below standard are serious health problems (Pelto & Pelto, 1989; Walker et al., 2006; Walker & Hamilton, 2008).

Indonesia is a developing country, and malnutrition is one of the major problems. Based on the Ministry of Health data in 2022, the prevalence of chronic malnutrition or stunting in Indonesia is 24.4%, acute malnutrition (wasting) is 7.1% and underweight is 17.0% (Ministry of Health, 2022). According to the World Health Organization (WHO) (2000), this condition is a serious public health problem. Therefore, currently, stunting is a nutritional problem that receives special attention both nationally and internationally even reducing stunting has become a national program. Stunting is also one of the priority areas in West Papua Province (Trihono et al., 2015; Satriawan, 2019; Presidential Regulation, 2021; Ministry of Health, 2022).

Good nutrition contributes positively to the growth and development of children, as well as the child's ability to play, learn, participate, and be useful. On the other hand, malnutrition will hurt the child's future (World Health Organization (WHO), 2000). Low nutritional status harms children's academic and motor skills. Chronic malnutrition results in lower academic achievement for school children. Stunted children due to malnutrition are more likely to enter school late, be absent more often, and not go to class (Sa'adah et al., 2014).

Children who are malnourished are easily sleepy and less enthusiastic about the learning process at school so learning achievement also decreases. A malnourished child has decreased thinking power caused of not optimal brain growth (Sari et al., 2016), and is less skilled in carrying out physical activities, caused the low motor skills (Noviyanti & Marfuah, 2017). Therefore, a factor of nutritional status is a significant influence on a person's motor performance and abilities. Nutrition is an important factor in contributing to the quality of human resources (Sa'adah et al., 2014).

Oransbari district is one of the districts in West Papua Province. The district is inhabited by transmigration from Javanese and indigenous Papuans. These experience a transition period from an isolated area to an expansion area and significantly change after access to transportation improves. Limited access to transportation, health, and communication illustrates environmental pressures that can impact on culture and the lives of people in the area. Previous studies have shown that environmental stress in early life produces an adaptive response in the form of accelerated growth and reproduction (Kawulur et al., 2023). Environmental pressures might also impact children's lives as shown by the quite high malnutrition among children in this area (Ministry of Health, 2022). This research aims to assess the association of nutritional status with cognitive abilities and motor skills in Papuan and non-Papuan children in the Oransbari District West Papua Province.

MATERIALS AND METHODS

The research was conducted at SD Inpres 54 and SDN 09 Oransbari, South Manokwari, West Papua Province from January to June 2023. The research was designed as a cross-sectional study on elementary school children 6–12 years. The total number of subjects successfully interviewed was 250 children, several subjects were eliminated due to incomplete data, leaving 161 children remaining. Semi-structured interviews with a questionnaire were carried out to collect data on cognitive and motor skills abilities. In addition, height and weight were measured to assess nutritional

status. Before data collection, all respondents had stated their consent to be involved in the research voluntarily.

Cognitive ability was taken from the average subject report scores related to the knowledge of all students. Motor skill was measured using a hand-strength coordination test (wall passing). The nutritional status assessment category based on body mass index at age (BMI/U) refers to (Ministry of Health, 2020). Severely thinness if the BMI/U value is <-3 SD; thinness if BMI/U-3 SD sd <-2 SD; good nutrition (normal) if BMI/U is -2 SD to +1 SD; overweight if BMI/U +1 SD to +2 SD; and obesity (obese) if BMI/U >+2 SD. The nutritional status category based on height according to age (TB/U) aged 6–12 years refers to the Ministry of Health (2023). The category consists of severely stunted if <-3SD, stunted if -3<SD<-2, and normal if ≥-2. The Pearson Chi-Square test with a significance level of P-value <0.05 was used to see the relationship between nutritional status and cognitive and motor abilities.

RESULTS

The Oransbari area is rural so in general, the socio-economic status of the people was categorized as low. This was reflected in parents' education being lower than the high school level, with quite a number never having formal education (Figure 1). The father's job is mostly as a farmer, while the mother's job is as a housewife (Figure 2). By age, the father's income ranges from 1–2 million (Figure 3). This value was lower when compared to the Regional Minimum Wage in West Papua Province of Rp. 3,282,000.

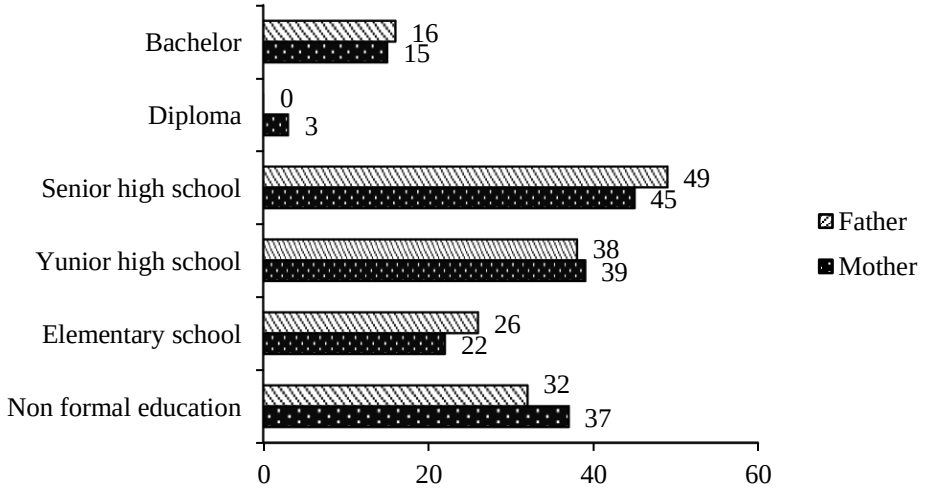

Figure 1. Education of parents

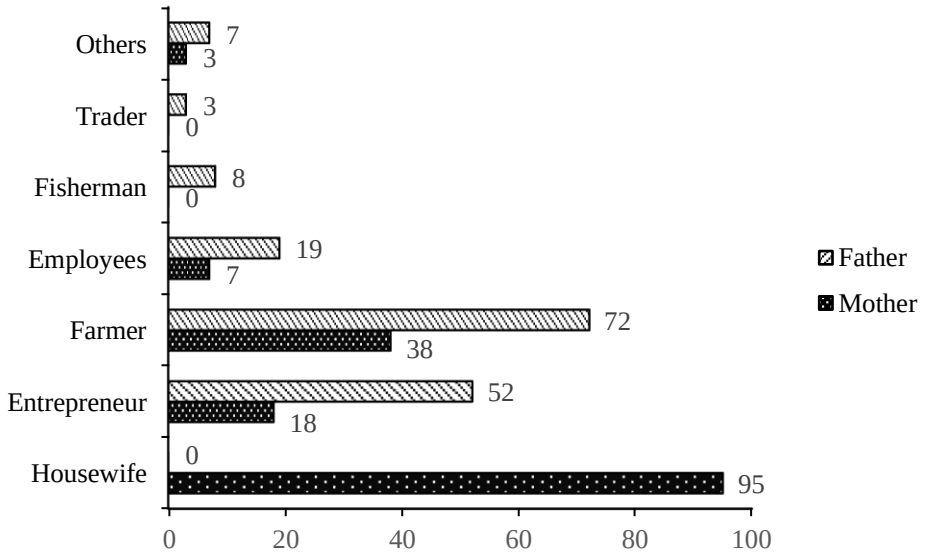

Figure 2. Occupation of parents

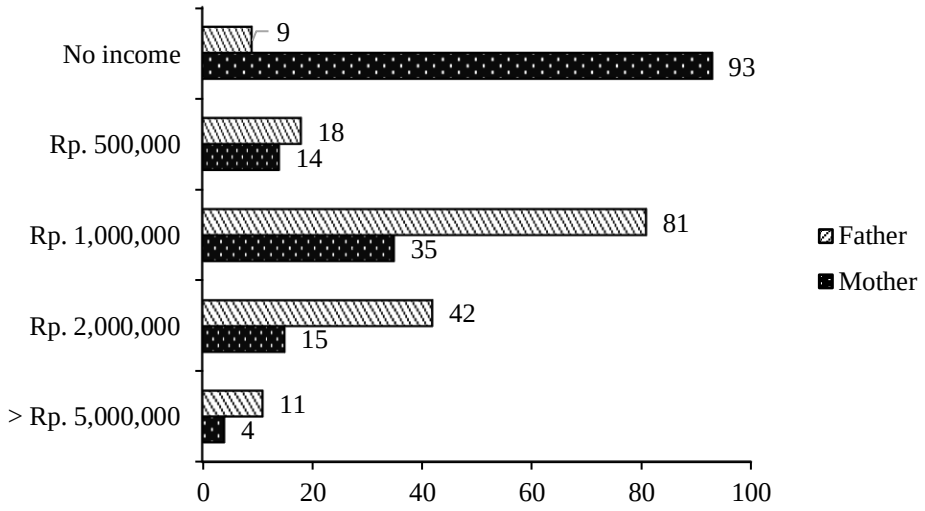

Figure 3. Income of parents

Oransbari society consists of various tribes. In general, the dominant tribes are the Javanese and the Arfak, which are the native tribes of Manokwari. Other tribes with relatively small numbers are Ambon, Batak, Biak, Bima, Bugis, Buton, Key, Lampung, Makassar, Wate, Ende, Serui, Ternate, Toraja, and Waropen. In summary, all these tribes were divided into two, tribes originating from Papua are categorized as Papuan, while other tribes originating from outside Papua are categorized as non-Papuan. The majority of ethnic groups come from non-Papuans with a percentage of 74.54% (120 people), while ethnic groups from Papua are 25.47% (41 people) (Figure 4).

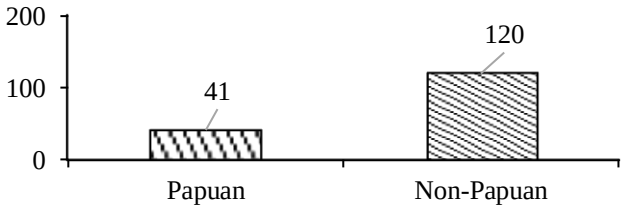

Figure 4. The proportion of Oransbari tribes based on Papuan and non-Papuan people

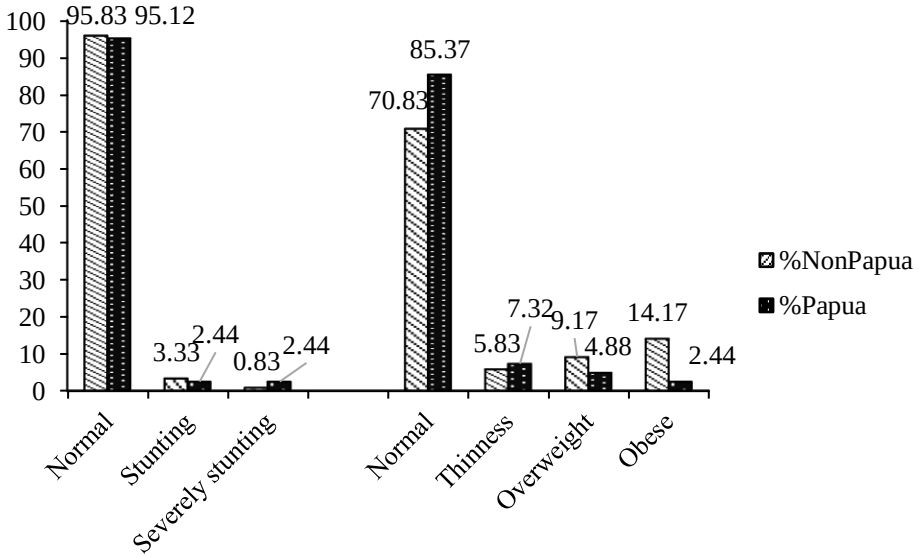

Figure 5. Percentage of nutritional status based on body height for age (TB/U) and body mass index for age (BMI/U)

The nutritional status of children in Oransbari was mostly a normal category, while stunting, and severe stunting which refers to undernutrition were quite low. There was a tendency for Papuan children to be more undernutrition than non-Papuan. The research showed severe stunting in Papuan

versus non-Papuan was 2.44%:0.83% and thinness at 7.32%:5.83%, except stunted category non-Papuan quite higher than Papuan (3.33%:2.44%). In contrast, the percentages of overweight and obese which refer to overnutrition were quite high in non-Papuan with values of 14.0% and 16.6% respectively (Figure 5).

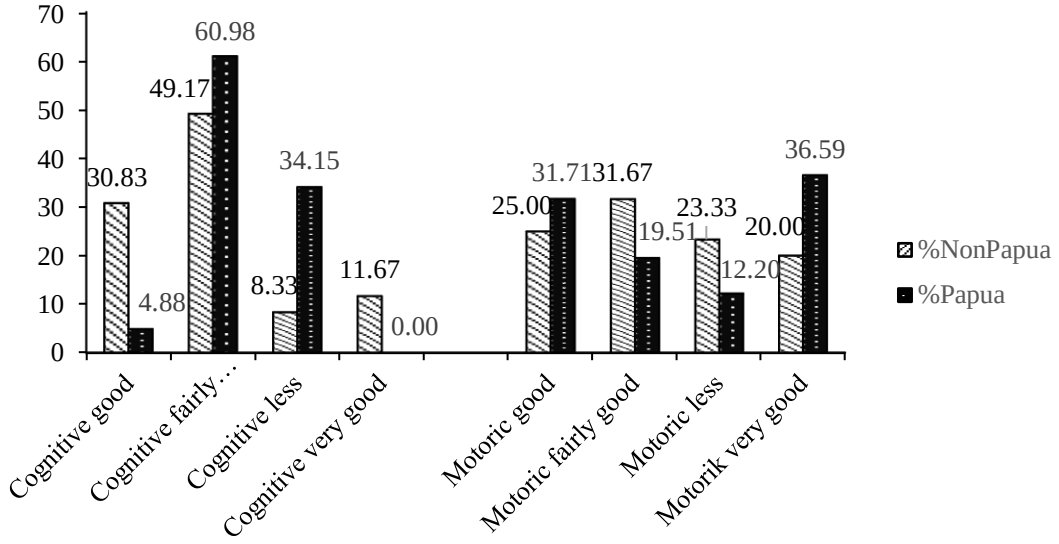

Figure 6. Percentage of cognitive ability and motoric skill of Papuan and non-Papuan children

Based on cognitive abilities, the percentage of good and very good were higher in non-Papuan than in Papuan. In contrast, the categories of fairly good and less were higher in Papuan than non-Papuan children. Motoric skills of children showed different results with cognitive ability. Papuan children tend to have better motoric abilities than non-Papuan children. Categories of very good and good were dominantly found in Papuan children, while less and fairly good categories were dominantly found in non-Papuan children (Figure 6).

Table 1. Nutritional status (BMI/U), cognitive ability, and motoric skill of children

Nutritional status	Cognitive				Motoric				Total
	Less	Fairly good	Good	Very good	Less	Fairly good	Good	Very good	
Underweight	2	6	1	1	2	3	2	3	10
Normal	20	67	25	8	22	35	33	30	120
Thinness	1	4	6	2	6	3	3	1	13
Obese	1	7	7	3	3	5	5	5	18

Table 2. Association of nutritional status (BMI/U) with cognitive ability and motor skill

Nutritional status	Cognitive		P-value	Motorik		P-value
	Good	Less		Good	Less	
Malnutrition	37	4	0.41	30	11	0.35
Normal	100	20		98	22	

Table 3. Association of overnutrition (obesity) and undernutrition (thinness) with cognitive ability and motoric skill

Nutritional status	Cognitive					Motoric				
	Less	Fairly good	Good	Very good	P-value	Less	Fairly good	Good	Very good	P-value
Obesity	1	7	7	3	0.09	3	5	5	5	0.99
Normal	20	67	24	8		22	34	33	30	
Underweight	2	6	1	1	0.89	2	3	5	0	0.99
Normal	20	67	25	8		22	35	65	0	

Based on Table 1, the number of children in the categories of good nutrition (normal), overweight, and obesity with good and very good cognitive abilities (51 children) is greater than the thinness category (2 children). Likewise, with motor skills, the number of children who have

nutritional status in the categories of normal, overweight, and obese (77 children) was higher than in the thinness category (5 children). This reveals that good nutrition is related to children's good cognitive and motor skills. However, the malnutrition category was not associated with cognitive by the chi-square test (P-value 0.41) and motor skills (P-value 0.35) (Table 2). Likewise, obesity and underweight cases were also not associated with cognitive abilities (P-values 0.09 and 0.89) and motor skills (P-value 0.99) (Table 3). This means that underweight and obesity found in children in Oransbari did not affect their motor and cognitive abilities.

DISCUSSION

The contribution of nutritional status to cognitive abilities and motor skills is not impacted in Oransbari children. Previous research explained various results in revealing the relationship between those. Some research showed there isn't a relation, whereas others state that there are relations, where cognitive and motor abilities would be lower in undernutrition. Lack of nutritional intake affects the brain's ability to think, concentrate, and remember so this can have an impact on low learning achievement (Subasinghe & Wijesinghe, 2006; Abdel-Rahman et al., 2017; Yaco & Abidin, 2018; Muflihatin et al., 2018; Sulistyono et al., 2020).

Several studies showed that malnutrition is caused by low nutritional intake, socio-economics, poverty, and disease (Pelto & Pelto, 1989; Siddiqui et al., 2020; Scheffler & Hermanussen 2021; Ma et al., 2022). From an evolutionary perspective, smaller body sizes such as stunting are more related to body plasticity and growth strategies in facing environmental stress conditions (Pelto & Pelto, 1989; Walker et al., 2006; Walker & Hamilton, 2008). Small bodies are more efficient in regulating body metabolism and need less energy for reproduction and survival processes. This argument is by the "small but healthy" theory (Pelto & Pelto, 1989) which provides an understanding that small body size is not always related to health problems such as malnutrition, however, it is a natural condition as a product of the body's adaptive response to environmental conditions. Walker et al. (2006) study revealed that several traditional populations living in tropical rainforest areas generally have a small and light body profile as an adaptation to forest conditions. These phenotypic characteristics make it easier to move when hunting or gathering food and are more efficient in allocating energy for metabolic needs and body functions.

We argue that the short body size incidence in Oransbari children may not be related to chronic malnutrition, but it was a natural response of the body to environmental conditions. A recent study showed that some children in the stunting category had a normal category on body mass index for age. Among seven children in the stunted category (five children stunted and two children severely stunted) in this study, only one child had a thinness status. Similar conditions were also found in Arfak children under 5 years old in Kwau Village, Arfak Mountains. The study showed that between three stunting children, only two children have the obese category based on measurements of body weight for body height (Lefteuw, 2022). This study highlights short body size does not always indicate malnutrition, but is genetically short.

Malnutrition (thinness) among children in Oransbari was relatively low (6.21%), compared to elementary school children in rural areas of Sunamganj District, which was 45.76% (Nath et al., 2019) and 11.4% in Ethiopia (Yisak et al., 2021). There were seven cases of thinness in non-Papuan children and three cases in Papuan children. The percentage of thinness cases in the present study was still low if compared with thinness for children aged 5–12 years data in West Papua Province of 9.1% (Ministry of Health, 2023). This significant difference needs to be reevaluated by involving a larger sample size to get a comprehensive picture of the nutritional status of children in West Papua Province.

Excess nutrition (overweight and obesity) found among children in Oransbari village was relatively high, especially among non-Papuan. In general, in rural areas, malnutrition-related to excess nutrition cases is rarely found due to limited resources such as food, socio-economics, and infrastructure access. However, these conditions were different in rural Oransbari.

Most of the people in the Oransbari area work as farmers, with incomes below the minimum wage. The dominant types of food they plant are rice, fruit, and other horticultural crops (Kawulur et

al., 2023). The Oransbari is also a producing area for rice production and horticultural crops such as vegetables and fruit which are distributed to urban Manokwari. This condition illustrates that community food security is sufficient to meet nutritional intake. The availability of sufficient food may cause excess nutrition in children and quite often in the Oransbari especially non-Papua children. However, the majority of producer farmers in this Oransbari area come from the transmigration from the Javanese tribe. Besides that, the relatively lower socio-economic level of the Papuan people in Oransbari and the majority of farmers from origin Papua are subsistence farmers may have implications for low cases of overweight and obesity in Papuan children but has no impact on lower cognitive abilities.

CONCLUSION

The impact of nutritional status on cognitive ability and motor skills is not a contribution to Oransbari children. Short body size in children in Oransbari may not be related to chronic malnutrition but it was a natural response of the body to environmental conditions. However, excessive nutrition of Oransbari children needs attention, because they are potentially linked to degenerative diseases in the future.

ACKNOWLEDGMENTS

Thank you to the Ministry of Education, Culture, Science and Technology and Papua University for providing research funding assistance and research grants through the Student Creativity Program of Exact Research (PKM-RE). Thank you also to Siti Hajar Ramadhani for her involvement from the beginning of preparing the proposal, collecting data, and processing the data so that this research could be carried out well.

REFERENCES

Abdel-Rahman, T. A., Kamal N. N., El-Dessouki K. H., & Abdallah A. A. (2017). Assessment of nutritional status and cognitive development of preschool children at Minia governorate, Egypt. *The Canadian Journal of Clinical Nutrition*, *5*(1), 72-94.

Artiningrum, N. T., Suryobroto, B., & Widiyani, T. (2014). Physical growth of Sasak children at different altitudes in Lombok Island. *HAYATI Journal of Biosciences*, *21*(3), 101-110. doi: 10.4308/hjb.21.3.101.

Kawulur, E. I. J. J., Suryobroto, B., Budiarti, S., & Hartana, A. (2012). Association of sexual maturation and body size of awful children. *HAYATI Journal of Biosciences*, *19*(3), 124-130. doi: 10.4308/hjb.19.3.124.

Kawulur, E. I. J. J., Kusumawati, E. D., Rohmatullayaly, E. N., & Anggriyani, I. R. (2023). Early menopause: Reproductive adaptation of Javanese women in Oransbari District West Papua. *HAYATI Journal of Biosciences*, *30*(3), 466-472. doi: 10.4308/hjb.30.3.466-472.

Lefteuw, A. B. (2022). Antropometri masyarakat Suku Arfak dalam menilai status gizi di Kampung Kwau Distrik Warmare Kabupaten Manokwari Provinsi Papua Barat (Undergraduate thesis). Universitas Papua, Indonesia.

Ministry of Health. (2020). *Standar antropometri anak*. Jakarta: Kemenkes Republik Indonesia.

Ministry of Health. (2022). *Buku saku hasil studi status gizi Indonesia (HSGGI) tingkat nasional, provinsi, dan kabupaten/kota tahun 2021*. Jakarta: Kementerian Kesehatan RI.

Ministry of Health. (2023). *Survey kesehatan Indonesia tahun 2023*. Jakarta: Kementerian Kesehatan RI.

Ma, Z. F., Wang, C. W., & Lee, Y. Y. (2022). Editorial: Malnutrition: A cause or a consequence of poverty? *Frontiers in Public Health*, *9*, 796435. doi: 10.3389/fpubh.2021.796435.

Muflihatin, I., Purnasari, G., & Swari, S. J. (2018). Analisis perkembangan motorik kasar balita ditinjau dari status gizi berdasrkan WHO di TK Bayangkara Polres Jember. *Jurnal Kesehatan*, *6*(1), 13-17.

Nath, J. C., Ahmad, I., Chowdhury, R. S., Razzak, A., Hossain, N., Costa, B. J., & Zzaman, W. (2019). *World Journal of Nutrition and Health*, *7*(1),1-5. doi: 10.12691/jnh-7-1-1.

Noviyanti, R. D., & Marfuah, D. (2017). *Hubungan pengetahuan gizi, aktivitas fisik, dan pola makan terhadap status gizi remaja di Kelurahan Purwosari Laweyan Surakarta.* Paper presented at Proceeding the 6th University Research Colloquium, Universitas Muhammadiyah Magelang, Indonesia. Retrieved from https://journal.unimma.ac.id/index.php/urecol/article/view/1059.

Pelto, C. H., & Pelto, P. J. (1989). Small but healthy. *Human Organization*, *48*(1), 11-15.

Presidential Regulation. (2021). Peraturan Presiden Republik Indonesia nomor 72 tahun 2027 tentang percepatan penurunan stunting. Retrieved from https://peraturan.bpk.go.id/Details/174964/perpres-no-72-tahun-2021.

Rohmatullayaly, E. N., Hartana, A., Hamada, Y., & Suryobroto, B. (2017). The growth pattern of body size in Baduy People. *HAYATI Journal of Biosciences*, *24*(2), 57-64. doi: 10.1016/j.hjb.2017.07.001.

Sa'adah, R. H., Herman, R. B., & Sastri, S. (2014). Hubungan status gizi dengan prestasi belajar siswa sekolah dasar negeri 01 guguk malintang Kota Padangpanjang. *Jurnal Kesehatan Andalas*, *3*(3). doi: 10.25077/jka.v3i3.176.

Sari, G., Lubis, G., & Edison, E. (2016). Hubungan pola makan dengan status gizi anak usia 3-5 tahun di Wilayah Kerja Puskesmas Nanggalo Padang 2014. *Jurnal Kesehatan Andalas, 5*(2). doi: 10.25077/jka.v5i2.528.

Satriawan, E. (2019). *Pengembangan peta status gizi balita di Indonesia (cetakan pertama)*. Jakarta: Tim Nasional Percepatan Penanggulangan Kemiskinan.

Scheffler, C., & Hermanussen, M. (2021). Stunting is the natural condition of human height. *American Journal of Human Biology*, *34*(e23693), 1-13.

Siddiqui, F., Salam, R. A., Lassi, Z. S., & Das, J. K. (2020). The intertwined relationship between malnutrition and poverty. *Frontiers in Public Health, 8*, 453. doi: 10.3389/fpubh.2020.00453.

Subasinghe, S. M. L. P., & Wijesinghe, D. G. N. G. (2006). The effect of nutritional status on cognitive and motor development of pre-school children. *Tropical Agricultural Research, 18.* 1-9.

Sulistyono, D., Rahayu, H. S. E., & Masithoh, R. F. (2020). The nutrition status and learning achievement of Mertoyudan Muhammadiyah Innovative Elementary School's students. *Media Keperawatan Indonesia*, *3*(3), 186. doi: 10.26714/mki.3.3.2020.186-190.

Trihono., Atmarita., Tjandrarini, D. H., Irawati, A., Utami, N. H., Tejayanti, T., & Nurlinawati, I. (2015). *Pendek (stunting) di Indonesia, masalah dan solusinya*. Jakarta: Lembaga Penerbit Balitbangkes.

Walker, R., Gurven, M., Hill, H., Migliano, A., Chagnon, N., de Souza, R., … Yamauchi, T. (2006). Growth rates and life histories in twenty-two small-scale societies. *American Journal of Human Biology, 18,* 295-311.

Walker, R. S., & Hamilton, M. J. (2008). Life-history consequences of density dependence and the evolution of human body size. *Current Anthropology*, *49*(1), 115-122.

Widiyani, T., Suryobroto, B., Budiarti, S., & Hartana, A. (2011). The growth of body size and somatotype of Javanese children ages 4 to 20 years. *HAYATI Journal of Biosciences*, *18*(4), 182-192. doi: 10.4308/hjb.18.4.182.

Yaco, N., & Abidin, U. W. (2018). Hubungan status gizi dengan prestasi belajar pada siswa di SMK Negeri 1 Polewali Kecamatan Polewali Kabupaten Polewali Mandar. *Jurnal Kesehatan Masyarakat*, *4*(2), 102-112.

Yisak, H., Tadege, M., Ambaw, B., & Ewunetei, A. (2021). Prevalence and determinants of stunting, wasting, and underweight among school-age children aged 6-12 years in South Gondar Zone, Ethiopia. *Pediatric Health, Medicine and Therapeutics*, *12*, 23-33. doi: 10.2147/PHMT.S287815.

World Health Organization (WHO). (2000). Nutrition for health and development: A global agenda for combating malnutrition. France: World Health Organization.

World Health Organization (WHO). (2022). Child growth standards. (2023, February 9). Retrieved from https://www.who.int/tools/child-growth-standards/standards.