RESEARCH PAPER

Effects of dietary diversity and parenting styles on growth parameters of children aged 2 – 5 years in a tertiary care setting of Chengalpattu district in India: A Cross-sectional study

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ABSTRACT

Introduction: Parental feeding practices and dietary diversity are key determinants of nutritional outcomes in early childhood. This study evaluates the impact of minimum dietary diversity (MDD) and parenting style on the growth parameters of children aged 2–5 years in a tertiary care setting in Southern India.

Materials and Methods: A hospital-based cross-sectional study was conducted at the Paediatrics OPD of Chettinad Hospital and Research Institute, Chengalpattu district, from December 2023 to May 2024. A total of 800 children aged 2–5 years were enrolled using universal sampling. Data were collected using a semi-structured questionnaire incorporating an MDD assessment and the Parenting Style Four-Factor Questionnaire (PSFFQ). Anthropometric parameters, including weight-for-height and mid-upper arm circumference (MUAC), were measured using WHO standard definitions. Data were analysed using IBM SPSS version 21.

Results: Of the 800 children enrolled, 48.2% met the minimum dietary diversity criteria. Regarding nutritional status, 41% had a normal weight-for-height, 22.8% had wasting, and 36.2% had severe wasting; 29.5% had MUAC indicative of acute malnutrition. Children without dietary diversity had a significantly higher risk of wasting and malnutrition compared to those with adequate dietary diversity. The predominant parenting style was uninvolved, followed by authoritative. Authoritarian parenting was the only style significantly associated with both dietary diversity and weight-for-height outcomes.

Conclusion: Dietary diversity was significantly associated with nutritional outcomes in children aged 2–5 years. Authoritarian parenting positively influenced dietary diversity and anthropometric parameters in this study population. Targeted interventions to improve dietary diversity, alongside parenting guidance tailored to local sociocultural contexts, are essential to reducing childhood undernutrition.

Keywords: Minimum Dietary Diversity; Anthropometry; Parenting Style; Children; Undernutrition; Chengalpattu; India.

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INTRODUCTION

Malnutrition remains a major public health challenge in developing countries. In 2022, an estimated 149 million children under the age of five were stunted, 45 million were wasted, and 37 million were overweight or obese worldwide.[1] Undernutrition is a contributing factor in nearly 50% of deaths among children under five in low- and middle-income countries.[2] Insufficient nutrition in early childhood manifests as wasting (acute undernutrition), stunting (chronic undernutrition), and underweight — each carrying significant consequences for a child's growth, cognitive development, and long-term health.

Dietary diversity is one of the most important modifiable determinants of childhood nutritional status. Consuming a wide variety of foods has a well-documented protective effect against undernutrition. Research has consistently shown a positive correlation between Minimum Dietary Diversity (MDD) and the adequacy of essential nutrient intake in young children.[3] MDD is a validated indicator used to assess whether children aged 6–23 months receive foods from at least four of seven recommended food groups, including grains, legumes, dairy, meat, eggs, and vitamin A-rich fruits and vegetables.[4] At the community level, MDD serves as a practical and interpretable tool for monitoring nutritional adequacy, identifying target populations, setting national-level targets, and evaluating the effectiveness of supplementary feeding interventions.[4,5] Although the WHO MDD indicator was originally validated for children aged

6–23 months as part of the Infant and Young Child Feeding (IYCF) framework, the dietary diversity scoring methodology has been increasingly applied to older preschool-aged children in research settings to assess food group adequacy, given the absence of a standardised equivalent tool for this age group. Studies have further confirmed that higher dietary diversity scores are positively associated with micronutrient sufficiency across different age groups and settings.[6]

While dietary diversity reflects what a child eats, parenting style shapes how and why those food choices are made. Parents are the primary decision-makers regarding the variety and quantity of food their children consume, and their feeding behaviours are deeply influenced by their overall parenting approach.[7] Parenting styles are broadly classified into four types: authoritative (demanding and responsive), authoritarian (demanding but less responsive), permissive (responsive but less demanding), and uninvolved (neither demanding nor responsive).[8] Evidence suggests that parental feeding practices have a meaningful influence on children's dietary patterns and weight outcomes. Longitudinal studies have shown that highly restrictive feeding is most strongly associated with inappropriate weight gain, while monitoring practices are linked to healthier weight trajectories.[9] Furthermore, the relationship between parenting practices and nutritional outcomes is modulated by factors such as parental educational attainment, socioeconomic status, cultural background, and genetic susceptibility, making it important to study these associations within specific geographic and demographic contexts.[10]

Despite the established individual importance of dietary diversity and parenting style, few studies have examined their combined effect on the growth parameters of young children, particularly in the Indian context. Therefore, this study aims to evaluate the impact of minimum dietary diversity and parenting style on the anthropometric outcomes of children aged 2–5 years attending a tertiary care centre in Southern India.

METHODOLOGY

Study Design and Setting

A hospital-based cross-sectional study was conducted at the Paediatrics Outpatient Department (OPD) of Chettinad Hospital and Research Institute (CARE), Chengalpattu district, Southern India, from December 2023 to May 2024.

Study Population and Sampling

A total of 800 children aged 24 to 60 months were enrolled using universal sampling. All participants who met the eligibility criteria during the study period were approached for inclusion.

Eligibility Criteria

Inclusion Criteria:

- Children aged 24 to 60 months attending the Paediatrics OPD during the study period
- Parents or primary caregivers residing within Chengalpattu district
- Parents or primary caregivers willing to provide written informed consent

Exclusion Criteria:

- Children with diagnosed chronic illnesses
- Children currently receiving corticosteroids or chemotherapy
- Children previously identified as malnourished and already enrolled in a nutritional rehabilitation programme
- Children residing outside Chengalpattu district

Ethical Approval

The study was conducted following approval from the Institutional Human Ethics Committee (IHEC) of Chettinad Hospital and Research Institute. Written informed consent was obtained from all participating parents or caregivers prior to data collection.

Data Collection Tool

Data were collected using a semi-structured questionnaire comprising three components:

Component 1 — Demographic and Anthropometric Data: Baseline information including age, gender, parental education, birth details, birth weight, and breastfeeding history was recorded. Anthropometric measurements — weight, height, and mid-upper arm circumference (MUAC) — were obtained for each child. Weight was measured using a calibrated digital weighing scale, and height was measured using a standardised stadiometer. MUAC was measured using a non-stretchable measuring tape at the midpoint of the left upper arm. All measurements were taken in duplicate by trained research personnel, and the mean value was recorded. Inter-observer reliability was assessed at the start of the study; observers were considered reliable when measurements were within an acceptable margin of error (±0.1 kg for weight, ±0.5 cm for height). Nutritional status was classified as normal, wasting, severe wasting, or stunting based on WHO growth standards.[11]

Component 2 — Minimum Dietary Diversity (MDD) Assessment: Dietary diversity was assessed using the WHO Minimum Dietary Diversity questionnaire,[12] which evaluates consumption across seven food groups: grains, roots and tubers; legumes and nuts; dairy products; meat and fish; eggs; vitamin A-rich fruits and vegetables; and other fruits and vegetables. A score of 4 or above (out of 7) was considered as meeting the minimum dietary diversity threshold. Although the WHO MDD indicator was originally developed for children aged

6–23 months, its food group scoring framework was adopted in this study for children aged 24–60 months, consistent with prior research in similar low- and middle-income country settings, in the absence of a validated equivalent instrument for this age group."

Component 3 — Parenting Style Assessment: Parenting style was assessed using the validated Parenting Style Four-Factor Questionnaire (PSFFQ).[13] This instrument classifies parents into four categories:

- **Authoritative** — demanding and responsive
- **Authoritarian** — demanding but low in responsiveness
- **Permissive** — responsive but low in demandingness
- **Uninvolved** — neither demanding nor responsive

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 21. Categorical variables were summarised as frequencies and percentages; continuous variables were expressed as mean and standard deviation (SD). The chi-square test was used to assess associations between categorical variables. Logistic regression was performed to evaluate the association between MDD and nutritional outcomes, adjusting for age, gender, and parental education. The independent samples t-test was used to compare continuous variables between two groups, and one-way ANOVA with Tukey post-hoc test was applied for comparisons across three or more groups. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Baseline Characteristics and Dietary Diversity

A total of 800 children were enrolled, with an equal distribution of male and female participants (50% each). The age groups were evenly distributed across the three intervals: 24 to 35 months (33.2%), 36 to 47 months (33.4%), and 48 to 60 months (33.4%). Parental education was similarly distributed across all four categories, with no single group predominating. Nearly all children were born in institutional settings (99.1%), and breastfeeding was initiated within one hour of birth in 92.4% of cases, reflecting good early feeding practices in this cohort.

Dietary diversity was assessed using the seven-group MDD questionnaire. Only 48.2% of children met the minimum dietary diversity threshold of a score of 4 or above, meaning that more than half the cohort had inadequate dietary diversity during the study period. Age, gender, and parental education were not significantly associated with dietary diversity status (all $p > 0.05$), suggesting that MDD was influenced by factors beyond basic demographic characteristics in this population.

Table 1: Baseline characteristics and prevalence of MDD among the study participants:

Characteristics	Number	Percentage (%)
Age (months)		
24 to 35	266	33.2
36 to 47	267	33.4
48 to 60	267	33.4
Gender		
Male	400	50
Female	400	50
Parent education		
Illiterate	198	24.8
Up to middle school	198	24.8
Above middle school	211	26.3
Undergraduate and above	193	24.1
Birth place		
Institutional delivery	793	99.1
At home	7	0.9
Birth weight		
2 to 2.9 kg	342	42.8
3 to 3.9 kg	420	52.4
≥ 4 kg	38	4.8
Breastfeeding initiated within 1 hour		
Yes	739	92.4
No	61	7.6
MDD		
Yes	386	48.2
No	414	51.8

Table 4: Association of MDD with demographic profile

Characteristics	MDD		p-value*
	Yes	No	
Age (in years)			
2 to 2.9	132	133	0.341
3 to 3.9	133	133	
4 to 4.9	149	120	
Gender			
Male	189	211	0.620
Female	197	203	
Parent education			
Illiterate	98	100	0.477
Up to middle school	103	95	
Above middle school	94	117	
Undergraduate and above	91	102	

*Chi-square test, $p < 0.05$ is significant

Nutritional Status

The nutritional profile of the study cohort revealed a high burden of undernutrition. Based on weight-for-height measurements, only 41% of children were classified as having normal nutritional status. Wasting was identified in 22.8% of children, while a notably high proportion — 36.2% — were classified as having severe wasting. This figure is clinically significant and indicates that more than one in three children in this tertiary care cohort were in a state of severe acute undernutrition at the time of assessment. Assessment of mid-upper arm circumference (MUAC) further corroborated this finding, with 29.5% of children having MUAC measurements indicative of acute malnutrition.

Table 2: Nutritional profile of the study participants

Characteristics	Number	Percentage (%)
Weight for height		
Normal	328	41
Wasting	182	22.8
Severe wasting	290	36.2
MUAC		
Normal	564	70.5
Acute malnutrition	236	29.5

Parenting Style Distribution

Parenting style was assessed using the PSFFQ, which generates a continuous score for each of the four parenting style dimensions. A higher mean score on a given dimension indicates stronger endorsement of that parenting style within the cohort. The mean scores were as follows: Uninvolved 32.90 (SD 4.7), Authoritative 27.05 (SD 4.2), Authoritarian 18.15 (SD 3.5), and Permissive 12.15 (SD 2.7). The Uninvolved dimension recorded the highest mean score, indicating that this parenting style was most strongly expressed across the cohort, followed by the Authoritative style. It should be noted that these scores reflect the dominant tendency within the cohort rather than a categorical classification of individual parents into a single style.

Table 3: Parenting style

Characteristics	Mean (SD)
Authoritative	27.05 (4.2)
Authoritarian	18.15 (3.5)
Permissive	12.15 (2.7)
Uninvolved	32.90 (4.7)

Association Between Dietary Diversity and Nutritional Outcomes

Logistic regression analysis, adjusted for age, gender, and parental education, demonstrated a statistically significant association between MDD and nutritional status ($p = 0.001$ for both weight-for-height and MUAC). Children without adequate dietary diversity were at substantially higher risk of wasting (aOR 20.8, 95% CI 12.2–35.6) compared to those with adequate dietary diversity. Conversely, children with adequate dietary diversity had significantly lower odds of severe wasting (aOR 0.02, 95% CI 0.01–0.06) and acute malnutrition by MUAC (aOR 0.18, 95% CI 0.12–0.25). These findings strongly support dietary diversity as a protective factor against undernutrition in this age group.

Table 5: Logistic regression of MDD with nutritional profile

Characteristics	MDD		aOR[$] (95%CI)	p-value
	Yes	No		
Weight for height				
Normal	306	22	REF	**0.001**
Wasting	74	108	20.8(12.2,35.6)	
Severe wasting	6	284	0.02(0.01,0.06)	
MUAC				
Normal	336	228	REF	**0.001**
Acute malnutrition	50	186	0.18(0.12,0.25)	

aOR[$] - adjusted for age, gender and parent education. $p < 0.05$ is significant.

Association Between Parenting Style and Nutritional Outcomes

When parenting style scores were compared across MUAC categories using the independent samples t-test, no statistically significant differences were observed for any of the four parenting styles (all $p > 0.05$), suggesting that parenting style alone did not directly influence MUAC-based nutritional status in this cohort.

Similarly, when parenting style scores were compared across weight-for-height categories using one-way ANOVA with Tukey post-hoc analysis, three of the four parenting styles showed no significant association. However, Authoritarian parenting scores differed significantly across the normal, wasting, and severe wasting categories ($p = 0.03$), indicating that higher authoritarian parenting scores were associated with differences in weight-for-height outcomes.

Table 6: Association between MUAC and parenting style

Characteristics	MUAC (mean (SD))		p-value*	95% CI
	Normal	Malnutrition		

Authoritative	27.13 (4.1)	26.86 (4.6)	0.42	-0.38, 0.91
Authoritarian	18.07 (3.6)	18.36 (3.3)	0.28	-0.83, 0.24
Permissive	12.22 (2.8)	11.97 (2.7)	0.25	-0.17, 0.67
Uninvolved	32.89(4.6)	32.94 (4.9)	0.88	-0.76, 0.66

*Independent sample T-test. p< 0.05 is significant

Table 7: Association between Weight for height and parenting style

Characteristics	Weight for height (mean (SD))			p-value*
	Normal	Wasting	Severe wasting	
Authoritative	27.13 (4.1)	27.16 (4.5)	26.88 (4.2)	0.70
Authoritarian	18.57 (3.5)	18.31 (3.5)	17.78 (3.5)	**0.03**
Permissive	12.22 (2.8)	12.14 (2.6)	12.07 (2.8)	0.81
Uninvolved	32.58 (4.5)	32.68 (5.2)	33.41 (4.4)	0.07

*ANOVA with Tukey post-hoc test. p< 0.05 is significant

Association Between Parenting Style and Dietary Diversity

Analysis of the association between parenting style and MDD using the independent samples t-test revealed that only the Authoritarian parenting style showed a statistically significant difference between children who met MDD criteria and those who did not (p = 0.04, 95% CI −0.01 to 0.92). Children of parents with higher authoritarian scores were more likely to achieve minimum dietary diversity. No significant associations were found for Authoritative, Permissive, or Uninvolved parenting styles and dietary diversity.

Table 8: Association of MDD with parenting style

Characteristics	MDD (mean (SD))		p-value*	95% CI
	Yes	No		
Authoritative	27.12 (4.1)	26.98 (4.3)	0.63	-0.73,0.44
Authoritarian	18.40 (3.4)	17.89 (3.6)	**0.04**	-0.01,0.92
Permissive	12.18 (2.7)	12.12 (2.8)	0.77	-0.44,0.33
Uninvolved	32.65(4.6)	33.14 (4.7)	0.14	-0.16,1.14

*Independent sample T-test. p< 0.05 is significant.

DISCUSSION

The existing literature has addressed the impact of dietary diversity and parenting style on childhood nutrition largely in isolation; few studies have examined their combined effect on growth outcomes. This study contributes to filling that gap by simultaneously evaluating the influence of Minimum Dietary Diversity (MDD) and parenting style on the anthropometric status of children aged 24–60 months in a tertiary care setting in southern India. The burden of undernutrition observed in this cohort was substantial: only 41% of children had a normal weight-for-height, while 22.8% were classified as wasted and 36.2% as severely wasted. A further 29.5% had mid-upper arm circumference (MUAC) measurements indicative of acute malnutrition. These figures are notably higher than community-based estimates, which likely reflects the referral bias inherent to a tertiary care population.

Only 48.2% of children in this cohort met the MDD threshold, consistent with rates reported in other studies from low- and middle-income settings, though with considerable variation. Blackstone and Sanghvi reported an MDD prevalence of 42.8% in Bangladesh,[3] while Kathuria et al. reported 35.3% in rural India, a population with limited dietary access compared to the peri-urban setting of the present study.[14] Markedly lower rates of 14.9% and 19.4% were reported by Eshete et al. and Rai et al. from sub-Saharan Africa and rural India respectively, populations facing greater food insecurity.[15][16] A higher rate of 59.9% was reported by Solomon et al. from Addis Ababa, an urban setting with relatively greater market access.[17] The variation across these studies reflects differences in geographic context, food availability, socioeconomic conditions, and the age groups studied, underscoring the importance of locally contextualised dietary interventions.

Regarding parenting style, the predominant styles observed in this southern Indian cohort were Uninvolved and Authoritative, a pattern broadly consistent with findings from comparable Indian settings.[19] Of the four parenting styles assessed, only Authoritarian parenting showed a statistically significant association with both dietary diversity (p = 0.04) and weight-for-height outcomes (p = 0.03). This finding aligns with evidence from Lopez et al., who reported positive associations between authoritarian and permissive parenting and child nutritional status,[18] and with research from Asian

contexts suggesting that the directive and structured approach characteristic of authoritarian parenting may promote consistent food provision and adherence to feeding routines. Several studies have further demonstrated that authoritative parenting positively influences children's feeding behaviour and nutritional outcomes in diverse international settings,[20–22] and the observed cultural transition towards this style in urban India[19] warrants longitudinal examination of its nutritional implications. The absence of significant associations for uninvolved and authoritative styles in this cohort may reflect the homogeneity of parenting score distributions or mediation through pathways not captured in this cross-sectional design. The variation in parenting-nutrition associations across global studies is likely attributable to differences in sociocultural context, parental education, socioeconomic status, food environment, and child birth order, all of which limit direct cross-study comparisons.

This study has certain limitations that should be considered when interpreting these findings. The use of the WHO MDD framework beyond its originally validated age range of 6–23 months is a recognised limitation; however, this approach was adopted in the absence of a validated equivalent instrument for children aged 24–60 months and is consistent with precedent in the published literature. As a hospital-based cross-sectional study conducted at a single tertiary care centre, findings may not be generalisable to the broader community population, and the cross-sectional design precludes causal inference. Future longitudinal, community-based studies with larger and more diverse samples would strengthen the evidence base in this area.

CONCLUSION

This cross-sectional study demonstrates that dietary diversity is a significant determinant of nutritional status in children aged 24–60 months attending a tertiary care setting in southern India. Only 48.2% of children met the minimum dietary diversity threshold, and inadequate dietary diversity was associated with substantially higher odds of wasting (aOR 20.8) and acute malnutrition by MUAC (aOR 0.18 for adequate vs. inadequate diversity). These findings underscore the need for targeted, community-level interventions to improve dietary diversity in this age group, including counselling on food group variety integrated into routine paediatric outpatient care. Of the four parenting styles assessed, only authoritarian parenting was significantly associated with both dietary diversity achievement ($p = 0.04$) and weight-for-height outcomes ($p = 0.03$), suggesting that structured, directive feeding practices may confer a nutritional benefit in this sociocultural context. As child-rearing norms in urban southern India continue to evolve, parenting guidance programmes that are sensitive to local cultural practices may offer an additional lever for reducing childhood undernutrition. Longitudinal and community-based studies are needed to confirm these associations and to establish the direction of causality.

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