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Enhancing Cognitive Development of Stunted Children through Sensory Modalities: Evidence from Mataram, Indonesia

Siti Zaenab[1], Ida Bagus Alit Arta Wiguna[2],

Institut Agama Hindu Negeri Gde Pudja Mataram, NTB, Indonesia
E-mail: chilasita68@gmail.com

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Abstract

Stunting is a chronic nutritional problem that is still a serious concern in Indonesia, especially in West Nusa Tenggara, where the prevalence reaches more than 30%. In addition to impacting delayed physical growth, stunting also has implications for children's brain and cognitive development, which is characterized by low IQ scores, language delays, and reduced problem-solving skills. This study aims to analyze how sensory modalities can be used to stimulate the brains of stunted children in Mataram, focusing on strategies applied by teachers and parents. The study used a qualitative descriptive approach with a phenomenological design, involving six stunted children at Dwijendra Mataram Kindergarten, as well as supporting data from teachers and parents through observation, structured interviews, documentation, and simple questionnaires. The results indicated that stunted children responded more slowly to visual and auditory tasks but were more adaptive to tactile and kinesthetic stimulation, while 70% of teachers had never received special training and 65% of parents did not understand the importance of sensory-based brain stimulation. These findings confirm that stunting in Mataram is not only influenced by malnutrition, but also by limited stimulation of the human senses, namely the senses of sight, hearing, smell, taste and touch. both at school and at home. The originality of this research lies in the introduction of the concept of modality task fit, which emphasizes the importance of choosing the type of stimulation according to the strength of the sensory pathway of stunted children. This concept contributes to early childhood education and public health by offering a precise, systematic, and effective intervention framework. The study's conclusions emphasized the importance of combining nutritional improvement with multi-sensory-based brain stimulation to optimize the cognitive development of stunted children.

Kata kunci:	*Abstrak*
stunting, stimulasi otak, modalitas indra, anak usia dini, Mataram	*Stunting merupakan masalah kronis yang masih menjadi perhatian serius di Indonesia, khususnya di Nusa Tenggara Barat yang prevalensinya mencapai lebih dari 30%. Selain berdampak pada keterlambatan pertumbuhan fisik, stunting juga berimplikasi pada perkembangan modalitas otak dan kognitif anak, yang ditandai dengan rendahnya skor IQ, keterlambatan bahasa, serta berkurangnya kemampuan pemecahan masalah. Penelitian ini bertujuan untuk menganalisis bagaimana modalitas indra dapat digunakan untuk menstimulasi otak anak stunting di Mataram, dengan fokus pada strategi yang diterapkan guru dan orang tua. Penelitian menggunakan pendekatan deskriptif kualitatif dengan desain fenomenologi, melibatkan anak stunting di TK Dwijendra Mataram, serta data pendukung dari guru dan orang tua melalui observasi, wawancara terstruktur, dokumentasi.. Hasil penelitian menunjukkan bahwa anak stunting merespons lebih lambat pada tugas visual dan auditori, tetapi lebih adaptif pada stimulasi taktil dan kinestetik, sementara 70% guru belum pernah mendapatkan pelatihan khusus dan 65% orang tua belum memahami pentingnya stimulasi modalitas indra. Temuan ini menegaskan bahwa stunting di Mataram tidak hanya dipengaruhi oleh kekurangan gizi, tetapi juga oleh keterbatasan stimulasi indra manusia yakni indra penglihatan, pendengaran, penciuman, perasa dan peraba. baik di sekolah maupun di rumah. Orisinalitas penelitian ini terletak pada pengenalan konsep modality task fit, yang menekankan pentingnya pemilihan jenis stimulasi sesuai kekuatan jalur indra pada anak stunting. Konsep ini memberikan kontribusi bagi ilmu pendidikan anak usia dini dan kesehatan masyarakat dengan menawarkan kerangka intervensi yang presisi, sistematis, dan efektif. Kesimpulan penelitian menekankan pentingnya mengombinasikan perbaikan gizi dengan stimulasi otak berbasis multi indra untuk mengoptimalkan perkembangan kognitif anak stunting.*

I. INTRODUCTION

Stunting is a chronic nutritional problem that is still a serious concern in Indonesia (Ariani, 2020; Budiastutik & Nugraheni, 2019; Mediani, 2020). Based on the 2022 Indonesian Nutrition Status Survey, the national stunting prevalence is still at 21.6%, higher than the WHO threshold of 20%. West Nusa Tenggara is one of the provinces with a fairly high prevalence of stunting, reaching more than 30%. This condition shows that stunting is still a major obstacle in efforts to produce a healthy and productive generation for Golden Indonesia 2045.

Stunting not only affects children's physical growth but also has significant implications for their brain and cognitive development (Borja & Amarra, 2013; Lessa Horta et al., 2016; Soliman et al., 2021). Children with a history of stunting tend to have lower IQ scores, experience language delays, and face difficulties in concentration and problem-solving. Research by Nazidah et al., (2022) confirms a significant relationship between stunting and delays in early childhood cognitive development. The latest findings of Lantara et al., (2024)

also show that stunted children aged 2–5 years experience a significant decline in memory and comprehension functions compared to children of their age.

The results of initial observations at Dwijendra Mataram Kindergarten in January 2024 found six children with indications of stunting. In learning activities, the children appear to be less responsive to sensory activities, such as recognizing colors, following the rhythm of music, or responding to the teacher's commands. Interviews with parents show that most have not done regular sense-based brain stimulation at home. A simple questionnaire distributed to 20 teachers in Mataram City showed that 70% of teachers had not received special training on stimulating stunted children, while 65% of parents admitted that they did not understand the importance of sensory exercise for children's development.

The initial data shows that there is a gap between the need for brain stimulation of stunted children and practices in the field that still focus on providing nutrition alone (Black et al., 2015; Haselow et al., 2016). In fact, the latest literature confirms the importance of developmental stimulation interventions. Abdurrahmat et al., (2023) showed that interventions in the form of stimulation of complementary foods

nutrition development and education significantly improved the weight, height, and nutritional status of stunted children. This means that nutritional fulfillment needs to be accompanied by brain stimulation so that the results are more optimal.

Research by Meliati et al., (2020) also supports the importance of the role of stimulation. Their study found that maternal self-stimulation in babies with a history of low birth weight was able to significantly improve motor and cognitive development. This phenomenon is relevant to the condition of stunted children who also need environmental support in the form of multi-sensory stimulation so that their brains develop optimally.

The results of international and national research strengthen the argument that brain stimulation based on sensory modalities is indispensable (Hariz et al., 2013; Polanía et al., 2018a, 2018b; Schulder et al., 2023). Visual, auditory, tactile, and kinesthetic stimulation can activate various parts of the child's brain that is in the golden age phase. Chang et al., (2002) even emphasized that stunted children have lower school achievement and smaller IQ scores than non-stunted children, regardless of their socioeconomic background. This condition indicates the importance of brain stimulation-based interventions so that children still can develop optimally.

From a theoretical perspective, neuroplasticity explains that the brain of early childhood is highly adaptive to environmental stimuli. Abebe et al., (2019) and Goodwin, (2008) has emphasized that early childhood education should foster awareness and understanding through sensory experiences. This theory is relevant in the context of research because it emphasizes the importance of providing diverse and repetitive sensory stimuli so that the child's brain can function optimally despite physical growth barriers.

Literature reviews in the last five years also support the direction of this research. The research of Susanti et al., (2024) shows that there is a relationship between feeding parenting and stunting incidence, while the study of Chattopadhyay & Saumitra, (2016) and Gladstone et al., (2014) highlights risk factors for malnutrition related to the low quality of child developmental stimulation. Meanwhile, the latest research by Abdurrahmat et al. (2023)

emphasizes the importance of early detection and sensory stimulation in dealing with stunting, an approach that is rarely comprehensively integrated in Indonesia.

The main gap identified is the lack of local research that examines the role of sensory modalities in stimulating the brains of stunted children, especially in Mataram City. Most of the research still focuses on nutritional interventions, while the stimulation aspect of the brain has not received much attention. In fact, the results of initial observations in the field show that the lack of sensory stimulation is actually an important factor that affects the delay in the development of stunted children in Mataram.

With this gap, research on brain stimulation of stunted children through sensory modalities in Mataram is expected to be able to make a new contribution to early childhood education and public health. This study emphasizes that in addition to nutrition, multi-sensory-based brain stimulation is an important strategy that needs to be integrated in handling stunting at the family, school, and community levels.

The main purpose of this study is to analyze the strategies of teachers and parents in stimulating the brains of stunted children through sensory modalities in Mataram City. This study aims to identify the forms of stimulation that have been carried out, analyze the obstacles faced by teachers and parents, and formulate practical solutions based on early childhood education theory.

The benefits of this research are divided into two aspects. From the theoretical side, this research contributes to the development of the literature on the relationship between stunting and multi-sensory stimulation, especially in Indonesia. From a practical perspective, the results of the research can be a guideline for teachers, parents, schools, and local governments in designing more comprehensive educational interventions for stunted children.

Thus, this research is expected to be an important reference in formulating more comprehensive intervention policies and strategies. This research not only focuses on nutritional aspects but also on brain stimulation, which is the foundation of early childhood cognitive development.

II. METHOD

This research was conducted with a qualitative descriptive approach using phenomenological strategies to explore in depth the practice of brain stimulation of stunted children through sensory modalities at Dwijendra Mataram Kindergarten. The study subjects included six early childhood children with indications of stunting as the main focus, as well as teachers and parents as supporting informants who were purposively selected according to their direct involvement in the stimulation process. The research instruments used consisted of observation sheets to record children's daily stimulation activities at school, structured interview guidelines submitted to teachers and parents to find out strategies and constraints, and documentation in the form of records of children's development and activities. The data obtained was analyzed through three stages, namely data reduction, data presentation, and conclusion drawing by triangulating sources to increase the validity of the findings. The results of observation and interviews were then supported by a simple

quantitative analysis with tabulation of the frequency and percentage of the questionnaire distributed to teachers and parents to strengthen the pattern of findings.

III. RESULTS AND DISCUSSION

1. Research Results

The results of this study were obtained from a series of observations on stunted children at Dwijendra Mataram Kindergarten, interviews with teachers and parents, and processing of supporting data in the form of simple questionnaires. The data collected was then analyzed qualitatively with a phenomenological approach to capture the meaning of teachers, parents, and children's experiences in the process of brain stimulation based on sensory modalities.

Observations show that stunted children in Dwijendra Mataram Kindergarten tend to be slower in responding to visual and auditory instructions than non-stunted children. For example, when the teacher invites them to sing while clapping their hands, some stunted children need to repeat the instruction more than twice. In addition, in color recognition activities, they often need direct help to point to or name the correct color. These findings show that there is a delay in sensory function that is closely related to brain ability.

Interviews with teachers revealed that most teachers have not received special training on stimulation of stunted children. They teach the same general method for all children. This causes stunted children not to receive treatment that suits their needs. Some teachers admitted that it was difficult to pay special attention due to limited time and the large number of students in the class.

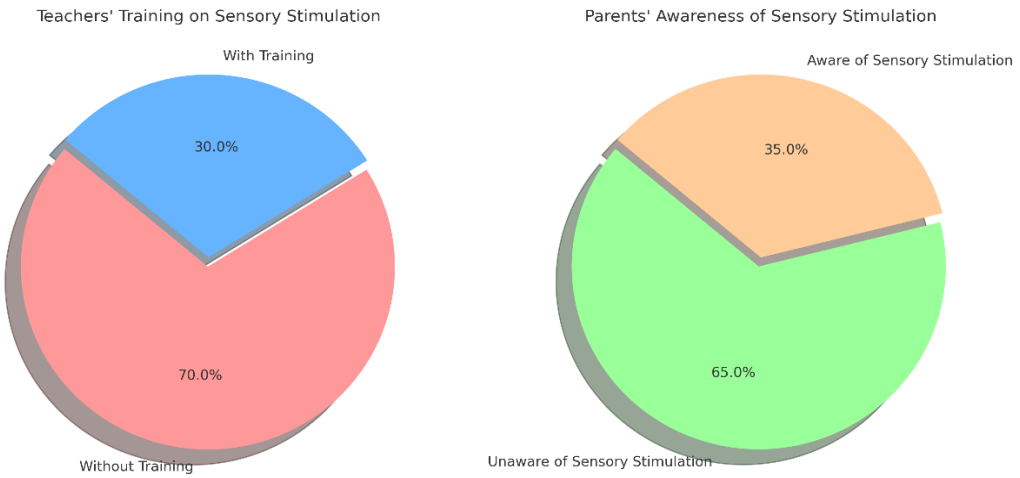

Figure 1. Field Data Visualization

Meanwhile, interviews with parents show that most of them do not understand the importance of targeted sensory stimulation at home. They consider nutritional intake to be enough to support children's growth and development. In fact, questionnaire data shows that 65% of parents rarely do simple activities such as reading stories, inviting children to listen to music, or practicing fine motor movements. This confirms that sensory stimulation at home has not been a priority.

In the analysis of questionnaire data, it was seen that 70% of Kindergarden teachers stated that they had never participated in training on brain stimulation strategies based on sensory modalities. The rest admitted that they only knew in general through teaching experience, not through official guidance. This condition creates a gap between needs in the field and teacher competence.

Analysis of the observation results showed that visual stimulation in the form of drawing and coloring activities could not be followed optimally by stunted children. They tend to get tired quickly and get bored easily. However, kinesthetic stimulation such as role-playing or body movements turns out to be easier to follow. This shows that each stunted child has different strengths and limitations of the senses, so the approach must be adjusted. In-depth interviews with teachers corroborated the results of observations. The teacher mentioned that stunted children understand instructions faster when given direct examples, not just verbal commands. For example, when invited to arrange blocks, children are more able to follow if the teacher participates in arranging them with them. These findings prove that tactile and kinesthetic stimulation are more effective than verbal instructions alone.

Documentation data shows that stunted children who receive regular sensory stimulation tend to have better development than those who do not. For example, a child whose parents often invite them to play with puzzles at home is faster to recognize shapes and patterns than other children who are only given toys without assistance. This confirms that parental involvement is an important factor in the success of stimulation.

Gambar 2. Word Text Query Chart

The results of the qualitative analysis also found that teachers often judge stunted children only by their physical appearance that looks healthy, without deeply checking their sensory functions. This causes some children to not be identified as having sensory barriers, so that treatment is less than optimal. This misperception is a serious challenge in early childhood education.

In terms of parenting, parents who work full-time admit that it is difficult to take the time to do stimulation. They give more responsibility to the school. As a result, children only

get limited stimulation during school hours, even though brain development requires consistent stimulation every day. This shows that there is a gap in roles between teachers and parents.

The latest literature supports the field findings. Research by Abdurrahmat et al., (2023) proves that complementary foods nutrition stimulation and nutrition education interventions provide positive results on the growth of stunted children. Likewise, research by Meliati et al. (2020) shows the important role of maternal stimulation for babies with a history of BBLR in improving cognitive development. These facts confirm the relevance of the research results to previous studies.

Triangulation analysis between observation, interview, and questionnaire data showed a consistent pattern that brain stimulation of stunted children in Mataram has not been optimally carried out due to the lack of understanding of teachers and parents about the importance of sensory modalities. Children are still educated with a general approach without differentiating methods that adapt to their sensory needs.

These results also show that although parents and teachers know the importance of nutrition, they pay less attention to the stimulation aspect of the brain. In fact, the latest literature confirms that nutrition and stimulation are two factors that complement each other. The absence of one will hinder the development of the child.

From the overall findings, it can be concluded that the stunting problem in Mataram is not only due to malnutrition but also due to the lack of brain stimulation based on sensory modalities both at school and at home. Teachers need special training, while parents need to be counseled on the importance of simple but consistent sensory stimulation.

Thus, the results of this study confirm that an effective intervention for stunted children must combine nutritional improvement with sensory-based brain stimulation programs. This program requires synergy between teachers, parents, and educational institutions so that stunted children in Mataram can develop optimally both physically and cognitively.

2. Discussion

Field findings show that cognitive barriers in stunted children at Dwijendra Mataram Kindergarten do not stand alone as a nutritional consequence but are intertwined with the low intensity and quality of multi-sensory stimulation at home and school. Slower response patterns on visual-auditory tasks as well as relatively better progress when stimuli are kinesthetic/tactile suggest that activation of certain sensory pathways is more "affordable" for the child, while other pathways require more structured training. This pattern is consistent with the literature that links stunting with a decline in core cognitive function (memory, language, comprehension), so that children need systematic stimulus support to "make up" their initial limitations.

When compared to the current research, our results are in line with a cross-sectional study in Makassar that found a meaningful relationship between stunting status and cognitive development scores for ages 2–5 years. The researcher emphasized that long-term malnutrition alters brain structure/function and impacts cognitive performance; our findings add a practical layer that the type of modality (visual, auditory, tactile, or kinesthetic)

mediates how effectively stimulation 'lands' on stunted children in the context of an early childhood education classroom.

On the other hand, evidence of the effect of stimulation by parents on infants with a history of BBLR showed a significant improvement in length/weight/cognition after daily stimulation-based interventions. Although populations are different (BBLR vs. stuned), the repair mechanisms are parallel: intensive stimulation adds sensory 'input' and facilitates learning measured on growth and development indicators. Our results replicate the direction of the findings in the context of Mataram City Kindergarden and emphasize the importance of orchestration of cross-sensory stimulation—not just the repetition of general activities so that learning transfer occurs in the cognitive domains relevant to school readiness.

A combination intervention in stunted toddlers that combined complementary foods education and stimulation packages showed significant improvements in weight, height, nutritional status, and energy intake but has not consistently increased developmental scores in a very short period of time (1 month). This provides an important context for our findings: shifts in nutritional indicators can occur relatively quickly with dietary and educational support, whereas cognitive "fruits" require time, repetition, and modality-specific stimulation design. Therefore, when teachers/parents in Mataram have not arranged a per-sense stimulation program and its implementation has not been intensive, the cognitive impact is naturally restrained even though nutritional awareness increases.

Another contrast emerged from a review study of stunting and early childhood cognition: a strong correlation of stunting and cognitive decline signaled systemic risks to language, attention, and problem-solving. Our field findings underscore the "implementation bottleneck": 70% of teachers have never been trained in sensory stimulation for stunting, and 65% of parents are not yet aware of simple stimulation practices at home. That is, the gap is not on "what needs to be done" according to the evidence, but on *who is doing it, how, and how often*. This is the locus of practical novelty of this research—shifting the focus from the "what" to *the delivery mechanism* and *stimulation dosage* per modality in the classroom and at home.

The theoretical implication is the need to map *modality–task fit*: stunted children in our observation are more likely to imitate actions (kinesthetic/tactile) than to follow abstract (auditory) or discrete visual instructions with high accuracy (rapid color/shape matching). By stringing together learning tasks that marry strong paths (tactile/kinesthetic) to "pull" weak paths (auditory/visual), teachers can design more realistic *scaffolding trajectories*. This adds to the contribution to early childhood education practice: not just "a lot of stimulation," but "stimulation aligned with the strength of the child's modality" to maximize transfer opportunities into the realms of language, pre-literacy, and executive functions.

Read together with the literature, our findings also challenge the field view that is too quick to conclude that "physical appearance means optimal sensory function." Classroom observations showed that several physically healthy children failed simple fine sensory tasks—an indication *of understimulation* rather than a mere nutritional deficit. This is consistent with evidence that even after nutritional interventions, without directed sensory exercise, cognitive acceleration does not automatically follow. Therefore, routine assessments of sensory function and assessment of sensory tasks should be a standard part of early childhood education services for at-risk populations.

Policy-wise, our results support the "two-track" model of intervention: the nutrition trajectory (complementary foods education, intake monitoring) *and the* stimulation trajectory (a daily program per modality with session plans, durations, and weekly achievement indicators). The intervention literature showing short-term nutritional impacts provides a foothold for securing a 'metabolic underpinning,' while a more modality-rich stimulation component targets medium-term cognitive 'leaps.' This recommendation is based on the 2023–2024 evidence and places Kindergarden and families as the main implementing units.

The *original contribution of this article lies in three key areas: the detailed mapping of stunted children's responses across modalities in real-world classroom situations; the association between the delivery gap (which includes a lack of teacher training and parental awareness) and stagnation in cognitive achievement; and the proposed modality–task fit as a replicable stimulation design strategy. L*inking local findings to primary evidence recently, this article shifts the discussion from "whether stimulation is important" to "what kind of stimulation, by whom, and how intense" in the context of urban early childhood stunting.

However, there are limitations worth noting: the small number of core children and purposive selection of informants' limit generalization; the duration of monitoring is not sufficient to capture *cognitive lag*; and there are no standardized pre-post cognitive measurements in specific domains (e.g., *working memory*, *phonological awareness*). These limitations, together with evidence that nutritional reinforcement alone has not increased development at 1 month, open up the opportunity for quasi-experimental trials with a stimulation dose of ≥12 weeks and sharper cognitive indicators.

A logical follow-up research direction is to compare "general" versus "modality–task fit" stimulation packages in stunted children, with pre–post and 3–6 month *follow-up cognitive outcomes*. Considering the results of the BBLR study based on maternal stimulation, parental involvement needs to be formatted as a core component with short but consistent daily home practice so that schools and homes become a single circuit of stimulation.

In practical terms, the recommendations that emerged from the results and literature are to seek rapid training for early childhood education teachers on simple sensory assessments and cross-sensory session design; provide a toolkit of 10–15 minutes of activity per modality that is easy to rotate in class; and compile *a home practice* sheet of two–three tactile/kinesthetic exercises plus one auditory/visual exercise per day for families. Thus, interventions become measurable, structured, and consistent while closing identified implementation gaps.

Finally, a critical reading of these results places stunting as an issue that must be addressed through the lens of *developmental systems*: nutrition organizes the biological substrate, while precise sensory stimulation organizes the architecture of the learning experience. When the two go hand in hand and are carried by trained agents (teachers) and motivated (parents), the latest literature hints at a real opportunity for cognitive improvement relevant and urgent prospects for Mataram and similar regions.

CONCLUSION

Brain stimulation through sensory modalities in stunted children at Dwijendra Mataram Kindergarten has not been running optimally due to the limited knowledge of

teachers and parents, so that children show slower sensory responses to visual and auditory tasks but are more adaptive to tactile and kinesthetic stimulation; these findings show that there is a gap between stimulation needs and field practice, and give birth to a new contribution in the form of modality-task fit concepts which emphasizes the importance of selecting the type of stimulation according to the strength of the sensory pathway of stunting children, so that it can be used as a foothold for teachers, parents, and researchers to design more precise, systematic, and effective interventions in improving cognitive function while expanding the development of early childhood education and public health.

BIBLIOGRAPHY

Abdurrahmat, A. S., Betaditya, D., Yunianto, A. E., Wardhani, Y. S., & Wardhani, Y. L. (2023). Intervention of Development Stimulation and Nutrition Education of Complementary Feeding on The Growth and Development of Stunting Under-Free Children. *Jurnal Ilmiah Kesehatan (JIKA)*, *5*(3). https://doi.org/10.36590/jika.v5i3.569

Abebe, B. T., Weiss, M., Modess, C., Roustom, T., Tadken, T., Wegner, D., Schwantes, U., Neumeister, C., Schulz, H., Scheuch, E., al., et, Abu-Saad, K., Murad, H., Barid, R., Olmer, L., Ziv, A., Younis-Zeidan, N., Kaufman-Shriqui, V., Gillon-Keren, M., … Masha'al, D. (2019). Mindfulness virtual community. *Trials*, *17*(1).

Ariani, M. (2020). Determinan Penyebab Kejadian Stunting Pada Balita: Tinjauan Literatur. *Dinamika Kesehatan: Jurnal Kebidanan Dan Keperawatan*, *11*(1). https://doi.org/10.33859/dksm.v11i1.559

Black, M. M., Pérez-Escamilla, R., & Rao, S. F. (2015). Integrating nutrition and child development interventions: Scientific basis, evidence of impact, and implementation considerations. *Advances in Nutrition*, *6*(6). https://doi.org/10.3945/an.115.010348

Borja, J. B., & Amarra, S. (2013). The impact of early nutrition on health: Key findings from the cebu longitudinal health and nutrition survey (CLHNS). *Malaysian Journal of Nutrition*, *19*(1).

Budiastutik, I., & Nugraheni, S. A. (2019). Determinant of Stunting in Indonesia: A Review Article. *International Journal of Healthcare Research*, *1*(2). https://doi.org/10.12928/ijhr.v1i2.753

Chang, S. M., Walker, S. P., Grantham-McGregor, S., & Powell, C. A. (2002). Early childhood stunting and later behaviour and school achievement. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *43*(6). https://doi.org/10.1111/1469-7610.00088

Chattopadhyay, N., & Saumitra, M. (2016). Developmental outcome in children with malnutrition. *Journal of Nepal Paediatric Society*, *36*(2). https://doi.org/10.3126/jnps.v36i2.14619

Gladstone, M., Mallewa, M., Alusine Jalloh, A., Voskuijl, W., Postels, D., Groce, N., Kerac, M., & Molyneux, E. (2014). Assessment of neurodisability and malnutrition in children in Africa. *Seminars in Pediatric Neurology*, *21*(1). https://doi.org/10.1016/j.spen.2014.01.002

Goodwin, P. M. (2008). *Sensory experiences in the early childhood classroom: Teachers' use of activities, perceptions of the importance of activities, and barriers to implementation*. Oklahoma State University.

Hariz, M., Blomstedt, P., & Zrinzo, L. (2013). Future of brain stimulation: New targets, new indications, new technology. In *Movement Disorders* (Vol. 28, Issue 13). https://doi.org/10.1002/mds.25665

Haselow, N. J., Stormer, A., & Pries, A. (2016). Evidence-based evolution of an integrated nutrition-focused agriculture approach to address the underlying determinants of stunting. *Maternal and Child Nutrition*, *12*. https://doi.org/10.1111/mcn.12260

Lantara, A. M. H. D., Sangkal, A., Latief, S., Darma, S., & Bakhtiar, I. K. A. (2024). Stunting and Cognitive Develompent of Children Aged 2-5 Years. *Jurnal Biologi Tropis*, *24*(1), 753–758.

Lessa Horta, B., Victora, C. G., Loret De Mola, C., Quevedo, L., Tavares Pinheiro, R., Gigante, D. P., Vieira, J., Motta, S., & Barros, F. C. (2016). Associations of Linear Growth and Relative Weight Gain in Early Life with Human Capital at 30 Years of Age THE JOURNAL OF PEDIATRICS • www.jpeds.com. *The Journal of Pediatrics*, *182*.

Mediani, H. S. (2020). Predictors of Stunting Among Children Under Five Year of Age in Indonesia: A Scoping Review. *Global Journal of Health Science*, *12*(8). https://doi.org/10.5539/gjhs.v12n8p83

Meliati, L., Ekayani, N. P. K., & Khadijah, S. (2020). Effects of the Mother's Individual Stimulation on the Growth and Development of Infants With Low Birth Weight History. *Journal of Holistic Nursing and Midwifery*, *30*(4). https://doi.org/10.32598/jhnm.30.4.2039

Nazidah, M. D. P., Fauziah, R., Hafidah, R., Jumiatmoko, J., & Nurjanah, N. E. (2022). Pengaruh Stunting pada Kognitif Anak Usia Dini. *Yinyang: Jurnal Studi Islam Gender Dan Anak*. https://doi.org/10.24090/yinyang.v17i1.4964

Polanía, R., Nitsche, M. A., & Ruff, C. C. (2018a). Establishing brain-behavior relations with NIBS Studying and modifying brain function with non-invasive brain stimulation. *Nature Neuroscience*, *21*.

Polanía, R., Nitsche, M. A., & Ruff, C. C. (2018b). Studying and modifying brain function with non-invasive brain stimulation. In *Nature Neuroscience* (Vol. 21, Issue 2). https://doi.org/10.1038/s41593-017-0054-4

Schulder, M., Mishra, A., Mammis, A., Horn, A., Boutet, A., Blomstedt, P., Chabardes, S., Flouty, O., Lozano, A. M., Neimat, J. S., Ponce, F., Starr, P. A., Krauss, J. K., Hariz, M., & Chang, J. W. (2023). Advances in Technical Aspects of Deep Brain Stimulation Surgery. In *Stereotactic and Functional Neurosurgery* (Vol. 101, Issue 2). https://doi.org/10.1159/000529040

Soliman, A., De Sanctis, V., Alaaraj, N., Ahmed, S., Alyafei, F., Hamed, N., & Soliman, N. (2021). Early and long-term consequences of nutritional stunting: From childhood to adulthood. *Acta Biomedica*, *92*(1). https://doi.org/10.23750/abm.v92i1.11346

Susanti, A. I., Arya, I. F. D., Megawati, G., Fatimah, S. N., Sari, S. Y. I., & Mandiri, A. (2024). Optimalisasi Peran Pola Asuh Orang Tua Dalam Pencegahan Stunting Pada Balita: Edukasi Komprehensif. *WIDYA LAKSANA*, *13*(2).