Research Article

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Dietary Influences On Child Health: Comparing Plant- Based And Western Eating Patterns.

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ABSTRACT

A plant-based diet has potential health benefits. To address this, data on dietary patterns, growth, and infection rates were collected from children adhering to a plant- based diet and compared to those following a Western diet through a questionnaire. The study comprised 88 children (44 on a plant-based diet and 44 on a Western diet) stratified into three age groups: under 3 years, 3 to under 6 years, and 6 to 13 years. Children following a plant-based diet exhibited a lower incidence of infections and recurrences during preschool and school age compared to those adhering to a Western diet. In the plant-based group, growth parameters were within normal ranges, and dietary patterns appeared well-balanced with antioxidant vitamins within recommendations apart from vitamin D. Notably, vitamin D consumption was also insufficient in the Western diet group. Adopting a plant-based eating regimen may yield health advantages for children worth an inquiry on the long-term.

Keywords : *plant-based diet; Western diet; children; health; infection.*

INTRODUCTION

Aging is influenced by multiple factors from early life, with nutrition being crucial for growth and development since fetal stages. Nutrition significantly enhances immune function alongside microorganisms. Adequate energy, protein, fat quality, and specific nutrients like vitamins A, B, C, D, E, zinc, iron, copper, and selenium optimize immunity [1,2]. A lack of essential nutrients can negatively impact various immune functions. This includes hindering the production of lymphocytes, antibodies, and cytokines, disrupting enzymatic processes, and exposing immune cells to oxidative stress [2].
In the presence of overt malnutrition, it is well known that children are exposed to high rates of infection which, in turn, worsen malnutrition and may lead to life-threatening events [1,3,4].
Malnutrition's first evidence occurred in the late 50' when Scrimshaw et al identified a synergistic effect between infection and malnutrition based on studies of the Institute of Nutrition of Central America and Panama in stunted children with diarrhea [5]. Since then, several nutrients, when not sufficiently introduced, have been linked to dysfunctional immune system making the body of both healthy individuals and people affected by more severe diseases (e.g. cancer, anorexia, human immunodeficiency virus), more vulnerable to infections or other complications [6,7]. Nutrient deficiencies and the resulting immune dysfunctions can impact people across the entire age spectrum, with infants and children more exposed to developmental delay, malnutrition and infections.
Although individual eating habits vary daily, most families follow a general eating routine [e.g., high-carb diet, high protein, high fat and processed food or mostly plant-based food (PBD)] based on cultural, personal, and lifestyle choices. Despite daily variation in eating, the Mediterranean diet is widely recognized as the most beneficial in terms of overall well-being. The Mediterranean diet, recognized as a lifestyle and included in the UNESCO intangible cultural heritage in 2010, is crucial for a balanced immune system, as emphasized in a recent Covid-19 study [8]. PBD similarly supports immune health due to their rich content of antioxidants, vitamins, and healthy fats found in nuts, seeds, whole grains, fruits, and vegetables. Initial studies indicate promising results regarding the association between PBD and immune function [8-10]. However, more evidence of PBD benefits in pediatric settings is needed [11-13]. The potential of PBDs to enhance the immune system is maximized when combined with regular

physical activity and a healthy lifestyle [14]. This study aimed to investigate the relationship between PBD and health balance in children, comparing it with those following a Western diet (WD).

PATIENTS AND METHODS

Study design

This study is a descriptive observational investigation conducted among children aged 1 to 13 years on PBD and WD. To ensure comparable representation of gender, age, and environmental factors, the group following the WD was selected to match the group adhering to a PBD. The research utilized a survey to collect data from children referring to a pediatric gastroenterology and nutrition service. The data collection instrument was a questionnaire. The questionnaire was organized into distinct sections, with a primary focus on dietary intake and pattern followed by personal information which included growth parameters, physical activity and infectious episodes and rates over one year. Guidance completing the questionnaire was given to the parents. The extent to which children actively participated in answering the questions was determined by their capability to do so. The inclusion criteria specified that the subjects had no chronic diseases or malformations and were not chronic users of medication that could impact growth or dietary habits. The 1–13-year age range was chosen based on data accessibility and the influence parents have on children during this period [15]. As children enter adolescence, they consume more meals outside the home, adjust their daily routines, and become less reliable in documenting their food intake [16-18]. Additionally, there is a possibility that adolescents following a PBD might be inclined to experiment with a WD, which would make comparisons unfeasible. During the teenage years, individuals tend to show less inclination towards embracing a vegetarian or vegan lifestyle [19]. The selected age range was further categorized into three groups (under 6 years, 6 to 13 years, and over 13 years) to account for variations in dietary intake across different developmental stages.

Dietary intake data

Nutritional information was collected through a combination of 24-hour dietary recall and food frequency questionnaires. The data included details on eating patterns, condiments, beverages (such as still or sparkling water, soft drinks, ready to drink tea, fruit juices), confectionery items, whether foods were organically or conventionally produced, use of whole grain foods, and supplements. Information on fast food consumption was also gathered. The collected data was subsequently evaluated using the Food Composition Database for Epidemiological Studies in Italy (BDA- https:\\ bda.ieo.it). A PBD was defined as one that may include dairy products and eggs but excludes meat, meat-based products, and fish (lacto-ovo vegetarian, or LOV), or as one that excludes all animal products entirely (vegan, or VE). Conversely, WD group was omnivorous.

Personal data

The data included anthropometric parameters (weight, height, and body mass index), community setting attendance, time spent sleeping, the duration and intensity of screen time activities, such as watching videos or using electronic devices, as well as the frequency and intensity of physical activity performed by preschool and school-aged children were examined. Most of these data were not quantifiable in toddlers especially related to physical activity and community setting attendance. In preschool children, physical activity was defined as time spent in outdoor activities such as nature walks, water play, obstacle courses, and scavenger hunts. In school children, physical activity was intended the time spent performing sport or exercise in a week. Medical conditions, use of drugs or supplements, and number of episodes of acute illness in the previous year (considered as body temperature =>38°C with or without antibiotic treatment, cold excluded) were recorded. The number of acute illness episodes could be easily tracked by parents using the records maintained by the general pediatrician. Children were classified according to the Italian growth standards based on their anthropometric data [20]. The protocol was approved by the Ethics Committee of the University Hospital Sant'Orsola Malpighi (38/2017/O/ Oss) and the study applied the Helsinki Declaration with guaranteed anonymity and signature of informed consent by parents at the time of enrolment.

Statistical analysis

Data were summarized based on the variable types. Frequencies, proportions, and associations between groups were done for categorical data. STATA software (version 17, Texas, USA) was used to compare groups. The choice between paired t-test and Wilcoxon test was determined by the distribution of variables. For comparisons involving three or more groups, either ANOVA or Friedman's test was employed. Statistical significance was established at a p-value less than 0.05.

RESULTS

Results were extracted from 88 questionnaires belonging to children of different ages: group 1 (age range 1-<3-year-old): 14 children on WD and 14 on PBD (7 girls and 7 boys in every group; 4 LOV and 10 VE); group 2 (age range 3- <6-year-old): 15 children on WD and 15 on PBD (8 girls and 7 boys in every group; 9 LOV and 6 VE); group 3 (age range 6-13-year-old): 15 children on WD and 15 on PBD (7 girls and 8 boys in every

group; 10 LOV and 5 VE).

Children were full term, had normal development and behavior, and attended community settings from 3 years of age. They lived in urban area. No data were available in social status and graduation level of parents.

Anthropometric data

In groups 1 and 2, no significant weight disparities were observed between PBD and WD children. However, group 3 showed notable differences: 66% of PBD children fell below the 25th percentile in weight vs 33% in WD children ($p<0.001$). In the same group, only 20% of the PBD children exceeded the 50th percentile for weight vs 50% of the WD ($p<0.05$).

In groups 1 and 2, no significant height variations were observed between PBD and WD children. However, in group 3, 66% of PBD children fell below the 50th percentile, compared to 33% of WD children ($p<0.001$). **Table 1** summarizes the children's distribution. Regarding BMI, analysis was limited to groups 2 and 3. In group 2, 40% of PBD children versus 7% of WD children were below the 25th percentile (p 0.03). Similarly, in group 3, 67% of PBD children compared to 20% of WD children were below the 25th percentile ($p <0.001$).

Table 1. Distribution of children based on their weight and height percentiles.

Groups	1<3 years		3 to < 6 years		6 to 13 years	
	Plant-based diet (n)	Western diet (n)	Plant-based diet (n)	Western diet (n)	Plant-based diet (n)	Western diet (n)
Height's percentile						
3-<25	2	2	2	2	2	1
25-<75	3	6	5	7	8	5
75-<97	7	4	7	5	5	8
=>97	2	2	1	1	0	1
Subtotal	14	14	15	15	15	15
Weight's percentile						
3-<25	1	2	1	2	5	2
25-<75	7	7	7	7	7	6
75-<97	5	5	7	5	3	7
=>97	1	0	0	1	0	0
Subtotal	14	14	15	15	15	15

n: number of children.

Food habits

The PBD and WD groups exhibited significantly different dietary patterns and intakes (**table 2**). The diet of all PBD children, with two exceptions, consisted entirely of organic and whole grain foods (**figures n. 1 and 2**). Among WD children, organic food consumption was observed in nearly 50% of group 1, decreasing progressively in subsequent groups. Older WD children consumed organic eggs and tomato sauce. WD diet was characterized by low fiber content. Less than one-third of WD children in groups 2 and 3 incorporated whole grain once or twice per week. Over half of the WD school children did not report consuming fruits and vegetables. They consumed meat and cheese more than four times per week, ingested cow's milk almost daily for breakfast with cookies or cereals, but rarely included legumes and fish in their diet. In contrast, PBD children consumed fruit, seeds, and nuts multiple times daily, particularly at breakfast and during snacks. They also consumed plant-based milk at breakfast. Approximately 75% of PBD and 66% of WD children in groups 1 and 2 consumed vitamin and mineral supplements, with notable disparities observed in group 3 (33% PBD vs 73% WD, Figure n. 3). The most frequently utilized supplements were vitamins B12, D, C, and iron. Sugar-sweetened beverages were predominantly consumed by WD children. Excluding groups 1 due to their young age, significant differences were noted in cola-like soda consumption: 40% of WD preschoolers versus 7% of PBD (p 0.003), and over 50% of WD school- age children compared to 0% of PBD (p 0.001). Orange soda was slightly more prevalent among PBD children (approximately 20%), but still less common than in WD children (33%). Substantial variations were also observed in fruit juice and candy intake. From age 3 onwards, nearly all WD children consumed fruit juices, while only 20% of PBD did, with PBD juices typically being 100% fruit without added sugar. Candy consumption was

significantly different in WD (28% of toddlers, 60% of preschoolers, and 73% of school-age children), compared to none of the PBD toddlers and 40% of school-age children. Data distribution is illustrated in **Figures n. 4 and n. 5**. Fast-food consumption (**figure n. 6**) commenced early in the WD groups, with 60% of WD toddlers and 66% of school-age children frequenting such establishments. This behavior was infrequent among PBD children (1 out of 15). The disparity between WD and PBS groups was statistically significant (p <0.001).

Table 2. Summary of dietary intake.

Variable		Children 1<3 years		Children 3 to < 6 years		Children 6 to 13 years	
		Plant-based diet (n 14)	Western diet (n 14)	Plant-based diet (n 15)	Western diet (n 15)	Plant-based diet (n 15)	Western diet (n 15)
Total calories	(kcal/d)	1090±45	1130±60	1290±90	1350±80	1740±102	1770±109
Protein intake	(% kcal/d)	13±2	16±2**	16±4	18±3	15±2	17±3
Lipid intake	(% kcal/d)	35±4	36±4	28±4	31±3^	30±3	33±4
Carbohydrate intake	(% kcal/d)	52±4	48±4^^	56±3	51±3**	55±4	50±4^^
Simple sugar intake	(% kcal/d)	13±2	18±2**	12±1	17±2**	13±2	16±4
Fiber intake	(gr/1000kcal)	8.2±2	6.2±2^	9.2±1.7	7±2^^	9.4±1.9	7.5±1.7*
Vitamin A	(µg/1000kcal)	312±46	270±35^	350±39	295±52^^	480±56	427±77^
Vitamin E	(mg/1000kcal)	5.5±0.9	4.5±0.9**	6.2±0.7	4.7±0.6**	8.1±0.8	6.9±1.1^^
Vitamin C	(mg/1000kcal)	36.7±4.6	27±3.5**	43±3.7	36±2.7**	56±6	44±8**
Vitamin D	(µg /1000kcal)	2.75±0.45	3.5±0.4**	4.7±0.8	6±0.4**	5.1±0.6	6.4±0.7**

n: number of children. P values were the result of the confrontation of PBD and WD in every age group. ** p<0.001; *p<0.01;^^p<0.005;^p<0.05.

Figure 1. Organic food consumption. The number of children consuming organic food for each dietary category is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based diet; WD: western diet.

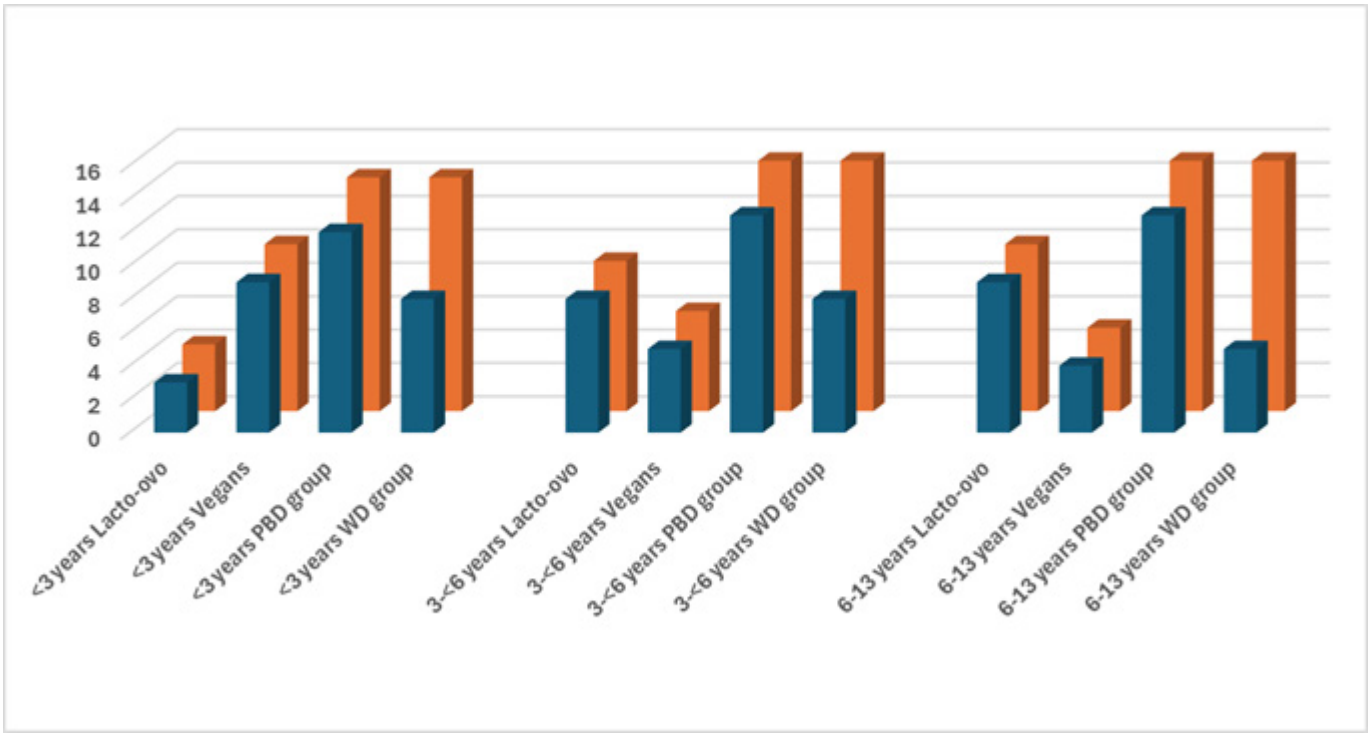

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Figure 2. Whole grain consumption. The number of children consuming whole grain for each dietary category is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based diet; WD: western diet.

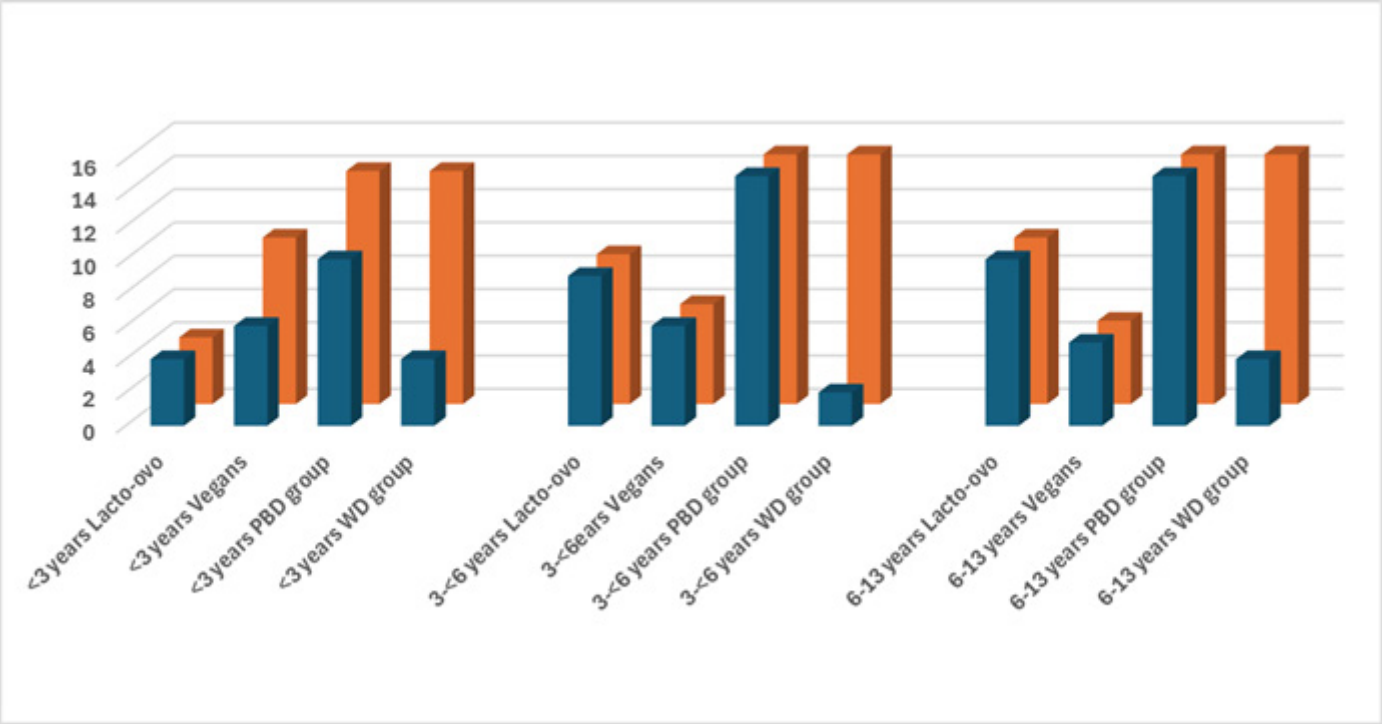

Figure 3. Use of food supplements. The number of children consuming supplements for each dietary category is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based diet; WD: western diet.

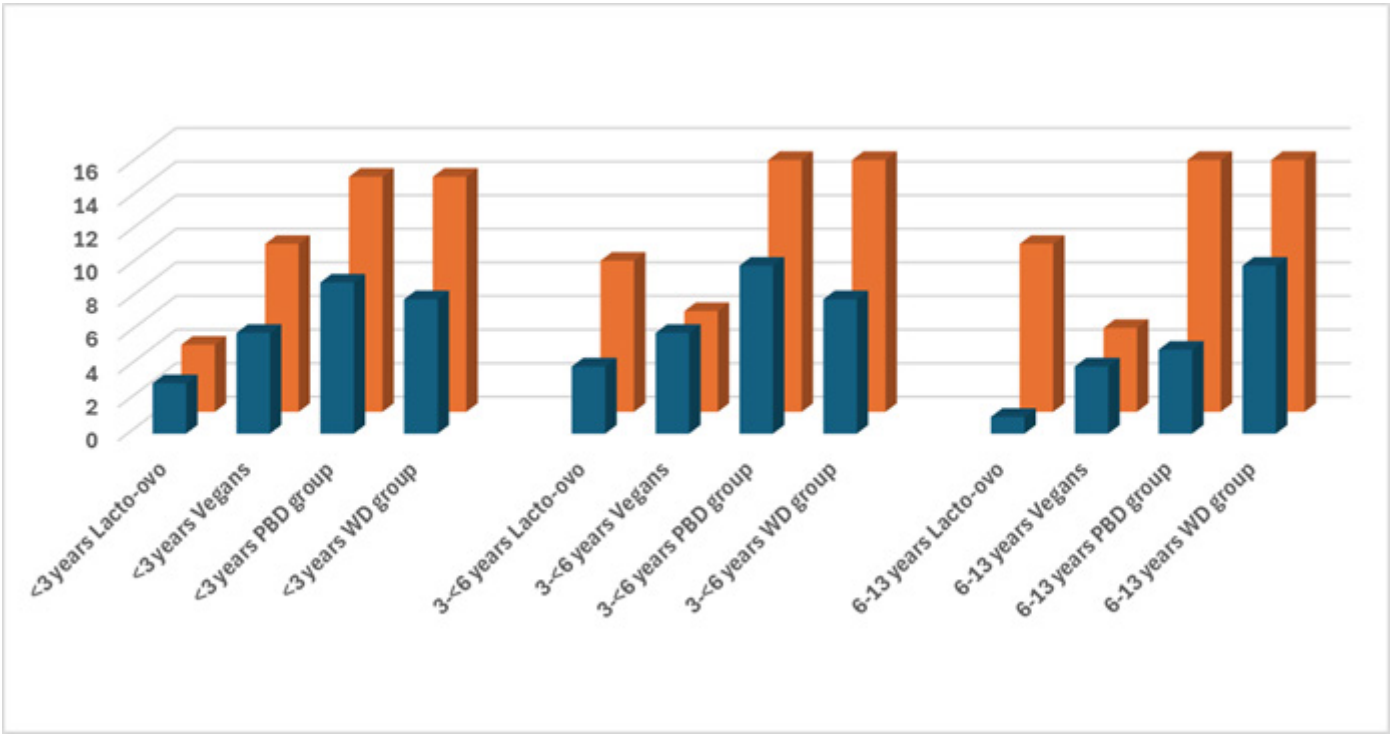

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Figure 4. Sugar-sweetened juice consumption. The number of children consuming sugar- sweetened juice for each dietary category is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based diet; WD: western diet.

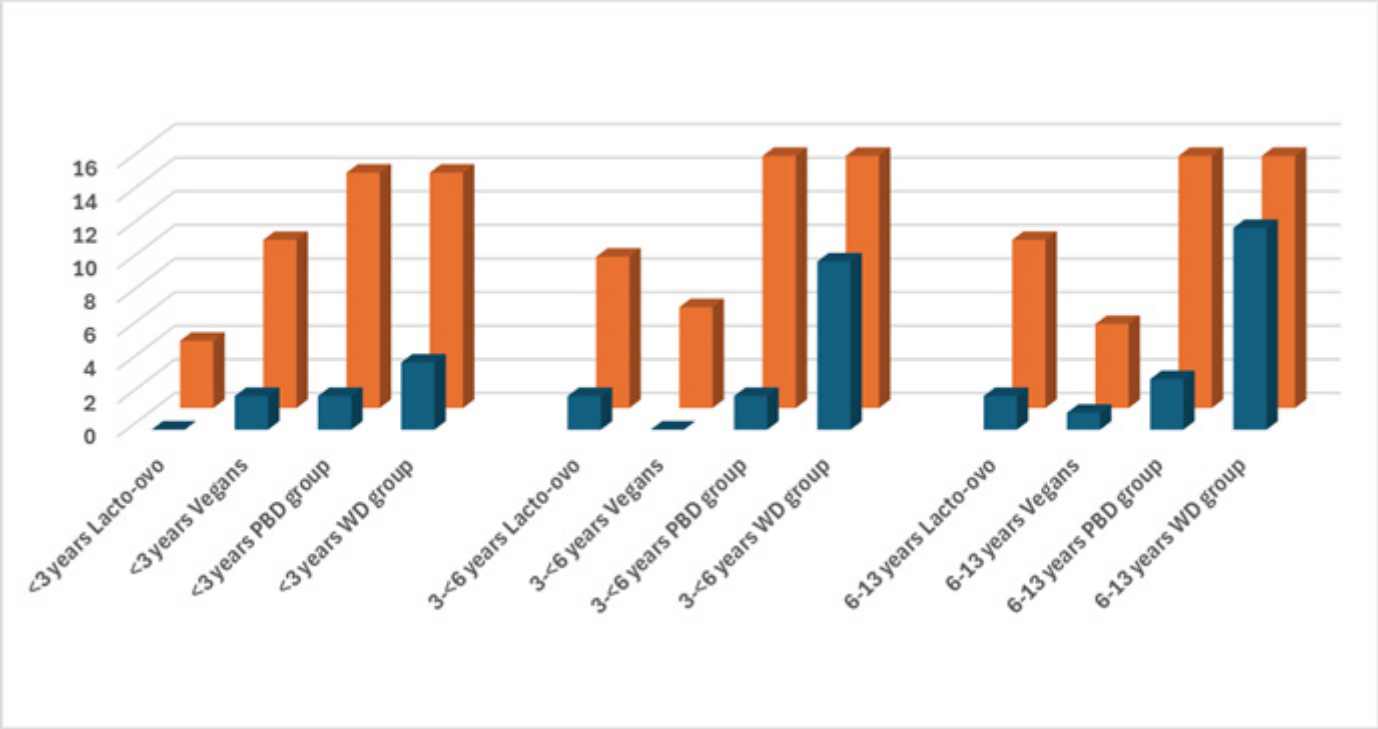

Figure 5. Candy consumption. The number of children consuming candy for each dietary category is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based diet; WD: western diet.

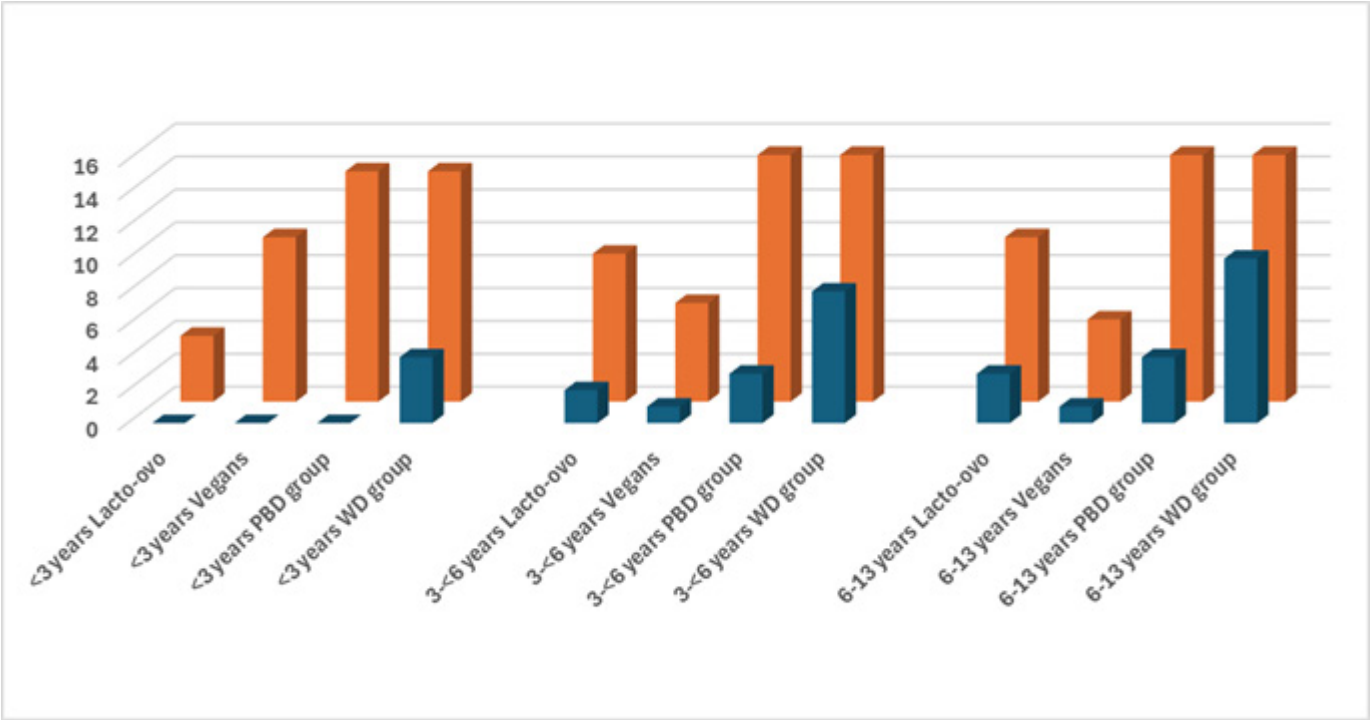

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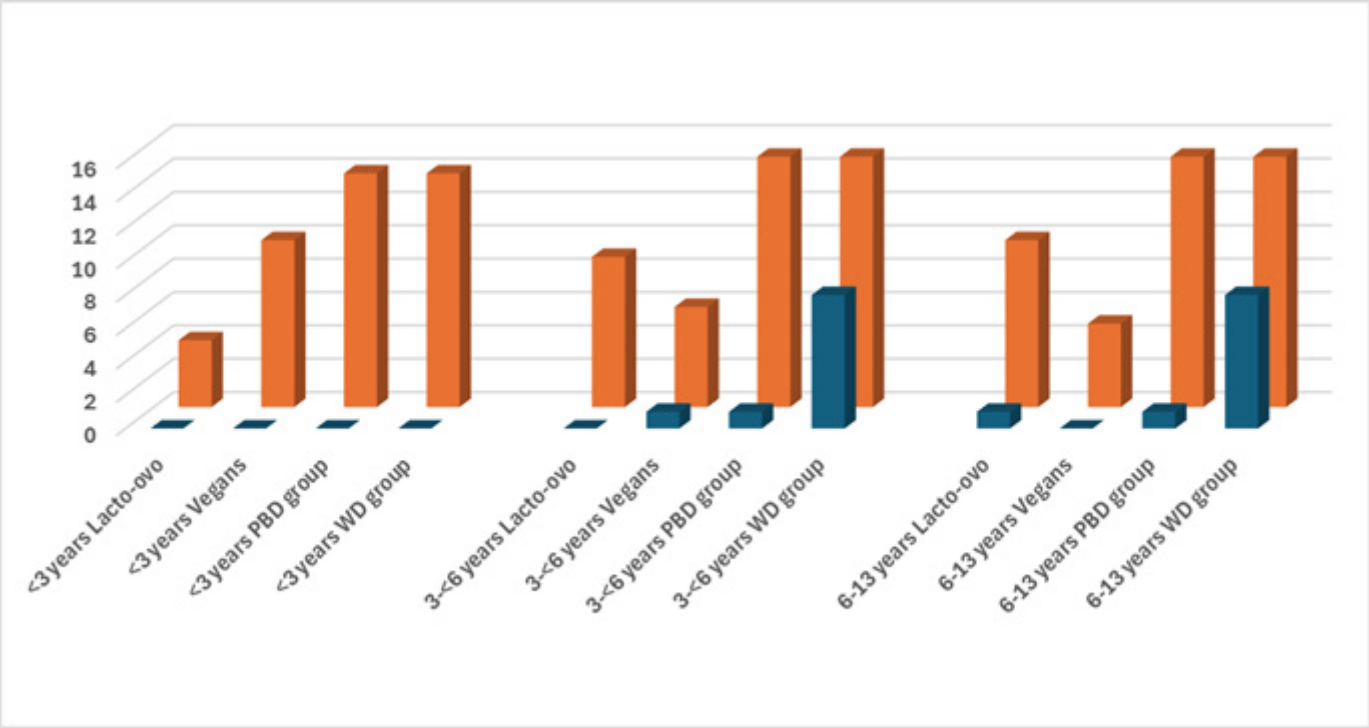
Figure 6. Fast food consumption. The number of children consuming fast food for each dietary category is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based group; WD: western diet.



Physical activity

Preschool children in the PBD group demonstrated higher engagement in physical activity compared to the WD group: 73% vs 26%. In school-aged children, all participants in both groups engaged in physical activity. The majority of WD school-aged children (13 out of 15) participated in physical activity once or twice per week, with the remaining children engaging three times per week. In contrast, among PBD school-aged children, 4 out of 15 engaged in physical activity twice per week, 3 out of 15 once per week, and 7 out of 15 three or four times per week.

Disease occurrence and frequency

Although the absolute number of PBD toddlers who reported an infection was higher compared to those on the WD, analysis of the infection rates revealed that the majority of PBD toddlers experienced only one episode of illness, while some WD toddlers had three or more episodes per year. No data on community attendance were available for the WD and PBD toddler groups. In Group 2, one- third of preschool children following PBD remained disease-free, while the remaining two-thirds experienced only one or two episodes throughout the year. Conversely, in the WD group, all children contracted an illness, with more than 50% experiencing three or more episodes. A similar pattern was observed in Group 3. **Figures n 7 and 8** (a, b, c) summarize these data.

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Figure 7. Incidence of acute illness within the past year. The number of children with acute illness within the past year is represented by blue bars, while orange bars show the total sample size for each category. The vertical axis denotes the number of children. PBD: plant-based diet; WD: western diet.

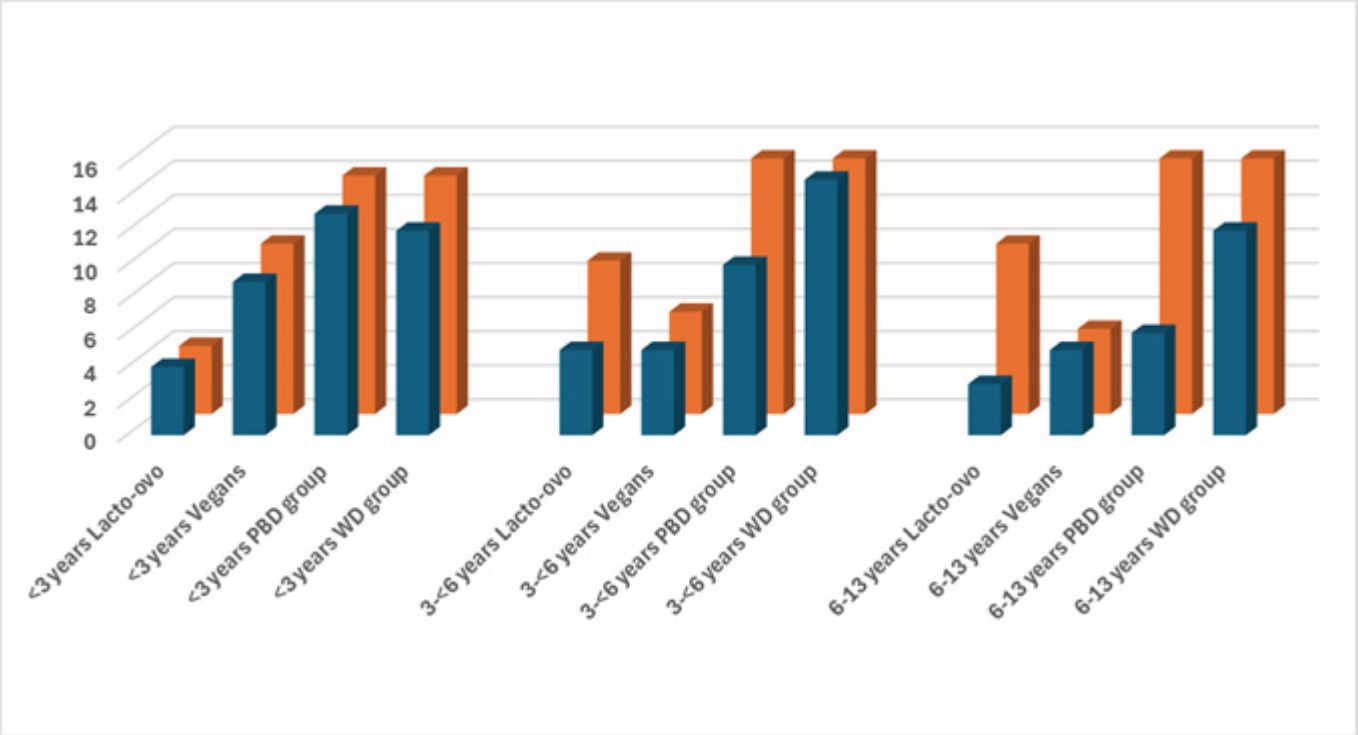
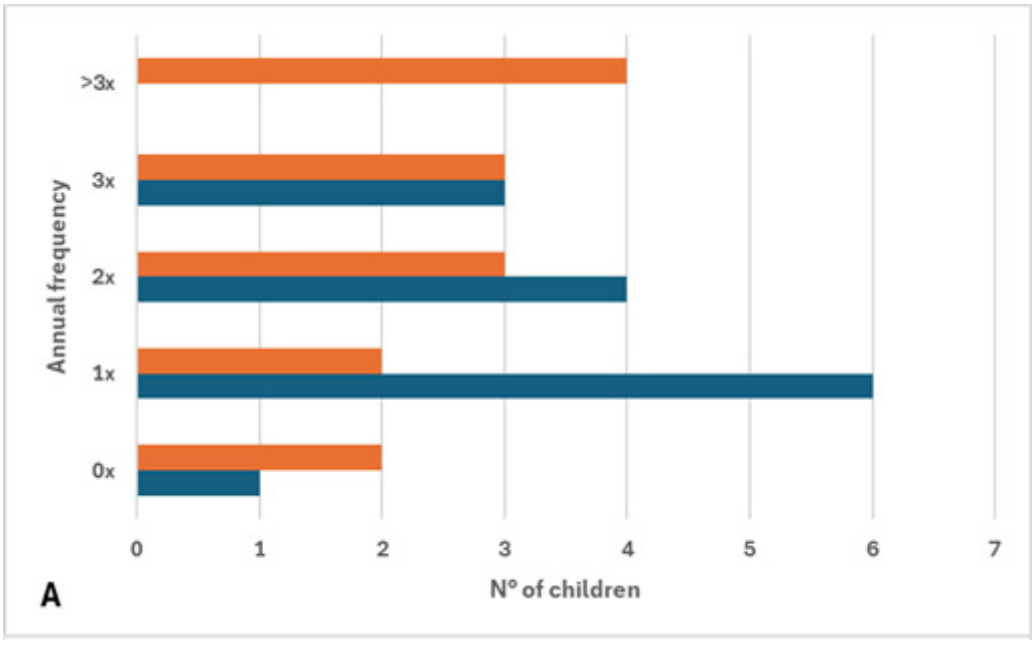
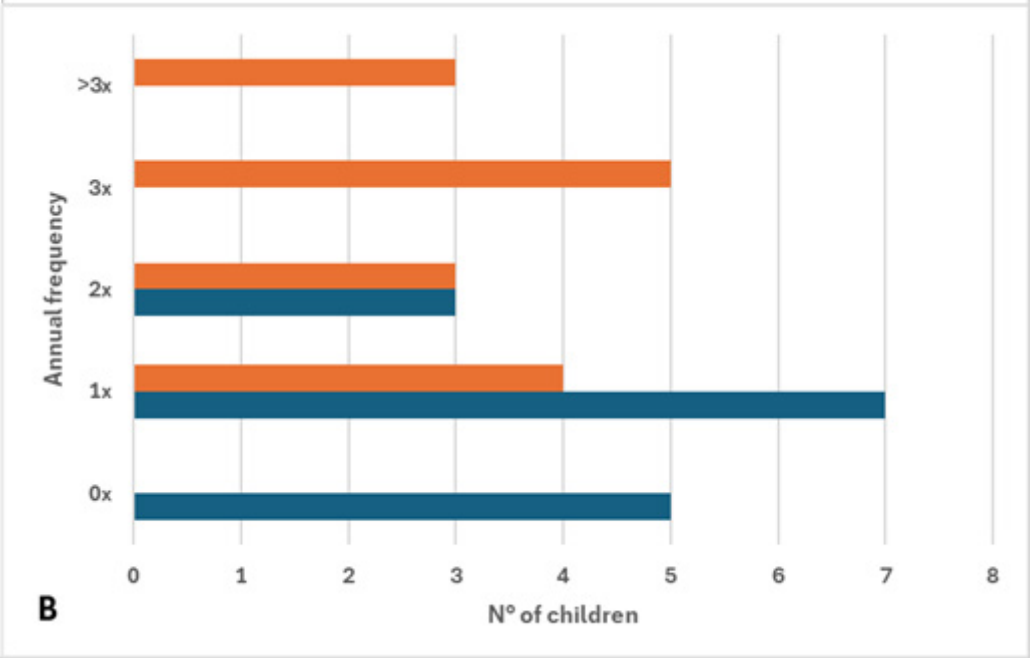
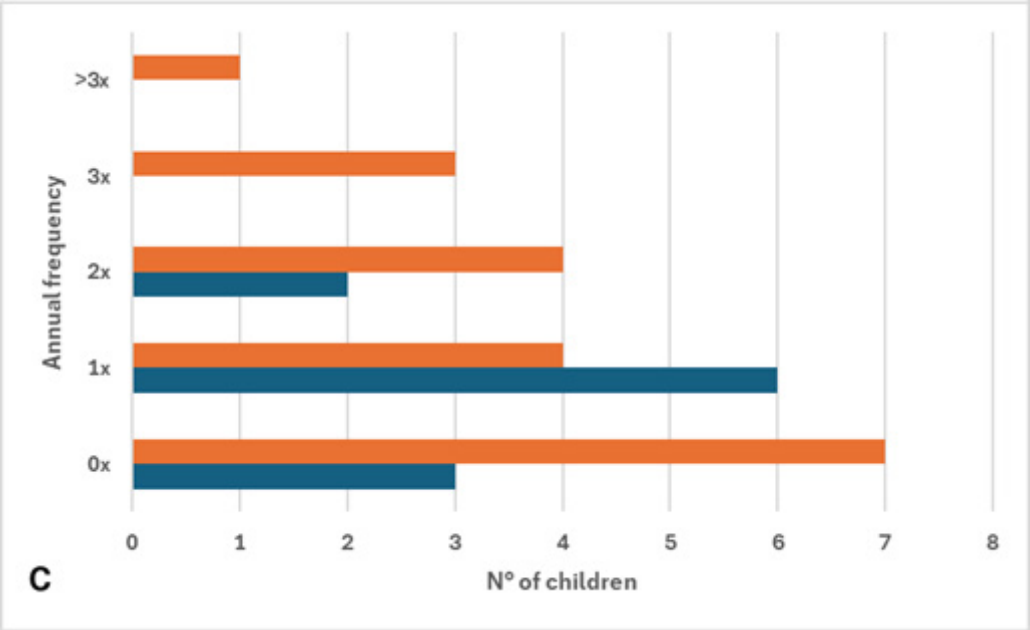


Figure 8. Number of acute illness episodes within the past year (A) in children <3 years; (B) in children between 3 and <6 years; (C) in children between 6 and 13 years of age. The blue bars represent the children on a plant-based diet (PBD), and the orange bars represent those on a Western diet (WD).







DISCUSSION

This study compared the health of children on PBD and WD. Dietary patterns, growth, physical activity, and infection incidence over a year were analyzed. PBD toddlers had higher initial infection susceptibility but lower recurrence rates than WD toddlers. PBD pre-school and school children showed greater protection, with fewer affected children and lower recurrence rates than the WD group. Although the lack of longitudinal follow-up prevents confirming PBD's protective effect on infections, the noticeable reduction in infectious episodes and reinfections among PBD children compared to WD children suggests the need for a larger sample size and prolonged observation. In addition to benefits for conditions like obesity, dyslipidemia, and hypertension [11,21], PBD provides protection against infections through systemic and gastrointestinal effects [22,23]. It modulates microbiota and immune function by selecting gut flora species with anti-inflammatory and gastrointestinal mucosal defense properties, promoting butyrate production, higher IgA expression, and reduced inflammatory genes [9,23]. PBD also affects acute and chronic conditions (e.g., viral and bacterial respiratory infections, asthma, neurodegenerative diseases, and

potentially cancer) due to its natural constituents, including minerals, vitamins, polyphenols, and antioxidants [21,24].

PBD groups consumed a high-quality, nutrient-dense diet of unrefined, minimally processed foods, including vegetables, fruits, whole grains, and healthy fats and protein, without affecting children's growth. Their antioxidant vitamin intakes were close to recommendations, except for vitamin D. Conversely, the WD patterns were rich in processed foods high in sugar and fat, low in fiber and antioxidant vitamins. Despite higher vitamin D intake in WD children than PBD, it was still below recommended levels. WD children consumed fast food more frequently than PBD, fostering habitual preferences for these foods. Researchers noted the adverse effects of WD's high processed food content, including fast food, on body functions, immune system dysregulation, and microbiota [22,23,25,26]. Myles suggested genetically modified food might reduce vitamin A and calorie intake [25]. The small sample size, though a limitation, is typical in PBD research in children. A recent systematic review included studies with similar or smaller samples, showing this study's sample size aligns with existing literature [27]. The sample's homogeneity, all from a local area, strengthens the reliability of observed differences. This consistency reduces confounding variables from diverse dietary patterns or food availability in different regions.

Both WD and PBD utilized dietary supplements, with the former receiving higher quantities during school years when infection rates were unexpectedly elevated. Conversely, PBD children did not receive extensive supplementation, indicating that PBD parents prioritize dietary nutritional adequacy over supplementation. The increasing popularity of supplements in Western societies stems from their accessibility, aggressive marketing, and the misconception that they can replace a diet rich in fruits and vegetables. Parents must recognize that supplements cannot substitute quality food, and healthcare professionals should emphasize a balanced, whole-food diet for optimal child nutrition and health. PBD children were more physically active than WD. Frequent exercise and proper nutrition are essential for boosting immunity and overall health [14]. Regular exercise habits established in childhood can lead to long-term benefits, such as reduced risk of chronic diseases in adulthood through better weight management, improved cognitive function, and enhanced mental health.

There are concerns that PBD might not provide all the necessary nutrients for proper growth and development in children. The comparison between the PBD and WD groups showed numerical differences but did not indicate malnutrition or stunting among PBD children. The balanced weight-to-height ratio in PBD children suggests healthy growth despite numerical differences. The presence of preadolescents in group 3, where discrepancies were noted, is a crucial variable, as growth spurts vary significantly in this age range, influencing measurements and group differences. The lack of longitudinal data limits a comprehensive growth trajectory, but the findings are significant amid contemporary health concerns. With childhood overweight and obesity prevalent worldwide, the absence of these conditions in the PBD group is a positive outcome.

Besides physical health concerns, some experts worry about social exclusion or limited food choices for children on PBD [11]. However, the families studied demonstrated strong nutritional knowledge and engagement, choosing PBD for ethical and social reasons. Their goal was to expand their children's perspectives, not restrict their diet. Their eating habits were like the traditional Mediterranean diet, suggesting a more nutritious and balanced approach.

Despite major medical and dietetic organizations [28,29] endorsing well- planned PBD for various life stages, skepticism remains among some healthcare professionals and the public [30]. This highlights the need for more comprehensive research on different PBD patterns and their long-term effects on children's health and development. Bias among healthcare providers is also an issue. Parents report hesitance in discussing their children's PBD with pediatricians. A recent survey found that 71% of parents adopting a vegan diet for their family sense skepticism and aversion from their children's pediatrician [31]. However, doctors' perspectives can improve with information campaigns [32].

CONCLUSION

Adopting PBD may offer children health benefits, including defense against short-term illnesses. However, these findings rely on self-reported data, which may contain inaccuracies or biases. The limited sample size further restricts the ability to draw statistically robust conclusions. Despite these limitations, the results are encouraging and could lay the groundwork for future research and prompt healthcare providers to discuss PBD with families. Future studies should gather more comprehensive dietary data, conduct laboratory analyses, and document infectious episodes prospectively in a larger participant group. Including adolescents could also be beneficial to assess PBD adherence and examine the impact of growth spurts on final height.

Author Contributions

Everyone participated in the manuscript and took public responsibility for its content. In particular: M.L.F.: conceived, coordinated, and carried out the study including statistical analyses and manuscript's draft. A.D.: collected, analysed data; F.M.A.P.: analysed data All contributed to drafting and revision of the paper.

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Hulsewé, K., van Acker, B., von Meyenfeldt, M., et al. (1999) Nutritional Depletion and Dietary Manipulation: Effects on the Immune Response. World J. Surg. 23, 536–544.https://doi.org/10.1007/PL00012344

2. Tourkochristou, E., Triantos, C., Mouzaki, A. (2021) The Influence of Nutritional Factors on Immunological Outcomes. Front Immunol. 31;12:665968. doi: 10.3389/fimmu.2021.665968. PMID: 34135894;PMCID: PMC8201077.

3. Chandra, R.K. (1996) Nutrition, immunity and infection: from basic knowledge of dietary manipulation of immune responses to practical application of ameliorating suffering and improving survival. Proc Natl Acad Sci U S A. 93(25):14304-7. doi: 10.1073/pnas.93.25.14304. PMID: 8962043; PMCID: PMC34479.

4. Chandra, R.K. (2002) Nutrition and the immune system from birth to old age. Eur J Clin Nutr. 56 Suppl 3:S73-6. doi: 10.1038/sj.ejcn.1601492. PMID: 12142969.

5. Scrimshaw, N. S., Taylor, C. E., Gordon, J. E., & World Health Organization. (1968) Interactions of nutrition and infection / Nevin S. Scrimshaw, Carl E. Taylor, John E. Gordon; prepared in consultation with seventeen specialists in various countries. World Health Organization.https://iris.who.int/handle/10665/41782.

6. Kiani, A.K., Dhuli, K., Donato, K., Aquilanti, B., Velluti, V., Matera, G., Iaconelli, A., Connelly, S.T.,Bellinato, F., Gisondi, P., Bertelli, M. (2022) Main nutritional deficiencies. J Prev Med Hyg.63(suppl.3):E93-E101.https://doi.org/10.15167/2421-4248/jpmh2022.63.2S3.2752.

7. Morales, F., Montserrat-de la Paz, S., Leon, M.J., Rivero-Pino, F. (2024) Effects of Malnutrition on the Immune System and Infection and the Role of Nutritional Strategies Regarding Improvements in Children's Health Status: A Literature Review. Nutrients 16, 1. https://doi.org/10.3390/nu16010001.

8. Trajkovska Petkoska, A., Trajkovska-Broach, A. (2021) Mediterranean Diet—A Healthy Dietary Pa_ern and Lifestyle for Strong Immunity. In: Agarwal, P., Nieto, J.J., Ruzhansky, M., Torres, D.F.M. (eds) Analysis of Infectious Disease Problems (Covid-19) and Their Global Impact. Infosys Science Foundation Series. Springer, Singapore. https://doi.org/10.1007/978-981-16-2450-6_13

9. Craddock, J.C., Neale, E.P., Peoples, G.E., Probst, Y.C. (2019) Vegetarian-Based Dietary Pa_erns and their Relation with Inflammatory and Immune Biomarkers: A Systematic Review and Meta-Analysis. Advances in Nutrition. 10,3,433-451, ISSN 2161-8313,https://doi.org/10.1093/advances/nmy103.

10. Link, V.M., Subramanian, P., Cheung, F., Han, K.L., Stacy, A., Chi, L., Sellers, B.A., Koroleva, G., Courville,A.B., Mistry, S., Burns, A., Apps, R., Hall, K.D., Belkaid, Y. (2024) Differential peripheral immune signatures elicited by vegan versus ketogenic diets in humans. Nat Med. 30(2):560-572. doi:10.1038/s41591-023-02761-2. Epub 2024 Jan 30. Erratum in: Nat Med. 2024 Jun;30(6):1785. doi:10.1038/s41591-024-02884-0.PMID:38291301; PMCID: PMC10878979.

11. Desmond, M.A., Fewtrell, M.S., Wells, J.C.K. (2024) Plant-Based Diets in Children: Secular Trends, Health Outcomes, and a Roadmap for Urgent Practice Recommendations and Research—A Systematic Review.Nutrients 16, 723. https://doi.org/10.3390/nu16050723.

12. Nathan, I., Hacke_, A.F., Kirby, S. (1996) The dietary intake of a group of vegetarian children aged 7-11years compared with matched omnivores. British Journal of Nutrition.75(4):533-544.doi:10.1079/BJN19960157.

13. Munteanu, C., Schwary, B. (2022) The relationship between nutrition and the immune system. Front. Nutr.9:1082500. doi: 10.3389/fnut.2022.1082500.

14. Shao, T., Verma, H.K., Pande, B., Costanzo, V., Ye, W., Cai, Y., Bhaskar, L.V.K.S. (2021) Physical Activity and Nutritional Influence on Immune Function: An Important Strategy to Improve Immunity and Health Status. Front Physiol.8;12:751374.doi:10.3389/fphys.2021.751374. PMID: 34690818; PMCID: PMC8531728.

15. Tell, M.N., Hedin, K., Nilsson, M., Golsäter, M., Lingfors, H. (2021) Food intake in children and adolescents: a cross-sectional study from 2009/2010 to 2015/2016. J Nutr Sci.15;10:e51.doi:10.1017/jns.2021.40.PMID:34367626; PMCID: PMC8327392.

16. Bandini, L.G., Must, A., Cyr, H., Anderson, S.E., Spadano,

J.L., Diey, W.H. (2003) Longitudinal changes in the accuracy of reported energy intake in girls 10-15 y of age. Am J Clin Nutr.78(3):480-4. doi:10.1093/ajcn/78.3.480. PMID: 12936932.

17. Lachat, C., Nago, E., Verstraeten, R., Roberfroid, D., Van Camp, J., Kolsteren, P. (2012) Eating out of home and its association with dietary intake: a systematic review of the evidence. Obes Rev.13(4):329-46.doi:10.1111/j.1467-789X.2011.00953.x. Epub 2011 Nov 23. PMID: 22106948.

18. Gaši, A., Mudnić, Ž., Rešetar, J., Gajdoš-Kljusurić, J., Sorić, M., Mišigoj-Duraković, M., Šatalić, Z. (2023) Effects of eating outside the home on adolescent diet quality. Hrvatski časopis za prehrambenu tehnologiju,biotehnologiju i nutricionizam [Internet].18(1-2):14-21.h_ps://doi.org/10.31895/hcptbn.18.1-2.1.

19. Havermans, R.C., Ru_en, G., Bartelet, D. (2021) Adolescent's Willingness to Adopt a More Plant-Based Diet:A Theory-Based Interview Study. Front Nutr. 30;8:688131. doi: 10.3389/fnut.2021.688131.PMID:34527686;PMCID: PMC8435572.

20. Cacciari, E., Milani, S., Balsamo, A., et al. (2006) Italian cross-sectional growth charts for height, weight and BMI (2 to 20 yr). J Endocrinol Invest. 29(7):581-93.

21. Kiely, M.E. (2021) Risks and benefits of vegan and vegetarian diets in children. Proc Nutr Soc.2021;80(2):159-164. doi: 10.1017/S002966512100001X. Epub Jan 28. PMID: 33504371.

22. Khalid, W., Arshad, M.S., Ranjha, M.M.A.N., Różańska, M.B., Irfan, S., Shafique, B., Rahim, M.A., Khalid,M.Z., Abdi, G., Kowalczewski, P.Ł. (2022) Functional constituents of plant-based foods boost immunity against acute and chronic disorders. Open Life Sci.8;17(1):1075-1093. doi: 10.1515/biol-2022-0104. PMID:36133422; PMCID: PMC9462539.

23. Zhang, C., Björkman, A., Cai, K., Liu, G., Wang, C., Li, Y., Xia, H., Sun, L., Kristiansen, K., Wang, J., Han,J., Hammarström, L., Pan-Hammarström, Q. (2018) Impact of a 3-Months Vegetarian Diet on the Gut Microbiota and Immune Repertoire. Front Immunol.27;9:908. doi: 10.3389/fimmu.2018.00908. PMID:29755475; PMCID: PMC5934425.

24. Kendrick, K.N., Kim, H., Rebholz, C.M., Selvin, E., Steffen, L.M., Juraschek, S.P. (2023) Plant-Based Diets and Risk of Hospitalization with Respiratory Infection: Results from the Atherosclerosis Risk in Communities (ARIC) Study. Nutrients.5;15(19):4265. doi: 10.3390/nu15194265. PMID: 37836549; PMCID:PMC10574784.

25. Myles, I.A. (2014) Fast food fever: reviewing the impacts of the Western diet on immunity. Nutr J.17;13:61.doi: 10.1186/1475-2891-13-61. PMID: 24939238; PMCID: PMC4074336.

26. Kayode, A.A.A., Okumede, G., Alabi, G., Onajobi, F. (2022) Is vegan diet advisable for children? Bioactive Compounds in Health and Disease. 5(2): 33-52.DOI: https://doi.org/10.31989/bchd.v5i2.892.

27. Neufingerl, N., Eilander, A. (2023) Nutrient Intake and Status in Children and Adolescents Consuming Plant-Based Diets Compared to Meat-Eaters:A Systematic Review.Nutrients.11;15(20):4341.doi:10.3390/nu15204341.PMID: 37892416; PMCID: PMC10609337.

28. American Academy of Pediatrics. (2004) Nutrition Aspect of Vegetarian Diets, Nutrition Handbook, 5°edition, Chapter 12, p.194. Cit. in Veganhealth.org, Pregnancy, Infants, and Children.

29. Position of the American Dietetic Association. (2009) Vegetarian Diets. Journal of the American Dietetic Association. 109:1266-1282.

30. Baldassarre, M.E., Panza, R., Farella, I., Posa, D., Capozza, M., Mauro, A.D., Laforgia, N. (2020) Vegetarian and Vegan Weaning of the Infant: How Common and How Evidence-Based? A Population-Based Survey and Narrative Review. Int J Environ Res Public Health.5;17(13):4835. doi: 10.3390/ijerph17134835. PMID:32635592; PMCID: PMC7370013.

31. Bivi, D., Di Chio, T., Geri, F., Morganti, R., Goggi, S., Baroni, L., Mumolo, M.G., de Bortoli, N., Peroni, D.G.Marchi, S., Bellini, M. (2021) Raising Children on a Vegan Diet: Parents' Opinion on Problems in Everyday Life. Nutrients.25;13(6):1796. doi: 10.3390/nu13061796. PMID: 34070399; PMCID: PMC8226937.

32. Espinosa, R., Arpinon, T., Maginot, P., Demange, S., Peureux, F. (2024) Removing barriers to plant-based diets: Assisting doctors with vegan patients. Journal of Behavioral and Experimental Economics.109,102175,ISSN 2214-8043,https://doi.org/10.1016/j.socec.2024.102175.