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Child Development Card (KKA) as a discriminant tool for the growth and development of stunted and normal children in Indonesia

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Abstract

Background: Stunting is a significant concern in Indonesia, but its detection currently relies on anthropometric measurements, lacking the integration of comprehensive evaluations of child development. Therefore, the Child Development Card (KKA) serves as a valuable instrument employed to assess the growth and developmental aspects of children.

Aim: This research aimed to investigate the potential of KKA as a discriminative tool for distinguishing between stunted and normal children.

Methods: The participants consisted of 159 and 88 normal and stunted children aged 13–24 and 25–60 months. The aspects of children's development examined included passive communication, social behavior, gross motor skills, active communication, fine motor skills, intelligence, and self-help skills. Discriminant analysis was conducted to identify the developmental aspects differentiating stunted children from normal children.

Results: The analysis using SPSS 25 showed that the discriminating aspects of children's development between stunted and normal children were gross motor skills, fine motor skills, passive communication, and intelligence. For the age group of 13–24 months, the discriminant function is represented as $D = -0.276 + 0.197K - 0.511GK + 0.361KP$. Meanwhile, for the age group of 25–60 months, the discriminant function is expressed as $D = -2.586 + 0.151GK - 0.081GH$.

Conclusion: Stunted and normal children could be differentiated based on four key aspects of development: gross and fine motor skills, passive communication, and intelligence. These findings aid in the early detection of stunted children and emphasize the crucial role of parental stimulation across these four aspects.

Keywords

Child Development Card (KKA), discriminant analysis, stunted children, normal children, Indonesia

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Introduction

Stunting poses a significant national challenge presently encountered by Indonesia. It pertains to the phenomenon of malnutrition in infants within the initial 1000 days of their lives, resulting in enduring setbacks in child growth and development.[1] Malnutrition during early childhood can hinder physical and mental development and result in death. Stunted children are at risk of experiencing decreased

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intellectual ability, productivity, and potential degenerative diseases in the future.[2]

According to the Indonesian Nutritional Status Study (SSGI) in 2021, the prevalence among Indonesian children is 24.4%. Even though there has been a decrease in this statistic compared to previous years, it remains considerably distant from the target established by the National Medium-Term Development Plan (RPJMN), which sets forth the objective of achieving a prevalence rate of 14% by 2024.[3]

The causes and risk factors of stunting can be categorized into three factors, namely (1) poor caregiving practices, (2) limited awareness among the community in using healthcare services, and (3) lack of access to nutritious food.[4] The first factor includes mothers' lack of knowledge, and failure to provide exclusive breastfeeding to infants aged 0–6 months as well as complementary feeding (MP-ASI) to infants. The second contributing factor encompasses pregnant women who fail to adhere to a 90-day iron tablet (Fe) consumption regimen and children aged 3–6 years who are not enrolled in Early Childhood Education (PAUD). Consequently, this leads to inadequate monitoring of their growth and development, and the third factor includes anemia in pregnant women and the high cost of nutritious food.

Stunting detection has been primarily conducted through anthropometric measurements, including height/length, weight, as well as arm and body circumference.[5] Even though the conventional anthropometric definition of stunting (height-for-age z-score below −2 standard deviations) was originally devised as a statistical indicator of the societal and economic deprivation experienced by children at the population level, it has become commonly employed to delineate cases of chronic malnutrition.[6] There is no biological basis for the −2 standard deviation (SD) cutoff to define stunting, making it a poor individual-level classification of malnutrition or disease.[7] Therefore, short stature does not necessarily indicate health or developmental issues in children.[8] Stunting measurements in children need to be complemented with other methods, such as assessing children's development using a Child Development Card (KKA).

A small portion of stunted children are assessed based on their development and KKA is used to monitor parental caregiving activities and children's development. It serves a dual function as a monitoring and communication tool for discussing child development between healthcare workers/community health volunteers and mothers/families of children.[9] In addition, KKA was developed by the National Population and Family Planning Board (BKKBN) in 1988, a usage guideline was published in 2010, and an online version was launched in 2021. KAA includes seven aspects of development, which are gross motor skills, fine motor skills, passive communication, active communication, intelligence, social behavior, and self-help skills.[9]

KKA has been used in the field but lacks empirical evidence that shows a comparison between the development of stunted and normal children. This comparison is important to identify the distinctive developmental patterns of stunted children compared to normal. Furthermore, understanding the distinctive developmental patterns of stunted children can serve as a reference for optimizing the aspects of development. The measurement results can also be used as a basis for designing appropriate stimulation or therapy for both individuals and groups of stunted children. The prevention and management of stunting are not solely focused on nutrition intake but also on providing appropriate stimulation to children.[10,11] Previous research[12] also showed that integrated programs involving stimulation successfully reduced the proportion of stunted children. Therefore, it is important to identify which aspects of development differentiate between normal and stunted children.

Table 1. Participants' characteristics.

Age	Normal children	Stunted children
13–24 months	43	22
25–60 months	116	66
Total	159	88

Methodology

The participants consisted of 159 normal children and 88 stunted children aged 13–24 and 25–60 months from three regencies in West Java: Sumedang, Tasikmalaya, and Ciamis regencies. Within these three regencies, one subdistrict serving as the locus of stunting was selected, resulting in the identification of the sub-districts Jatigede, Ciawi, and Sindangkasih. Data collection was randomly conducted from these three sub-districts, which are the focal points for stunting.

The KKA is fundamentally structured according to developmental stages: 0–6, 7–12, 13–24, and 25–60 months. However, the categorization into two groups, specifically 13–24 and 25–60 months, is implemented because children under 13 months have not yet displayed all the intended measured abilities. Details of participant' characteristics can be seen in Table 1. Therefore, measurements are only taken within the age ranges of 13–24 and 25–60 months because within these age ranges, all aspects of abilities are evident. Consequently, the sample only comprises children aged 13–24 and 25–60 months.

Each participant's growth and development were measured using KKA[9], which consisted of 46 items as listed in Table 2, measuring seven aspects, namely:

1. Gross motor skills (six items) refer to the aspect of development where children perform movements involving large muscle groups and require energy.

Table 2. Child Development Card (KKA) items.

No.	Item	Age (Month)	Aspects of growth and development
1	Eyes glance to the right or left	1	Passive communication
2	Reply smiling at others	2	Social behavior
3	Tilt head	3	Gross motor skills
4	Self-tilt	4	Gross motor skills
5	Produce 3 different sounds	5	Active communication
6	Reach for and hold objects in front of them	6	Fine motor skills
7	Sit independently without assistance	7	Gross motor skills
8	Open the lid of the toy	8	Fine motor skills
9	Active in the game "Peekaboo"	9	Social behavior
10	Take objects with thumb & other fingers	10	Fine motor skills
11	Clapping, greetings, farewell, etc.	11	Intelligence
12	Walking close when called	12	Fine motor skills
13	Walk independently	13	Gross motor skills
14	Brew a drink with a spoon	14	Intelligence
15	Insert/remove small objects	15	Fine Motor Skills
16	Say 2 different words correctly	16	Active communication
17	Give 3 objects by naming	17	Intelligence
18	Know and name the 3 parts of the body	18	Passive communication
19	Eat independently with a spoon	19	Self help
20	Pronounce sentences consisting of two words	20	Active communication
21	Recognize 3 pictures and say the names 21 Passive Communication	21	Passive communication
22	Arrange up 5 pieces of objects without falling	22	Intelligence
23	Saying when need to pee or defecate	23	Self help
24	Kick the ball without holding on	24	Gross motor skills
25	Mention the names of 3 objects with their use	25	Active communication
26	Hand washing with shower	26	Self help
27	Answering the question "What are you doing?"	27	Active communication
28	Standing on the toes of both feet	28	Gross motor skills
29	Draw straight lines correctly	29	Intelligence
30	Carry out 2 orders at once	30	Passive communication
31	Undress with buttons without assistance	31	Self help
32	Collect similar objects	32	Intelligence
33	Use question or denial sentences	33	Active communication
34	Draw a circle with ends meeting	34	Intelligence
35	Say own name & gender	35	Active communication
36	Active socializing with friends	36	Social behavior
37	Draw various shapes	39	Intelligence
38	Fasten the cloth buttons correctly	42	Self help
39	Mention yourself with "I"	45	Active communication
40	Separate objects of different sizes	48	Intelligence
41	Draw people	51	Intelligence
42	Cut food with a knife	54	Self help
43	Carry out 3 sequential orders	57	Passive communication
44	Dance to music	60	Fine motor skills
45	Tell simple stories	63	Active communication
46	Count goods to 10	66	Intelligence

2. Fine motor skills (six items) are movements performed by specific body parts and involved small muscle groups. Children do not require much energy for these movements.
3. Intelligence (11 items) refers to the ability to comprehend, think, remember, and solve problems.
4. Passive communication (five items) is the ability to understand signals and speech from others.

Table 3. Growth and development of stunted and normal children 13–24 month.

	Mean normal children	Standard deviation normal children	Mean stunted children	Standard deviation stunted children	*F*	*P*
KP	18.40	3.44	17.55	3.54	0.87	0.36
TLS	18.72	3.57	16.73	5.88	2.89	0.09
GK	18.67	3.65	18.59	3.62	0.01	0.93
KA	18.05	3.27	17.36	2.94	0.68	0.41
GH	18.44	3.67	17.82	3.59	0.43	0.52
K	18.23	3.72	13.50	8.95	9.07	0.00

GH = fine motor skills; GK = gross motor skills; K = intelligence; KA = active communication; KP = passive communication; TLS = social behavior.

Table 4. Growth and development of stunted and normal children 25–60 month.

	Mean normal children	Standard deviation normal children	Mean stunted children	Standard deviation stunted children	*F*	*P*
KP	40.54	10.27	35.85	12.85	7.30	0.01
TLS	40.90	10.03	37.91	14.52	2.67	0.10
GK	40.49	10.47	34.33	11.29	13.75	0.00
KA	40.55	10.19	36.17	13.43	6.15	0.01
GH	40.80	10.24	37.64	14.01	3.06	0.08
K	40.08	10.09	36.89	10.10	4.19	0.04
MDS	39.11	11.09	34.09	12.43	7.89	0.01

GH = fine motor skills; GK = gross motor skills; K = intelligence; KA = active communication; KP = passive communication; MDS = self help; TLS = social behavior.

5. Active communication (nine items) is the ability to express feelings, desires, and thoughts through crying, body movements, or speaking.
6. Social behavior (three items) refers to the ability to interact and socialize. This includes interacting and behaving with family members and others in their environment.
7. Self-help skills (six items) refer to the ability and skills to perform simple tasks related to their daily life.

KKA was measured by directly observing children in their developmental aspects. This research used KKA, which has been categorized based on the developmental aspects, and uses an observation guide. The guide consisted of instructions to be given to mothers and children, success indicators, targeted behaviors, operational behaviors, required equipment, and measurement procedures for each behavior.[13] The guide was developed according to the developmental aspects based on children's age.

Children are given a score of 1 when the targeted behavior can be performed and a score of 0 when it cannot. Subsequently, the dataset underwent discriminant function analysis, a statistical technique used to determine the variables that differentiate or separate between two or more groups. This technique aims to find the best linear combination of variables that distinguishes between these groups. The goal is to identify which variables contribute the most to the classification or discrimination between different groups.[14] In this research context, discriminant analysis was conducted to determine the developmental aspects differentiating stunted children from normal children.

Results

Tables 3 and 4 illustrate the overview of growth and development in stunted and normal children aged 13–24 and 25–60 months based on univariate analysis. In the 13–24 months age group, aspects of social behavior and intelligence exhibit significant values. Meanwhile, in the 25–60 month age group, all aspects show significant values. However, after conducting a discriminant function analysis, a discriminant function was discovered for the 13–24 month age group as $D = -0.276 + 0.197\,K - 0.511\,GK + 0.361\,KP$. While for the 25–60 month age group, it was found as $D = -2.586 + 0.151\,GK - 0.081\,GH$. This implies that the growth and development aspects predicting a child's tendency toward stunted are intelligence, gross motor skills, and passive communication in the 13–24 month group, and gross motor skills as well as fine motor skills in the 25–60 month group.

Discussion

Discriminant factors in growth and development of stunted and normal children aged 13–24 months

The discriminant analysis indicated that the discriminating factors for stunted children are gross motor skills, passive communication, and intelligence. This aligns with WHO[15] where stunting can cause developmental impairments in gross and fine motor skills, language abilities, and social skills.

The findings show that gross motor skills are the most distinguishing aspect of development in identifying stunted children. The specific skills referred to are walking independently and kicking a ball without support. Furthermore, they are associated with compromised growth potential in children, usually caused by insufficient nutrition. In cases of children from low socioeconomic backgrounds, the frequency of breastfeeding and the provision of breast milk substitutes tends to be low, and the incidence of infectious diseases is high.[16]

Passive communication is also a differentiating aspect of development in identifying stunted children. The abilities in question encompass the identification of three body parts, as well as the recognition and naming of three pictures. This observation aligns with the findings of Nahar et al.,[17] where stunted children exhibit inferior communication skills in comparison to their non-stunted counterparts.

Intelligence is also an aspect of development that can distinguish stunted children. The aspects include the ability to pour a drink using a spoon, providing three objects and correctly naming them, and successfully stacking five objects without toppling. The findings are in line with previous research,[18] indicating that children experiencing stunting demonstrate lower intelligence scores compared to non-stunted children. This leads to the conclusion that stunting adversely affects children's cognitive abilities.

Discriminant factors in growth and development of stunted and normal children aged 25–60 months

The discriminant analysis indicates that the discriminating factors for stunting are gross and fine motor skills. These results show that gross motor skills in children aged 25–60 months are the most distinguishing aspect of development in identifying stunting cases. The specific skills are standing on the tips of both feet and dancing to music. This is consistent with research findings on children aged 3–65 months, where acute nutritional disorders are associated with delayed development of gross motor skills, fine motor skills, social interaction abilities, and language development.[19]

Additionally, fine motor skills are a differentiating aspect of development in identifying stunting. The skills referred to are inserting and removing small objects. These results align with the research on 525 children, showing a significant relationship between stunting and impaired fine motor skills in under 5 years old.[20] In a similar finding, stunted children have poorer fine motor skills. This research shows that stunting can have a negative impact on the fine motor skills of young children, affecting their future development.[21,22]

Based on the explanation, gross motor skills are a strong discriminant factor for distinguishing stunted children in the age groups of 13–24 and 25–60 months. The skills are directly influenced by anthropometric factors, which determine stunting. This is a foundational aspect of development that contributes to other aspects, such as play activities and socialization. Furthermore, gross motor skills build self-confidence while engaging in environmental activities. Kartika et al.[23] also reported a relationship between stunting and gross motor development. Stunted children are likely to have 5.02 times the risk of experiencing impaired gross motor development compared to normal children. This is often due to the presence of malnutrition, which affects the development of the cerebellum, the area of the brain responsible for motor control. This phenomenon also hinders the formation and maturation of muscle tissue, resulting in stunted children having slower acquisition of motor skills and weaker muscles.

Children aged 0–5 years learn and acquire abstract concepts through physical exploration involving gross and fine motor skills. Therefore, impaired gross motor skills hinder the development of fine motor skills, as well as the exploration of the environment in children. This limits experiences, such as feeling textures, comparing sizes, and planning movements. The limited development of environmental experiences restricts thinking abilities, which ultimately affects passive communication. In line with previous research, stunted children experience delays in language development, making it difficult to express their desires, needs, thoughts, and ideas. Consequently, they interact with others through body movements or passive communication.[17]

Conclusion

Based on the discriminant function analysis and the discussion presented, four aspects of development can distinguish stunted children. These aspects are gross motor skills, fine motor skills, passive communication, and intelligence. These findings serve as valuable tools for early identification of a child's susceptibility to stunting. Consequently, parental stimulation in these four areas is paramount for the developmental progress of stunted children, commencing from their birth.

Recommendations

To optimize the development of stunted children, it is recommended to promptly provide stimulation for the enhancement of their gross motor skills, fine motor skills, passive communication, and intelligence. Examples of

stimulation that can be provided to enhance gross and fine motor skills include facilitating head support by placing children on their stomachs and engaging them with toys, promoting body tilting by producing sounds with a toy to prompt leaning, and allowing grasping and holding of objects in front. After children have acquired the fundamental abilities within the 0–6 month age range, they will progress to developing additional skills, including sitting, standing, walking, and gaining control over their body movements to maintain balance. Examples of stimulation for passive communication and intelligence include engaging in contact by following a toy with their eye gaze and attributing meaning to simple movements, such as waving, saying goodbye, and clapping hands.

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Author contributions

Ratna Jatnika: Manuscript writing, method, data analysis, and research management.
Hendriati Agustiani: Theoretical concept, data collection, and research management.
Fitri Ariyanti Abidin: Theoretical concept and data collection.
Fitriani Yustikasari Lubis: Theoretical concept and data collection.
Kustimah Kustimah: Theoretical concept and data collection.
Lucia Voni Febriani: Theoretical concept and data collection.
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Ethical approval

The study was approved by The Research Ethics Committee Universitas Padjadjaran Bandung (registration number: 973/UN6.KEP/EC/2022).

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References

1. Mawarti R. Stunting knowledge on the prevention of babies with BBLR in the PKU Muhammadiyah Yogyakarta Hospital. *Int J Heal Sci Technol* 2021; 2(2): 55–63.
2. Directorate General of Health Services. Apa Itu stunting, https://yankes.kemkes.go.id/view_artikel/1516/apa-itu-stunting (2022, accessed 7 February 2023).
3. National Development Planning Agency. *The national medium-term plan (RPJMN) for 2022–2024*. Jakarta: Bappenas, 2020.
4. Ministry of Health of the Republic of Indonesia. Situasi balita pendek di Indonesia. *Infodatin Pusat Data dan Informasi Kementerian Kesehatan RI*. https://www.kemkes.go.id/article/view/16090700002/situasi-balita-pendek-di-indonesia.html (2016, accessed 7 February 2023).
5. Prabhat N, Sarika G and Arlappa N. Anthropometric diagnosis of 6-59 months children with severe acute malnutrition: weight for Height-Z scores versus mid upper arm circumference. *Trends J Sci Res* 2022; 1(1): 40–48.
6. Perumal N, Bassani DG and Roth DE. Use and misuse of stunting as a measure of child health. *J Nutr* 2018; 148(3): 311–315.
7. Pelletier DL. The relationship between child anthropometry and mortality in developing countries: implications for policy, programs and future research., The J of Nutr 1994; 124: s2047–s2081.
8. Grace K, Nagle NN and Husak G. Can small-scale agricultural production improve children's health? Examining stunting vulnerability among very young children in Mali, West Africa. *Ann Am Assoc Geogr* 2016; 106(3): 722–737.
9. Susilawati E, Yanti and Hindratni F. *Penggunaan Kartu Kembang Anak (KKA) Sebagai Media Dalam Memantau Perkembangan Anak*. Pekanbaru: Taman Karya 2022.
10. Beal T, Tumilowicz A, Sutrisna A, et al. A review of child stunting determinants in Indonesia. *Matern Child Nutr* 2018; 14(4): e12617.
11. Hati FS and Pratiwi AM. The effect of education giving on the parent's behavior about growth stimulation in children with stunting. *NurseLine J* 2019; 4(1): 12–20.
12. Rahayu LS and Safitri DE. Child care practice as a risk factor of changes in nutritional status from normal to stunting in under five children. *Indian J Nutr Diet* 2018; 5(2): 77–81.
13. Bentzen WR. *Seeing young children: a guide to observing and recording behavior*. New York: Delmar Publishers, 1993.
14. Hair JF, Black WC, Babin BJ, et al. (eds). *Multivariate data analysis*. 8th ed. Cengage: Learning EMEA, 2019.
15. World Health Organization. *Childhood stunting: challenges and opportunities. Report of a promoting healthy growth and preventing childhood stunting colloquium*. Geneva: World Health Organization. https://iris.who.int/bitstream/handle/10665/107026/WHO_NMH_NHD_GRS_14.1_eng.pdf?sequence=1 (2014, accessed 10 March 2022).
16. Iannotti L, Jean Louis Dulience S, Wolff P, et al. Nutrition factors predict earlier acquisition of motor and language milestones among young children in Haiti. *Acta Paediatr* 2016; 105(9): e406–e411.
17. Nahar B, Hossain M, Mahfuz M, et al. Early childhood development and stunting: findings from the MAL-ED birth cohort study in Bangladesh. *Matern Child Nutr* 2020; 16(1): e12864.

18. Maulina R, Qomaruddin M, Prasetyo B, et al. The effect of stunting on the cognitive development in children: a systematic review and meta-analysis. *Stud Med* 2023; 17(1–2): 19–27.
19. Abessa TG, Bruckers L, Kolsteren P, et al. Developmental performance of hospitalized severely acutely malnourished under-six children in low-income setting. *BMC Pediatr* 2017; 17(1): 197.
20. Meylia KN, Siswati T, Paramashanti BA, et al. Fine motor, gross motor, and social independence skills among stunted and non-stunted children. *Early Child Dev Care* 2022; 192(1): 95–102.
21. Adair LS, Martorell R, Stein AD, et al. Size at birth, weight gain in infancy and childhood, and adult blood pressure in 5 low- and middle-income-country cohorts: when does weight gain matter? *Am J Clin Nutr* 2009; 89(5): 1383–1392.
22. Yap F and Sawyer A. The effects of stunting on fine motor skills in early childhood: a systematic review. *Matern Child Nutr* 2020; 16(4): e12973.
23. Kartika C, Suryani YD and Garna H. Hubungan *stunting* dengan perkembangan motorik kasar dan halus anak usia 2–5 tahun di Desa Panyirapan, Kecamatan Soreang Kabupaten Bandung. *J Intégr Kesehat Sains* 2020; 2(2): 104–108.