

Promoting Vegetable Consumption among Malaysian Young Children: A Socio-Ecological Perspective

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ABSTRACT

Vegetable consumption is a critical component of children's nutrition, yet young children in Malaysia often fail to meet recommended intake levels. This paper explores the barriers and potential strategies for improving vegetable consumption among Malaysian preschool children through a socio-ecological perspective. Factors influencing intake are multi-dimensional, ranging from biological and behavioural traits of children, parental feeding practices, and home environments, to wider community influences, economic constraints, and existing government policies. Food neophobia, parental modelling, limited school-based nutrition education, and the lack of targeted interventions further exacerbate the problem. Addressing these barriers requires integrated strategies involving parents, teachers, and policymakers to create consistent and supportive nutrition environments both at home and in early childhood education settings. The paper highlights research gaps and emphasizes the need for evidence-based, culturally relevant, and developmentally appropriate interventions to foster positive attitudes toward vegetables. By adopting a holistic socio-ecological approach, this study aims to inform policy, strengthen educational practices, and contribute to the promotion of sustainable healthy eating habits among young children in Malaysia.

Keywords— early childhood nutrition, food preference, vegetable consumption, parental influence.

INTRODUCTION

Vegetable consumption is widely recognized as a crucial component of a balanced diet and foundational for children's lifelong health (WHO, 2018a). Early childhood is a formative period when dietary preferences are established and tend to persist in later life. Although Malaysian dietary guidelines recommend at least two servings of vegetables daily for children under seven, empirical evidence indicates that this target is rarely met in practice. Healthy eating habits should be cultivated from home during early childhood as lifelong practices, yet a pilot needs analysis among preschool teachers in Kuala Lumpur revealed a strong demand for the development of structured nutrition education modules to enhance children's understanding and acceptance of balanced diets (Sha An Ali et al., 2020 & Wan Risad et al., 2023).

Promotion of vegetable intake among young children is challenging and influenced by multiple interacting factors. Locally, a qualitative study in Kuala Lumpur revealed that children's perspectives on vegetables and even participation in gardening activities shape their willingness to consume vegetables, suggesting that hands-on, experiential approaches may foster better acceptance (Mok et al., 2023). At the preschool level, educators have expressed a strong need for structured learning modules focused on fruits and vegetables, highlighting the potential for school-based interventions (Sukor et al., 2025).

Beyond the local context, broader evidence from low- and middle-income countries underscores common barriers such as socio-demographic constraints, cultural preferences, environmental limitations, food costs; and outlines effective strategies like behaviour-change communication, nutrition education, gardening initiatives, and policy-supported programs such as farm-to-institution and subsidies (Kaur S., 2023); all of which may be adapted for the Malaysian setting. Although nutrition education has been identified as a strategy to enhance

children's understanding of balanced diets, however, previous studies have tended to adopt a general approach without addressing specific needs such as those of stunted children in childcare settings (Zulkifli et al., 2025).

A balanced diet is important for children's growth and development. Southeast Asian Nutrition Surveys (SEANUTS) findings in Indonesia, Thailand, Vietnam and Malaysia show that children's IQ and cognitive performance are influenced by their nutritional status. In Malaysia, studies show that children who are undernourished grow to be underweight, show stunted height and face the probability of developing low IQ (Poh et al., 2019).

Consumption of macronutrients such as carbohydrates, fats and proteins, and micronutrients such as vitamins and minerals are essential for brain development, especially in early childhood (Who, 2018b). In a study conducted by (Poh et al., 2019).in the Southeast Asian Nutrition Surveys (SEANUTS) involving children between 5 and 12 years of age in Malaysia, children with obesity commonly consume an energy-rich diet but with low micronutrient content, e.g. iron, sodium, zinc and vitamin B12 which all play important roles in cognitive development.

In Malaysia, the Ministry of Health and the Ministry of Education carry out various efforts concerning health and nutrition as part of the pre-school system. These include implementing one-off programs such as Modul Latihan Penyediaan Makanan di TASKA, TADIKa dan Prasekolah and Modul Penyediaan Makanan Berkhasiat bagi Kanak-kanak Prasekolah which are training modules. Besides that, the Malaysian Nutrition Association provides a nutritional guide for early childhood education professionals and a downloadable activity book on their website. However, these efforts do not particularly stress vegetable consumption at home. As such, further research should include more focus on the home environment.

This paper employs a socio-ecological framework to understanding vegetable consumption among Malaysian preschoolers from a socio-ecological perspective. By exploring individual traits (e.g., taste preferences, food neophobia), family dynamics (e.g., parental modelling, home mealtime routines), educational settings (e.g., teacher-led modules), community environments, and policy-level factors, it aims to identify gaps and propose integrated, evidence-based, culturally relevant interventions. Such a holistic approach is vital to foster sustainable, healthy dietary behaviors during early childhood and contribute to broader public health outcomes.

Theoretical Framework

This study adopts a socio-ecological perspective to understand and promote vegetable consumption among young children, supported by several theories of learning and development. Children's knowledge, attitudes, and behaviours toward food particularly vegetables are shaped through complex interactions between individual, familial, and environmental factors. To strengthen this framework, multiple learning and developmental theories are integrated list in Fig. 1 below.



Fig. 1 Socio-ecological Perspectives

Firstly, Social Cognitive Theory (Bandura, 1986) serves as a foundation in explaining how children acquire eating behaviours through observation, modelling, and reinforcement. Children aged 4 to 6 learn not only from direct experience but also from observing parents, teachers, and peers during mealtimes. Within this theory, three interrelated determinants are emphasised: personal factors (such as intrinsic motivation and self-regulation), environmental influences (such as parental encouragement and food availability), and behavioural outcomes (such as children's willingness to try vegetables). This triadic reciprocity highlights the importance of aligning home and preschool environments to create consistent positive exposure to vegetables.

Secondly, Cognitive Developmental Theory (Piaget, 1970) explains how children at the pre-operational stage (ages 4–6) actively construct knowledge through exploration and interaction with their environment. At this stage, children are curious learners who benefit from concrete, hands-on experiences, such as gardening, food preparation, or taste-testing activities. These experiences enable them to assimilate and accommodate new knowledge, thereby fostering more positive attitudes towards vegetable consumption.

Thirdly, Sociocultural Theory (Vygotsky, 1978) underscores the role of social interactions and cultural tools in learning. Children's eating behaviours are not developed in isolation but are socially mediated, particularly within the home and school settings. Guided participation from parents and teachers through scaffolding strategies such as encouragement, storytelling, and shared cooking activities helps children to internalise positive food-related practices. The *Zone of Proximal Development (ZPD)* is especially relevant here, as children may initially resist vegetables but, with appropriate support and modelling, gradually develop acceptance and preference.

In addition, Gagné's Theory of Instructional Events (1965) provides a useful lens for structuring effective pedagogical interventions. According to this theory, learning occurs in sequential stages gaining attention, presenting stimuli, providing guidance, eliciting performance, and offering feedback. These stages can be applied in the development of structured nutrition education modules to ensure that knowledge about vegetables is not only delivered but also reinforced through practice and reflection.

Finally, Cognitive Developmental and Behavioural Perspectives converge to suggest that motivation and reinforcement play a critical role in sustaining behavioural change. Positive reinforcement (e.g., praise, rewards, enjoyable mealtime experiences) and repeated exposure have been shown to improve children's willingness to consume vegetables (Holley et al., 2018; Hodder et al., 2018).

The framework (refer to Figure 2) shows interaction between socio-ecological layers (individual, family, school, community, policy) and multiple learning theories guiding strategies to promote vegetable consumption.

It is essential to anchor the study within a strong theoretical foundation. Understanding children's vegetable consumption requires not only empirical evidence but also guidance from established learning and developmental theories. This study integrates a socio-ecological perspective with relevant learning theories, including Social Cognitive Theory, Cognitive Development Theory, Sociocultural Theory, Gagné's Instructional Events, and Behavioural-Developmental Perspectives.

Conceptual Framework: Promoting Vegetable Consumption among Young Children

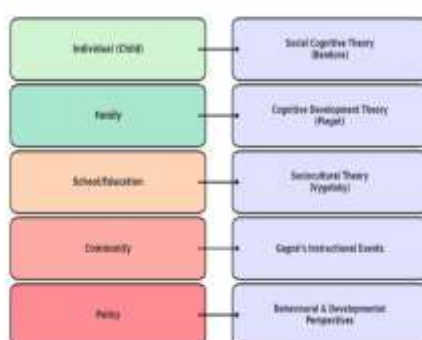


Fig. 2 Conceptual Framework

By integrating these theories, this study frames vegetable consumption as both a cognitive process (knowledge and understanding), a social process (interaction with parents, teachers, and peers), and a behavioural process (habit formation). This multi-theoretical approach ensures that interventions are developmentally appropriate, socially contextualised, and pedagogically structured, thereby strengthening efforts to cultivate sustainable healthy eating behaviours among young children in Malaysia.

LITERATURE REVIEW

Importance of Vegetable Consumption in Early Childhood

Vegetables are central to a balanced diet as they provide essential fibre, vitamins, and minerals needed for growth and development. Dietary fibre from vegetables aids digestion, prevents constipation, and contributes to gut health, which is increasingly recognised as foundational for immunity and overall wellbeing (Taylor et al., 2016; Samuel et al., 2018). Beyond physical health, vegetable intake has been linked to improved cognitive function, attention span, and school readiness, as nutrient sufficiency is critical for brain development (Poh et al., 2019).

Globally, systematic reviews confirm that higher fruit and vegetable intake reduces the risk of cardiovascular disease, cancer, and all-cause mortality, reinforcing the need to promote these foods from early childhood (Aune et al., 2017). More recent evidence highlights that dietary deficiencies during the preschool years contribute not only to malnutrition but also to developmental delays, including stunting and impaired learning capacity (WHO, 2020; Sukor et al., 2025). Thus, establishing vegetable intake during early childhood is both a preventive health measure and an investment in human capital.

Current Intake Patterns among Children

Despite international and national recommendations, children's vegetable intake continues to fall short of targets. The WHO recommends at least five daily servings of fruits and vegetables, yet in many low- and middle-income countries (LMICs), average consumption remains significantly below this level (Kaur, 2023).

In Malaysia, national dietary guidelines recommend two servings of vegetables daily for children under seven (MOH, 2010). However, local studies consistently report that preschool-aged children consume less than the recommended amounts. A large-scale study in Kuala Lumpur found that children aged 1 to 6 consumed only 1.07 servings of vegetables per day (Chong et al., 2017). More recent regional studies in Terengganu confirmed similar findings, where children aged 4 to 6 years often consumed less than two servings daily, with food fussiness, parental education, and family mealtime routines emerging as significant predictors of intake (Sukor et al., 2025).

Interestingly, children tend to prefer fruits over vegetables, citing bitterness and texture as deterrents (Sha An Ali et al., 2020). This preference pattern is not unique to Malaysia; studies in Europe and Australia also report children's higher acceptance of sweet-tasting fruits compared to bitter-tasting vegetables (Nicklaus, 2015; Ambrosini et al., 2014). The persistence of low vegetable intake globally indicates that structural and behavioural challenges remain inadequately addressed.

Determinants of Vegetable Acceptance and Consumption

a. Biological and Sensory Influences

Children's reluctance to consume vegetables is partly biological. Many vegetables are naturally bitter due to compounds such as glucosinolates, making them less palatable to young children (Bell & Tepper, 2006). Food neophobia, or the reluctance to try unfamiliar foods, further exacerbates this challenge (Pliner, 1994). This behaviour is common in early childhood and can persist into later years if not addressed (Caton et al., 2014). Recent studies reaffirm that food neophobia is a significant barrier to vegetable acceptance, often requiring repeated exposure and parental modelling to overcome (Coulthard & Sahota, 2016; Holley et al., 2018).

b. Parental and Family Influences

Parents play a pivotal role in shaping children's food preferences. Parental modelling: where children mimic the dietary habits of their caregivers has been repeatedly shown to influence vegetable intake (Wardle et al., 2003; Gibson et al., 2020). Negative parental behaviours, such as limited time for meal preparation or reliance on convenience foods, often result in lower vegetable availability at home (Gerritsen et al., 2019). Conversely, positive strategies, including encouragement, repeated offering, and involving children in meal preparation, are associated with increased acceptance (Remington et al., 2012).

Recent Malaysian evidence highlights that parental education and mealtime structures significantly predict vegetable intake in preschoolers (Sukor et al., 2025). Additionally, parental food neophobia has been found to directly influence children's willingness to try new foods, underscoring the intergenerational transfer of food behaviours (Coulthard & Sahota, 2016).

c. Educational and School-Based Influences

Preschools are strategic platforms for instilling healthy eating behaviours, yet in Malaysia, formal curricula rarely emphasise vegetable-specific nutrition (Curriculum Development Division, 2016). Teachers themselves report insufficient resources and training for nutrition education, calling for structured, developmentally appropriate modules (Mok et al., 2023).

International evidence supports the integration of experiential learning methods such as gardening, cooking activities, and sensory play to enhance children's vegetable acceptance (Hodder et al., 2018). A recent Malaysian qualitative study involving preschoolers found that gardening activities not only improved children's familiarity with vegetables but also positively shaped their attitudes toward consumption (Sukor et al., 2025). Such approaches highlight the potential of early childhood education settings as vehicles for behavioural change.

d. Community and Policy-Level Factors

At the broader level, socio-economic status, cultural norms, and food environments significantly influence vegetable intake. Families from lower socio-economic backgrounds often face affordability and accessibility issues, limiting their ability to provide a variety of vegetables at home (Poh et al., 2019; Kaur, 2023). In Malaysia, government-led initiatives such as nutrition modules and dietary guidelines exist, but these often focus broadly on healthy eating rather than specifically addressing vegetables (MOH, 2016).

A global narrative review stresses that without supportive food systems such as farm-to-school programs, subsidies for healthier foods, and culturally tailored nutrition policies behavioural interventions alone may be insufficient (Kaur, 2023). Integrating community- and policy-level strategies with family and school interventions is therefore essential for sustainable change.

Intervention Approaches and Research Gaps

Evidence-based strategies to increase vegetable intake include repeated exposure, parental modelling, and structured nutrition education (Hodder et al., 2018). Studies also demonstrate the effectiveness of combined approaches where schools, families, and communities work together to reinforce consistent healthy eating messages (Hong et al., 2018).

In Malaysia, however, intervention research remains limited. One of the few local trials, which focused on repeated exposure to a single vegetable (cabbage) among preschoolers, showed some improvement in acceptance but lacked diversity and long-term assessment (Noradilah & Zahara, 2012). More recent work has shifted towards participatory approaches, including children's involvement in gardening and experiential food activities, which have shown promising outcomes (Sukor et al., 2025).

Nevertheless, significant gaps remain. Most studies are cross-sectional, with limited intervention designs tailored to the socio-cultural context of Malaysian families. There is also a lack of evaluation of policy-level strategies,

such as school canteen standards or subsidies for vegetables in early childhood settings. As highlighted by recent reviews, a socio-ecological approach that integrates individual, family, school, community, and policy dimensions is urgently needed to create a supportive nutrition environment (Kaur, 2023; Mok et al., 2023).

METHODOLOGY OF LITERATURE SEARCH

To strengthen the transparency of this review, a systematic literature search was conducted across two major databases: Scopus and PubMed. The search included studies published between 2015 and 2025. The following keywords and Boolean operators were used:

("vegetable" OR "veggies" OR "produce" OR "greens") AND ("consumption" OR "intake" OR "diet" OR "eating") AND ("children" OR "preschool" OR "youth" OR "kids") AND ("nutrition" OR "dietary" OR "food" OR "health") AND ("Malaysia" OR "Malaysian" OR "Southeast Asia" OR "Asia")

Inclusion criteria:

1. Studies involving children aged ≤ 6 years,
2. Empirical studies (quantitative, qualitative, or mixed methods),
3. Conducted in Malaysia,
4. Peer-reviewed journal articles

Exclusion criteria:

1. Studies focusing solely on fruit intake without reference to vegetables,
2. Grey literature without peer review,
3. Populations outside early childhood (≥ 7 years).

The review process followed the PRISMA guidelines to ensure rigor and reproducibility. Figure 3 presents the adapted PRISMA flow diagram, while Table 1 summarizes the studies reviewed.

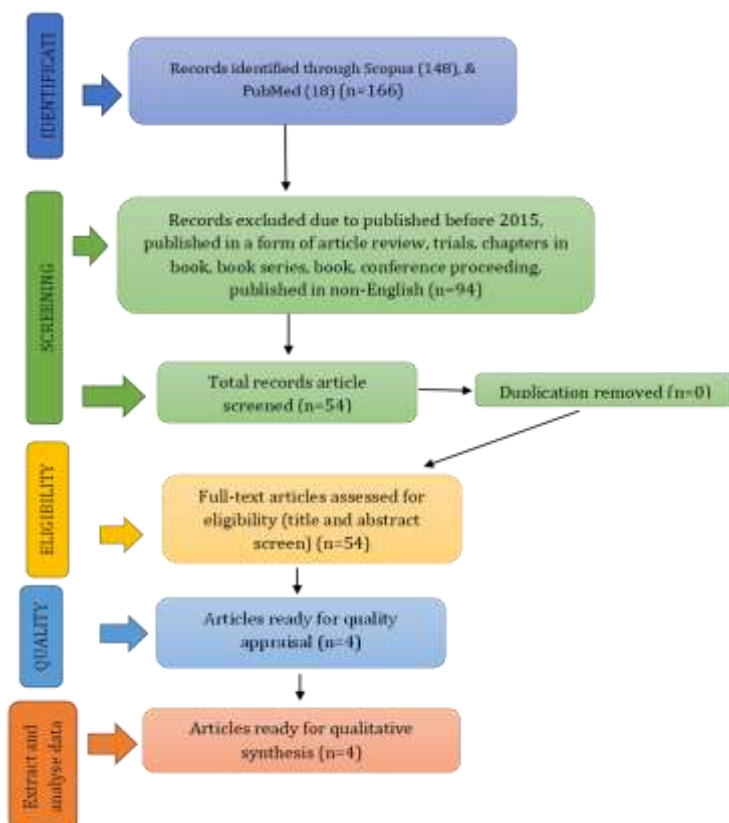


Fig. 3 PRISMA Flow Diagram

Table 1. Summary of Reviewed Studies

Author/Year	Location	Study Design	Sample	Key Findings
Chong et al. (2017)	Kuala Lumpur	Cross-sectional	1,100 children (1–6 yrs)	Average vegetable intake 1.07 servings/day.
Sukor et al. (2025)	Terengganu	Mixed method	400 preschoolers & teachers	Teacher needs modules; family mealtime patterns influence intake.
Mok et al. (2023)	Kuala Lumpur	Qualitative	30 preschoolers	Gardening increased familiarity and positive attitudes.
Zulkifli et al. (2025)	Malaysia	Needs assessment	150 stunted children	Highlighted tailored nutrition modules for undernourished preschoolers.

Significance of the study

This study contributes to the growing body of knowledge on early childhood nutrition by providing a socio-ecological analysis of the barriers that hinder vegetable consumption among Malaysian young children. Its significance is threefold:

Practical and Educational Contribution

The findings offer insights for parents, teachers, and early childhood educators to design developmentally appropriate, culturally relevant strategies that address children's reluctance toward vegetables. In particular, the study underscores the need for experiential learning approaches, parental modelling, and consistent home–school collaboration to foster acceptance of vegetables.

Policy and Public Health Contribution

At the policy level, the study highlights gaps in existing nutrition initiatives in Malaysia, which often overlook vegetables as a specific target for early interventions. By identifying structural barriers, such as food accessibility and limited institutional support, the study provides evidence that can inform policymakers to strengthen nutrition programs and integrate vegetable promotion into national early childhood health and education frameworks.

While current evidence identifies multiple socio-ecological factors influencing vegetable consumption, it is critical to acknowledge the limitations of existing studies. Many Malaysian studies rely on cross-sectional designs, limiting causal inference. Sample sizes are often small and regionally restricted, raising concerns about representativeness and generalizability across diverse cultural and socioeconomic groups. Moreover, intervention studies lack longitudinal follow-up, making it difficult to assess sustained behavioural change. Finally, policy-level analyses are limited, creating a gap in understanding systemic influences.

These limitations highlight the need for more robust, large-scale, and longitudinal research that accounts for Malaysia's cultural diversity and socio-economic disparities. Addressing these gaps would enhance the applicability of findings for policy and practice.

Future studies should explore underutilised local vegetables (e.g., *ulam*, indigenous leafy greens) as culturally relevant options, conduct longitudinal intervention studies to examine sustained behavioural change, develop and evaluate integrated school–home–community programs with parental and teacher collaboration, assess the impact of policy measures such as subsidies or farm-to-school initiatives and investigate nutrition education approaches tailored for stunted or at-risk children in childcare settings.

By explicitly charting these directions, this study aims to guide policymakers and researchers toward sustainable, evidence-based strategies.

CONCLUSIONS

Promoting vegetable consumption among young children remains a critical yet complex challenge in Malaysia. This study reveals that barriers exist at multiple levels, including children's biological predispositions, parental practices, school environments, community contexts, and policy frameworks. These interconnected influences demonstrate that efforts to improve vegetable intake cannot be limited to individual behaviour change alone but must instead adopt a socio-ecological approach.

By situating vegetable consumption within a broader framework of learning and development theories, the study emphasises the importance of creating consistent and supportive nutrition environments across home, school, and community settings. Parents and teachers play pivotal roles in shaping children's food preferences, but their efforts must be reinforced by systemic support through effective policies, accessible resources, and culturally relevant education modules.

Moving forward, the study calls for integrated strategies that involve all stakeholders such as children, families, educators, communities, and policymakers to cultivate positive dietary behaviours and ensure healthier generations. Addressing the barriers to vegetable consumption in early childhood is not only a matter of improving immediate nutrition but also a long-term investment in public health, educational outcomes, and national human capital development.

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