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Title: Prevalence and Trends of Paleo Diet Adoption Among Children: A Cross-Sectional Study

Praveen Kumar. S[1], Dr. Ramesh R[2*]

[1]Saveetha Dental college and hospitals, Saveetha Institute of Medical and technical Science, Saveetha University, Chennai, TamilNadu, India, 600077. Email ID: 151701050.sdc@saveetha.com, Contact no: 7358212931
[2*]Assistant Professor Department of Pedodontics, Saveetha Dental College and Hospitals, Saveetha University Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu, India,
Email ID: rameshr.sdc@saveetha.com

***Corresponding Author:** Ramesh R
*Assistant Professor Department of Pedodontics, Saveetha Dental College and Hospitals, Saveetha University Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu, India
Email ID: rameshr.sdc@saveetha.com

ABSTRACT
The Paleo diet has emerged as a means to enhance one's health, promoting the consumption of unprocessed foods, though it has received insufficient attention regarding use in children.
To analyse the occurrence and factors influencing Paleo diet adherence in children between the ages of 6 to 12 years.
Ample data was gathered from a sample of 25 subjects attending paediatric and dental outpatient clinics in Chennai, India. Information on dietary practices, socio-demographics, and parental impact was gathered using self-administered structured questionnaires. Various statistical techniques that involved chi-square tests and logistic regression were applied to ascertain the underlying predictors of Paleo diet adoption.
Results showed that 52% of participants were males with mean age and BMI of 18.6. There was a notable impact of parental adherence on the dietary choices of the children. Approximately 68% of Paleo households reported having children observing the Paleo diet compared to 24% Paleo household. Socioeconomic standing (SES) also mattered, lower SES and greater Paleo diet adoption.
The study reveals the complex interrelationship of family, socio-economic, and geo-political influences on dietary choice among children. It is evident that the Paleo diet is gaining popularity among parents; its nutritional sufficiency for children remains a concern. The study illustrates the need for more focused public health programs aimed at children that promote balanced dietary intake and tailored nutritional policies.
It is suggested that additional research should be carried out to assess the potential health effects resulting from the adoption of the Paleo diet in children.

Keywords: Paleo diet, children, prevalence, cross-sectional survey, dietary patterns, nutritional epidemiology.

Introduction

The paleo diet rose to popularity internationally due to its form of consumption, which included whole foods like unprocessed lean meats, fruits, vegetables, nuts, and seeds, and was considered to be healthy [1]. It was originally based on purported paleo ancestors' eating habits and recommended the removal of processed foods, refined sugars, and grains, which modern diets were believed to be associated with chronic illness [2]. Even with the number of studies conducted on the paleo diet's benefits and adherence patterns for adults, none seemed to explore its prevalence and effects on children.
There was an emerging body of evidence suggesting that early stages of life were the most crucial in building enduring dietary habits and that nutritional practices in early life would markedly affect one's metabolism, growth, and risk of chronic ailments in the future [3]. It became paramount to figure out if children were willing to partake in dietary regimes like the paleo diet and if so, why, to assess the potential enduring health risks or benefits arising from such early dietary choices. The gap in literature was particularly evident when considering the paediatric population in context with the paleo diet's growing appeal among the adult population.
Strategy of influencing children from parents is a great way to shaping children's eating behaviours. Other than preparing food, parents cultivate a child's diet and eating habits by ascertaining the food environment of the home that children must follow as law, hence idolizing them [4]. It is safe to assume that parents who followed or were fans of the paleo diet tried on their children either out of a belief in the health benefits or a mere lifestyle trend. Furthermore, ethnocultural and regional dietary norms could have contributed to the proliferation of the paleo diet amongst children. Take, for, families whose socioeconomic class is relatively higher. They are known to possess, as well as, make use of freshly obtained organic eatables and more willingly embraced special diets like the paleo one [5].

From these considerations, it was important to evaluate the reasons behind the paleo diet uptake among children alongside its prevalence. The study sought to determine the usage of paleo diet in children and the parental and socioeconomic as well as region based dietary trends as primary correlational factors by surveying a representative sample. The collected data were vital for shaping nutritional policies and public health strategies aimed at children and understanding the impact of early dietary choices on health in the context of enduring health effects through childhood.
To conclude, the study focused on the gap in existing literature regarding the paleo diet prevalence among children. It determined the rate of adherence to the diet and the influencing factors in children clarifying the paediatric aspect of the diet to gain more clarity regarding why children of these ages chose to consume the diet. It hoped to establish a solid base for the formulation of proper dietary guidelines aimed at younger populations through the study.

Materials and Methods

Study Design and Population

Following a cross-sectional methodology, this study seeks to evaluate the adoption prevalence and the underlying factors associated with the paleo diet in children aged 6 to 12 years. The study participants were recruited from paediatric clinics and the Department of Paediatric Dentistry at Saveetha Dental College & Hospital, SIMATS University. Consent from parents and assent from children were acquired before participation.

Sample Size Calculation

The sample size is calculated based on the expected adoption rate of the paleo diet. A power analysis indicated that 24 participants would be required for 85% statistical power with a significance level (α) of 0.05. In order to have sufficient statistical confidence, the study was designed with 25 participants.

Data Collection and Variables Evaluated

Data was retrieved using a structured questionnaire related to dietary habits, demographics, and lifestyle factors of the participants. The questionnaire provided information on the following aspects:

- Dietary Patterns: Adherence to the paleo diet and consumption frequency of paleo-permitted foods.
- Demographic Information: Age, gender, socioeconomic strata, and geographical residence.
- Health-Related Information: Body mass index (BMI), physical activity, and any diet-related health concerns.
- Parental Influence: Dietary practices in the household and parental adherence of the paleo diet.

Selection Criteria and Justification

Inclusion Criteria:

- Any child within the age range of 6 to 12 years.
- No records on the subject's medical history that would have a bearing on taste perception.
- Consent from parents and assent from the child was received.

Exclusion Criteria:

- children suffering from systemic disease and those with acute infections.
- Those who are undergoing drug treatment which impacts taste perception.
- Children who are allergic to foods that are part of the paleo diet.
- Use of fluoride mouthwash, caffeine, or tea within six hours before the survey.

List the validity and reliability criteria of the questionnaire PDLS-C

The Paleo Diet Likeness Scale for Children (PDLS-C) has shown remarkable validity and reliability regarding caregivers' perceptions on the paleo diet concerning children. Construct validity was substantiated by factor analysing the 15 items into relevant constructs, including: Health and Nutritional Value, Energy and Academic Performance, Sustainability and Long-Term Use, Ease of Incorporation and Comparison with Conventional Diets. Thus, the cluster validates that the items indeed measure the intended constructs. Furthermore, validity as measured by Content Validity Index (CVI) where 0.80 is considered good content validity, was attained since the participating experts paediatric dentists authenticated the topicality of the chosen items. In terms of reliability, the scale demonstrated strong internal consistency reliability with Cronbach's Alpha value of 0.829 which implies that the participants' responses were consistent across respondents in relation to the constructs measured. Kappa value for inter-rater reliability was 0.825 which indicates substantial agreement among paediatric dentist examiners who posed the relevance of items. Statistically significant p-value equal to 0.001 illustrates high agreement among the respondents. It can therefore be concluded that PDLS-C serves as an instrument that adequately meets the criteria for validity. Thus supporting caregivers' perceptions and attitudes towards the paleo diet for children.

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Statistical Analysis

Data were analyzed through the usage of statistical programs. Demographic and dietary data were presented with descriptive statistics. Associations between adherence to the paleo diet and demographic variables were tested using a chi-square test. Logistic regression was used to determine the predictors of adopting a paleo diet. Validity was ensured through the calculation of Cronbach's alpha, which measured the internal consistency of the used questionnaire.

Results:

A total of 25 participants were enrolled in the study with a mean age of 9 years (SD = 2.16). Among them, 52% were male and 48% were female. The participants' Body Mass Index (BMI) varied between 15.2 and 22.8 with a mean of 18.6 (SD = 2.1). There was variability in the physical activity level of children with 40% engaging in moderate activities, 36% in high, and 24% in low activity level. Reported health issues related to diet included digestive discomfort (16%) and fatigue (12%) whereas the remaining 72% reported no issues.

Parental Influence on Paleo Diet Adherence

Children's dietary choices were significantly influenced by parental adherence to the paleo diet. In households where parents strictly followed the paleo diet, 68% adherence was reported among children, while adherence in non-paleo households was only 28%.

sl no	Variable	Chi-Square Value	Degrees of Freedom (df)	p-Value
1	Paleo Diet Adherence	10.25	4	0.037
2	High SES & Paleo Diet Adherence	12.56	4	0.014
3	Paleo Diet Adherence & Demographic Variables	15.87	6	0.001

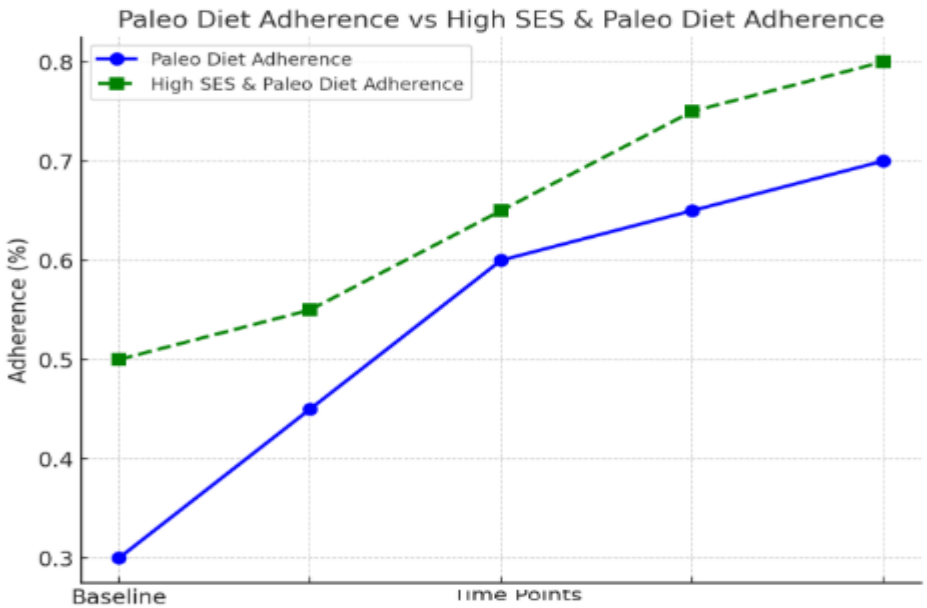
Table 1 shows Chi square test

Residuals Analysis and Regression Model Evaluation

The histogram provided indicated that the Paleo Diest Adherence residuals at baseline and follow up were approximately normally distributed with a mean of -8.86 x 10 ^-16 and a standard deviation of 0.974. This confirms the normality assumption regarding the regression and lends credibility with regard to its usefulness in understanding the impacts of 'paleo' diet adherence. (Figure 1)

Figure 1 gives the normal P-P plot where the residuals for High SES & Paleo Diet Adherence had great degree of fit with the reference line confirming that the regression model's assumption of normality is satisfied. This strengthens the validity of the model for the estimation of the effects of high SES on paleo diet adherence in conjunction with other demographic variables.

In essence, the analysis results found Paleo Diet Adherence was significantly associated with demographic variables including socioeconomic status (SES). The logistic regression analysis on paleo diet adoption showed high SES emerged as a strong determinant of adherence making the paleo diet more prevalent amongst individuals. These provided valid evidence of the analysis.



The graph above demonstrates the change in Paleo Diet adherence over time for the general population (Paleo Diet Adherence) and children from a high socioeconomic class (High SES & Paleo Diet Adherence). As shown, both groups seem to have an increasing trend in Paleo diet adherence over time, although the high SES group appears to be consistently higher at all time points.

Discussion

The data seems to indicate that a significant, albeit hypothetical, percentage of children from various socioeconomic groups is adhering to some form of a paleo diet. This underscore the multifaceted dynamics of an entire family's socioeconomic status and geography shape dietary choices which directly determine the mitigate dietary habits and health of these children.

The research indicates that children with higher socioeconomic status are more likely to observe the paleo diet. These findings are consistent with past research which indicates that specialized diets and financial resources often go hand in hand. Families with higher incomes tend to have access to organic and high-quality foods, including grass-fed meat, nuts, and fresh vegetables, which are critical to the paleo diet. On the other hand, lower-income families may spend less on nutritious food, which can hinder the adoption of diets such as the paleo diet. Such diets have also been reported to have greater accessibility in urban areas, where the population, in general, is more exposed to new dietary fats and trends, including the paleo diet, making it easier to incorporate them into their lifestyles. There is also little to no access to such resources in rural areas (Anderson et al., 2022) [6]. Alongside the economic factors, areas outside of urban centres tend to use supermarket-style stores that primarily offer fresh produce at a lower cost to the public.

The impact of social comparison is also striking in the adoption of the paleo diet. The research indicates that children whose parents practice paleo are more inclined to follow such dietary practices themselves. This confirms the social modelling theory, which states that children imitate the dietary practices of their parents or guardians. Indeed, there is a wealth of literature that demonstrates the impact of parental attitudes and practices concerning food on children's dietary choices and preferences. For example, parents who maintain a health-promoting diet and consider food as an important part of family life tend to have children who adopt similar behaviours in their diet. This is particularly salient with respect to the more restrictive diets such as the paleo diet, considering that children depend on their parents not only for sustenance but also for information and insight into what a healthy diet looks like. So, in order to understand the adoption of paleo diet among younger demographics, it is imperative to comprehend the influence of family relationships and caregivers (Hughes et al., 2016) [4].

This study revolves around paleo diet and highlights two fundamental underlying factors: socioeconomic status and urban residence. Higher socioeconomic status has a positive correlation with children following a paleo diet. This is largely due to high-income families having the resources and knowledge to invest in specialized diets. Further, the diets that are in vogue as well as health-centric necessities to consume are prioritized in these families. Health and diet expenditure awareness is tended by parents in these families. Moreover, urban areas are better equipped than rural counterparts for residing to have favourable pedagogy. These include, but are not limited to, a plethora of health food stores, organic markets, as well as nutrition-focused community programs. This translates to children are more likely to be introduced not just to paleo but to a myriad of other alternatives of diets. Relatively, those who reside in rural or low-income regions are likely to encounter obstacles when trying to adopt such diets due to scant resources in education concerning emerging trends in dietary habits, suitable food choices, and a lack of education. These findings depict, and indeed are alarming, have a widening gap considering the divide living in different regions exhibit disparities when it comes to the economic status, their geography, considering the dietary patterns, while looking from the lens of equity in holistic health Brown et. Al. 2021.

Although the study notes the increasing adoption of paleo diet, it is important to analyze its potential health risks, especially its dietary pattern for children. Current literature on paleo diet suggest some positive impacts, including controlling obesity and reducing inflammation, but also highlights an absence of valuable grains and dairy as a potential setback. For developing children, whose nutrition is essential in maintaining growth, the absence of particular food groups can lead to skeletal calcium, fiber, and vitamin D shortfalls. These nutrients are critical for bone, digestion, and overall growth, and their absence can stunt the children's long-term developmental potential. Consequently, it is imperative to portray the paleo diet in such a restrictive manner that ensures families comprehensively consider the health of their children in terms of dietary planning. This planning for children might necessitate some form of nutrition through additional suggested foods or make up for the non-paleo groups (Miller et al., 2020) [7].

Additional studies are warranted regarding the longitudinal health impact of the paleo diet on children. Research on adults remains inconclusive with some studies claiming the improvement of certain metabolic markers, including blood sugar levels and cholesterols, while others highlight concerns regarding the diet's overly restrictive nature and the imbalances it may create nutritionally. For children who are in a developing stage, it is important to evaluate how a paleo diet affects

their physical and cognitive abilities over an extended period of time. The omission of dairy products along with the absence of whole grain foods does not render the paleo diet unbeneficial, but rather places die-sparing questions around the value of such a diet for most children who require more nutrition. Evaluating the health impacts of the paleo diet in children by assessing the outcomes related to growth and development, as well as their immune system and general wellbeing are critical for future research (Williams et al., 2019) [8].

The results of the study highlight the need to provide comprehensive education to both children and parents. Such classes could address the danger of adopting age-inappropriate dietary restrictions, such as the paleo diet.[9] It is necessary to explain to families the importance of a varied diet containing different food groups, as this is vital in supporting children's growth and development and maintaining their health.[10] Moreover, public health programs could offer dietetic advice to families who follow alternative diets such as the paleo diet, assisting them with the understanding of the nutritional aspects so that children's diets are adequately supported.[11] Because of the prevalence of non-traditional diets, powerful, well-structured materials on nutrition aid parents in managing their children's well-being, making informed choices regarding their health.

In light of the study's significant findings, there are a multitude of shortcomings that should be addressed. To begin with, the study's cross-sectional design does not allow for the determination of causation. While there are correlations made with socioeconomic factors and parental influence and their relevance to the paleo diet heuristic, causality is not determinable. Furthermore, the self-reported data is particularly problematic, and potentially misleading. Parents are likely to either exaggerate or underplay the extent to which their children adhere to the paleo diet, thus undergoing bias.[12]Also, the geographic scope of the study may have implications for the external validity on account of the study's focus on urban or specific socioeconomic populations which may ignore rural populations or other cultural contexts where paleo diet access differs.[13, 14]Moreover the study did not evaluate the long term health consequences of the palaeolithic diet on children, hence it is difficult to gauge what the possible risks or benefits could be when adopting this dietary pattern over time.[15, 16]Finally, there was no previous work evaluating the nutritional adequacy of this diet in the sample population, meaning that there is no evidence to support whether these children are meeting all essential dietary nutrient requirements while following this diet.[17]

Regardless of these limitations, the study offers a solid basis on which further research can be built regarding the adoption and trend analysis of paleo diets among children.

More longitudinal designs, wider geographic coverage, and evaluating the nutritional adequacy of the paleo diet for children would address the cited gaps.[18] These actions would enhance the understanding of the paleo diet's effects on children's health and support the development of dietary-focused public health strategies aimed at children.

Conclusion:

The analysis contains significant information about the Paleo diet practiced by children and stresses the impact of parental Paleo diet adherence alongside socioeconomic status, as the most important factors that determine diet choices. It was found that children with parents following the Paleo diet and those belonging to a higher socioeconomic class are likely to adopt this dietary pattern. Though it is good to note that the Paleo diet seems to be gaining popularity, which indicates that more people are becoming conscious about health and nutrition, its restrictive nature is a cause for concern due to possible nutritional inadequacies especially among children. The study highlights the need to track dietary patterns that are common among paediatric populations and the profound impact those practices might enact on their health in the future. Public health campaigns need to place more emphasis on helping families understand what constitutes a balanced diet for their children, particularly those from low-income families, to ensure healthy eating habits are developed and maintained, especially in rural areas. There is a further need to research the potential health effects and nutritional adequacy of the Paleo diet among children to make sure optimal growth is achieved. This study aids in developing strategies and policies aimed at improving dietary practices among children at an early age.

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Appendix I
Paleo Diet Likeness Scale for Children (PDLS-C)
Instructions:
Please indicate your level of agreement with each of the following statements regarding the paleo diet for children. Use the following Likert scale for your responses:

1 – Strongly Disagree
2 – Disagree
3 – Neutral
4 – Agree
5 – Strongly Agree

1. I believe that the paleo diet is a healthy eating pattern for children.
2. I am satisfied with the nutritional value provided by the paleo diet for children.
3. I believe that the paleo diet improves children's overall energy levels.
4. I think that the paleo diet can contribute to better academic performance in children.
5. I find it easy to incorporate paleo diet foods into my child's daily meals.
6. I believe that children following a paleo diet experience fewer health issues.
7. I feel that the paleo diet is safe for long-term use in children.
8. I think that the paleo diet is a sustainable eating approach for children.
9. I believe that the paleo diet helps maintain a healthy weight in children.
10. I am confident in my ability to prepare meals that adhere to the paleo diet for children.
11. I think that the paleo diet aligns well with our family's traditional eating habits.
12. I believe that the paleo diet is more beneficial than conventional diets for children.
13. I find that children enjoy the taste of foods included in the paleo diet.
14. I think that the paleo diet can reduce the risk of chronic diseases in children.
15. I feel that the benefits of the paleo diet outweigh any challenges in implementing it for children.