ORIGINAL RESEARCH

Evaluation and Comparison of Nutritional Status According to Area of Residence and Type of Institute, its Effect on Plaque and Gingival Status: A Comparative Longitudinal Study

Anupama G Gaur[1], Meenakshi Sharma[2], Rajesh Sharma[3], Nitin Gautam[4]

Abstract

Need of the study: Schoolchildren constitute about 113.8 million (2000–2001 census) population of India and around 11,413,000 comprises schoolchildren in Rajasthan (2000–2001 census), with overall 2.4% children suffering from dietary inadequacies. In the causation of nutritional deficiency diseases, dietary inadequacies have been considered a predominant etiological factor. To overcome such dietary problems and initiate any programs for improvement in general and oral health status, the present study was undertaken in the form of a dietary record of five consecutive days among schoolchildren belonging to different geographical areas.

Aim: To evaluate and compare nutritional status according to area of residence and type of institution and its possible effect on plaque and gingival status among 12–15-year-old schoolchildren of Jaipur.

Materials and methods: The list of schools was collected using simple random technique in both rural and urban areas of Jaipur city. Overall, four schools were drawn randomly from the selected area (two from government and two from private).

Results: In the urban area, nutrient scores (NS) were higher compared to rural areas, irrespective of the season. In contrast to this, plaque and gingival scores were higher in private schools of rural areas.

Conclusion: There is a need for awareness regarding applied nutrition among schoolchildren, irrespective of the area.

Keywords: Nutritional counseling, Nutritional status, Schoolchildren, Seasonal variation.

International Journal of Clinical Pediatric Dentistry (2023): 10.5005/jp-journals-10005-2691

Introduction

Schoolchildren constitute about 113.8 million (2000–2001 census) population of India and around 11,413,000 comprises schoolchildren in Rajasthan (2000–2001 census), with overall 2.4% children suffering from dietary inadequacies.[1] Etiological factors for all deficiency diseases are dietary inadequacies predominantly.[2] Children are invariably the victims of these foodstuffs with very little nutritional value.[3] Deficiency diseases due to dietary inadequacies are found to be predominant factors in relation to oral health. To overcome such dietary problems and initiate any programs for improvement in general and oral health status, it becomes necessary to have an exact information about the consumption patterns, which in the present study was undertaken in the form of a dietary record of five consecutive days among schoolchildren belonging to different geographical areas.

Aim

To evaluate and compare nutritional status according to area of residence and type of institution and its possible effect on plaque and gingival status among 12–15-year-old schoolchildren of Jaipur.

Objectives

- To evaluate nutritional status by calculating the nutrient score (NS) for 5 days.
- To evaluate and compare nutritional status according to area of residence and type of institution.

[1]Department of Pediatric and Preventive Dentistry, Mahatma Gandhi Dental College & Hospital, Jaipur, Rajasthan, India

[2]Department of Pedodontics and Preventive Dentistry, Government Medical College, Jaipur, Rajasthan, India

[3]Department of Pedodontics, Jaipur Dental College, Jaipur, Rajasthan, India

[4]Department of Prosthodontics, Indira Gandhi Govt. Dental College, Jaipur, Rajasthan, India

Corresponding Author: Meenakshi Sharma, Department of Pedodontics and Preventive Dentistry, Government Medical College, Jaipur, Rajasthan, India, Phone: +91 1412280022, e-mail: dr.mesharma@gmail.com

How to cite this article: Gaur AG, Sharma M, Sharma R, *et al.* Evaluation and Comparison of Nutritional Status According to Area of Residence and Type of Institute, its Effect on Plaque and Gingival Status: A Comparative Longitudinal Study. Int J Clin Pediatr Dent 2023;16(S-3):S233–S239.

Source of support: Nil

Conflict of interest: None

Materials and Methods

Study Design

A comparative longitudinal study was conducted to evaluate and compare nutritional status of two different areas (rural and urban).

Study Area

For the present study, Jaipur city was selected.

Population density of Jaipur is 471 persons/km^2.[4] In Jaipur, maximum temperature in summer ranges between 33 and 45°C, whereas minimum temperature ranges between 24 and 27°C. From the Department of District Education Office (Jaipur) and Shiksha Sankul Jaipur, list of schools was collected.

Pilot Study

A pilot study of 135 subjects of rural and urban Jaipur was conducted.

Study Sample

- Study population: The study comprised 230 schoolchildren from rural and 276 from urban areas.
- Sampling procedure: One tehsil was selected using simple random sampling (SRS) from Jaipur. In rural area, Village Bhanpur under Jamwa Ramgarh Tehsil was selected. List of all government and private schools was obtained and was arranged according to the strength of students. One government and private school of rural and urban areas were included in the random number table.

For selection of study sample, SRS was used.
Inclusion criteria:

- Schoolchildren with parent consent in the age group of 12–15 years.
- Students who were present on the scheduled date of investigation.
- Schools who were having >500 students were opted for the study.
- Training and calibration: In order to limit the examiner variability, the clinical recordings were done by the single examiner who was calibrated for the same. Ethical clearance was obtained from the research review board of Government Dental College.

The examination of single subject was conducted in about 10–15 minutes, and survey was conducted for at least 4 days a week.

- Examination area: The clinical examination was conducted in the school premises.

Implementing the Survey

Methodology

The finding of the clinical examination was collected in winter and summer seasons through Hindi and English proforma.

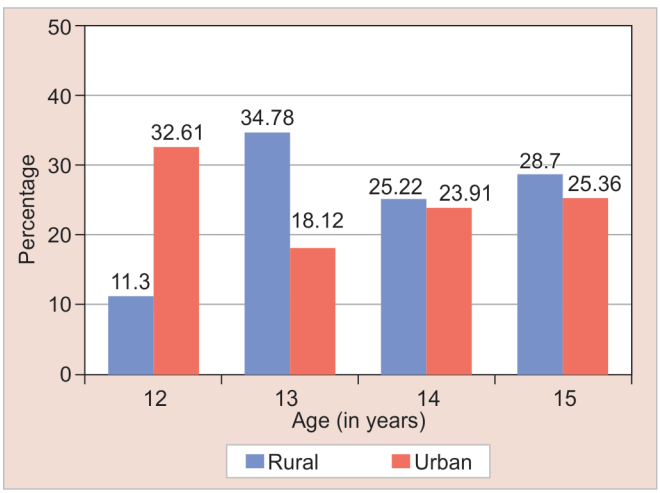

Fig. 1: Distribution of study participants according to area and age

General Information

The survey was conducted in two parts. First part consisted of 5 days dietary diary, and second part included plaque and gingival index (GI).

Clinical Examination

Clinical oral examinations were conducted during summer and winter in which plaque and GI were used.

- Plaque status was assessed by using plaque index (PI) (Silness and Loe in 1964).[5]
- Gingival status was assessed by using GI (Loe and Silness in 1963).[6]

Nutritional status was assessed.[7]

Step 1 (Recording of 5-day Diet Diary)

The students were instructed to maintain 5-day diet diary, including weekdays. Students recorded the meal timing with the quantity consumed with and without sugar.

Step 2 (Calculation of NS)—Abraham E Nizel in 1989

Nutrient score (NS) was calculated using the Nutrient Evaluation Chart.

Statistical Analysis

The statistical analysis was done using Chi-squared test.

Results

The study group comprised 506 schoolchildren, out of whom 230 were in rural areas and 276 in urban areas. Government school comprises 312 schoolchildren, and private school comprises 194 schoolchildren.

Distribution of Study Participants According to Area, Institutions, Age, and Gender

Out of 230 schoolchildren from rural Jaipur, 100 (43.48%) were males and 130 (56.52%) were females. According to age, 26 (11.30%) were of age 12 years, 80 (34.78%) were of age 13 years, 58 (25.22%) were of age 14 years, and 66 (28.70%) were of age 15 years. Among 276 schoolchildren from urban Jaipur, 134 (48.55%) were males and 142 (51.45%) were females. According to age, 90 (32.61%) were of age 12 years, 50 (18.12%) were of age 13 years, 66 (23.91%) were of age 14 years, and 70 (25.36%) were of age 15 years.

Out of 312 schoolchildren from government schools, 162 (51.92%) were males and 150 (48.08%) were females. According to age, 88 (28.21%) were of age 12 years, 72 (23.08%) were of age 13 years, 69 (22.11%) were of age 14 years, and 83 (26.60%) were of age 15 years. Among 194 schoolchildren from private schools, 112 (57.73%) were males and 82 (42.27%) were females. According to age, 28 (14.43%) were of age 12 years, 58 (29.90%) were of age 13 years, 55 (28.35%) were of age 14 years, and 53 (27.32%) were of age 15 years (Figs 1 to 4).

Comparison of PI Scores in Rural Areas According to Institutions

In rural area, plaque scores among government schoolchildren were found to be 3.66 + 1.56 in summers and 3.85 + 1.81 in winters, which was not statistically significant (>0.05) (Table 1 and Fig. 5). Whereas scores among private schoolchildren were found to be 4.90 + 2.50 in summers and 5.46 + 2.26 in winters which was also not statistically significant (>0.05).

Comparison of PI scores in Urban Areas According to Institutions

In urban area, plaque scores among government schoolchildren were found to be 3.48 ± 2.49 in summers and 3.51 ± 2.82 in winters, which was not statistically significant (>0.05) (Table 2 and Fig. 6). Whereas, scores among private schoolchildren were found to be 4.29 ± 2.50 in summers and 4.17 ± 3.08 in winters which was also not statistically significant (>0.05).

Comparison of GI Scores in Rural Areas According to Institutions

In rural area, gingival scores among government schoolchildren were found to be 3.43 ± 1.73 in summers and 3.51 ± 2.38 in winters, which was not statistically significant (>0.05) (Table 3 and Fig. 7). Whereas scores among private schoolchildren were found to be

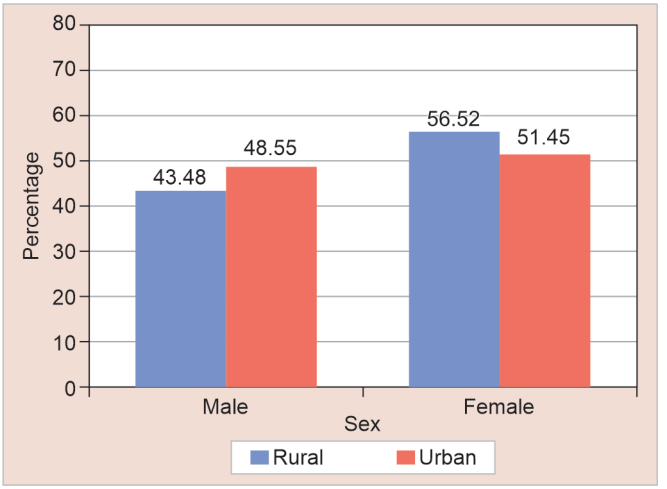

Fig. 2: Distribution of study participants according to area and gender

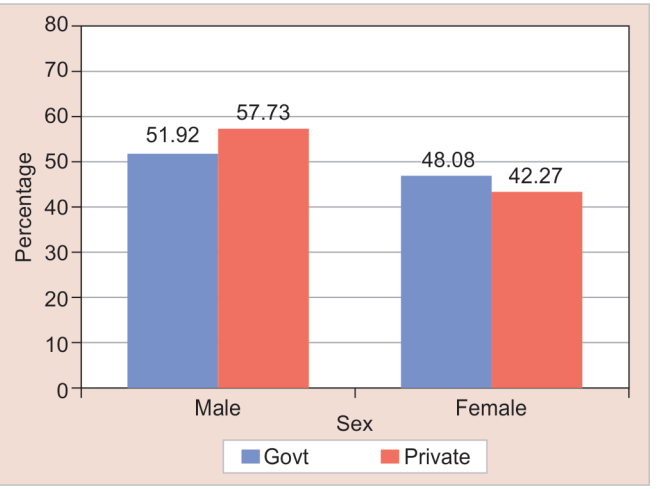

Fig. 4: Distribution of study participants according to type of institution and gender

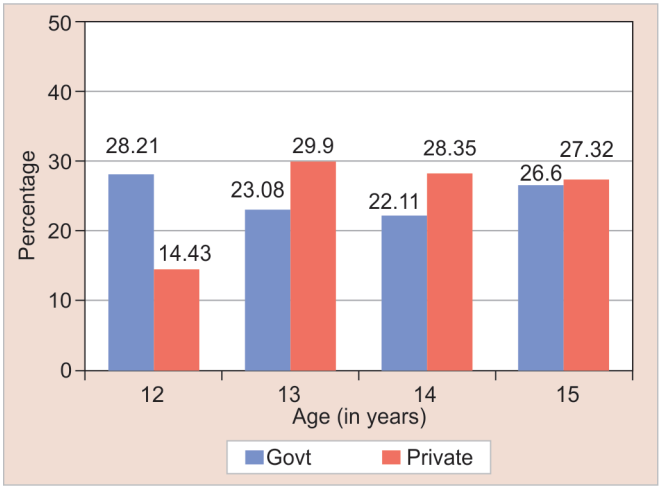

Fig. 3: Distribution of study participants according to type of institution and age

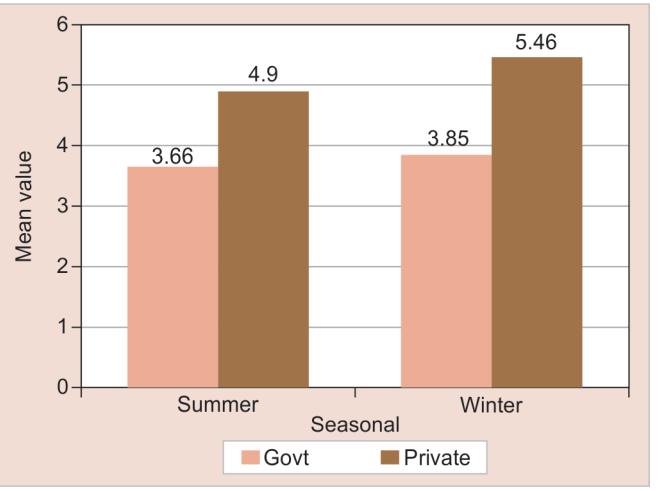

Fig. 5: Comparison of PI according to institutions among study participants in rural area

Table 1: Comparison of PI according to institutions among study participants in rural area

	Mean ± standard deviation			
Institutions	*Summer*	*Winter*	*p-value*	*Significance*
Government school (*n* = 82)	3.66 ± 1.56	3.85 ± 1.81	>0.05	Nonsignificant
Private school (*n* = 129)	4.90 ± 2.50	5.46 ± 2.26	>0.05	Nonsignificant

Table 2: Comparison of PI according to institutions among study participants in urban area

	Mean ± standard deviation			
Institution	*Summer*	*Winter*	*p-value*	*Significance*
Government school (*n* = 195)	3.48 ± 2.49	3.51 ± 2.82	>0.05	Nonsignificant
Private school (*n* = 48)	4.29 ± 2.50	4.17 ± 3.08	>0.05	Nonsignificant

Table 3: Comparison of GI according to institutions among study participants in rural area

	Mean ± standard deviation			
Institutions	*Summer*	*Winter*	*p-value*	*Significance*
Government school (*n* = 82)	3.43 ± 1.73	3.51 ± 2.38	>0.05	Nonsignificant
Private school (*n* = 129)	4.54 ± 2.77	4.62 ± 2.80	>0.05	Nonsignificant

Table 4: Comparison of GI according to institutions among study participants in urban area

	Mean ± standard deviation			
Institution	*Summer*	*Winter*	*p-value*	*Significance*
Government school (*n* = 195)	2.52 ± 2.91	2.87 ± 3.50	>0.05	Nonsignificant
Private school (*n* = 48)	3.44 ± 2.70	3.65 ± 3.49	>0.05	Nonsignificant

Table 5: Comparison of NS according to institutions among study participants in rural area

	Mean ± standard deviation			
Institution	*Summer*	*Winter*	*p-value*	*Significance*
Government school (*n* = 82)	61.17 ± 18.07	50.58 ± 16.43	<0.001	Significant
Private school (*n* = 129)	64.16 ± 13.27	63.01 ± 21.26	>0.05	Nonsignificant

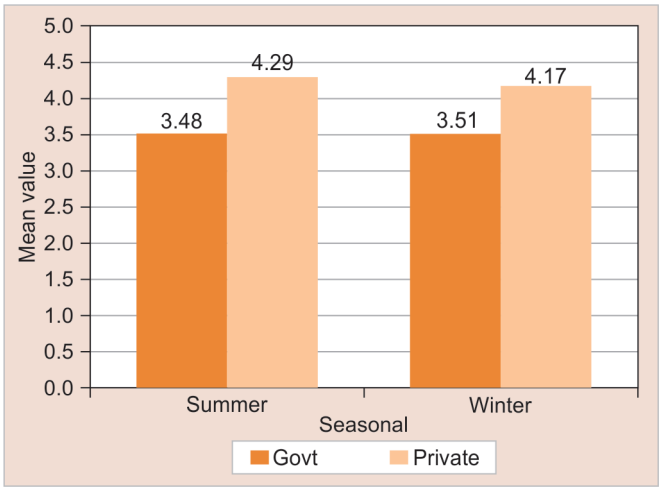

Fig. 6: Comparison of PI according to institutions among study participants in urban area

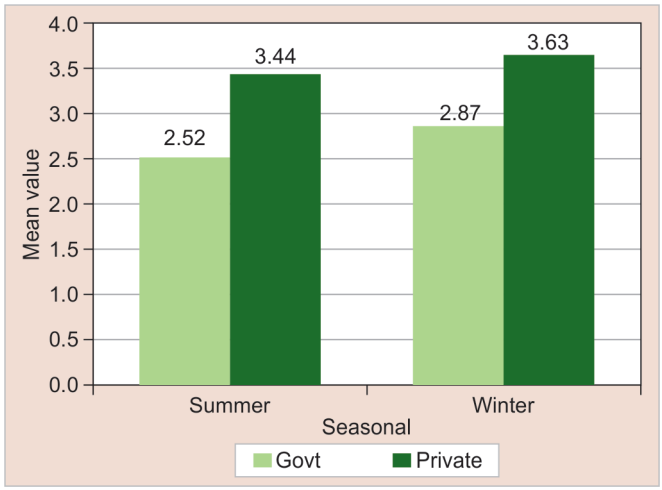

Fig. 8: Comparison of GI according to institutions among study participants in urban area

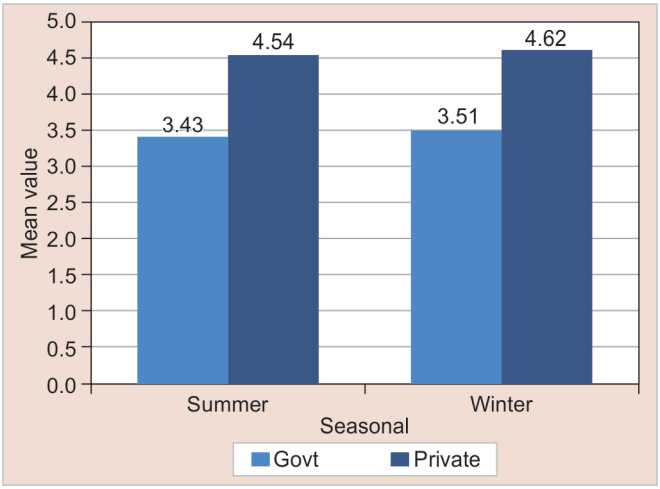

Fig. 7: Comparison of GI according to institutions among study participants in rural area

4.54 ± 2.77 in summers and 4.62 ± 2.80 in winters which was also not statistically significant (>0.05).

Comparison of GI Scores in Urban Areas According to Institutions

In urban area, gingival scores among government schoolchildren were found to be 2.52 ± 2.91 in summers and 2.87 ± 3.50 in winters, which was not statistically significant (>0.05) (Table 4 and Fig. 8). Whereas scores among private schoolchildren were found to be 3.44 ± 2.70 in summers and 3.65 ± 3.49 in winters which was also not statistically significant (>0.05).

Comparison of NS in Rural Areas According to Institutions

In rural area, NSs among government schoolchildren was found to be 61.17 ± 18.07 in summers and 50.58 ± 16.43 in winters which was statistically significant (<0.001) (Table 5 and Fig. 9). Whereas scores among private schoolchildren were found to be 64.16 ± 13.27 in

Table 6: Mean NS according to institutions among study participants in urban area

	Mean ± standard deviation			
Season	*Summer*	*Winter*	*p-value*	*Significance*
Government school (*n* = 195)	62.26 ± 11.45	61.88 ± 15.02	>0.05	Nonsignificant
Private school (*n* = 48)	71.18 ± 13.35	74.77 ± 17.00	>0.05	Nonsignificant

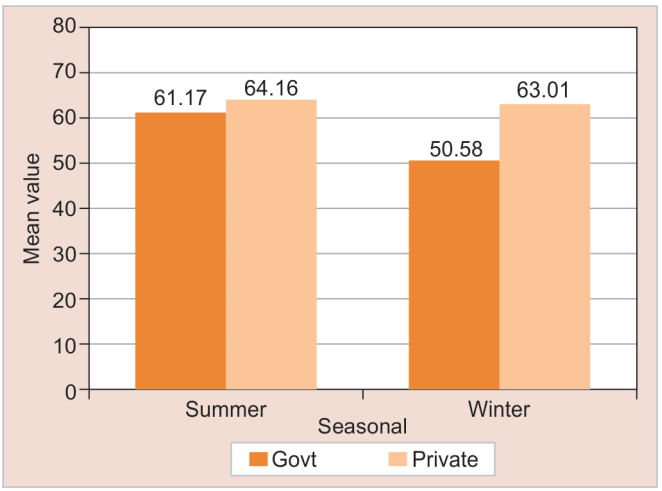

Fig. 9: Comparison of NS according to institutions among study participants in rural area

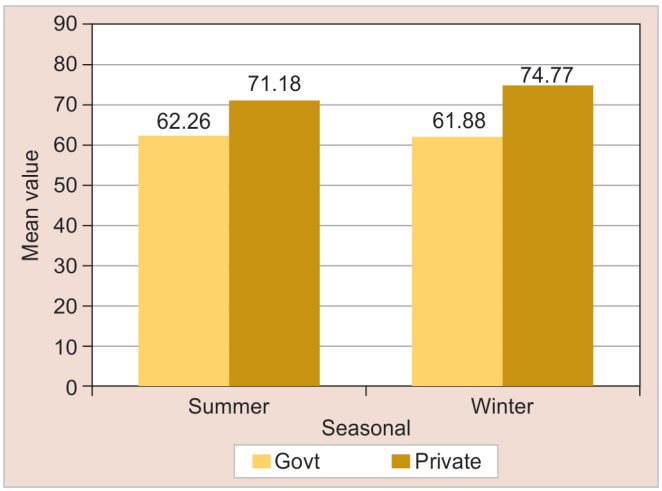

Fig. 10: Comparison of NS according to institutions among study participants in urban area

summers and 63.01 + 21.26 in winters which was not statistically significant (>0.05).

Mean NS in Urban Areas According to Institutions

In urban area, NSs among government schoolchildren were found to be 62.26 ± 11.45 in summers and 61.88 ± 15.02 in winters, which was not statistically significant (<0.001) (Table 6 and Fig. 10). Whereas scores among private schoolchildren were found to be 71.18 ± 13.35 in summers and 74.77 ± 17.00 in winters which was also not statistically significant (>0.05).

Discussion

One of the glaring features of the health scenario in the past few decades has been the conspicuous differences in the oral health status between the urban and rural populations and between the urban rich and urban poor. The vast unmet dental health needs better strategies for primary level of prevention.[8]

This survey was conducted on government and private schoolchildren of rural and urban areas of the city, which integrated students from diverse socioeconomic backgrounds. In the past, Petersen has also presented a risk factor model considering the socioenvironmental factors and outcomes on oral health.[9]

Recent studies suggest that other factors, such as individual subjects' speed of consumption, may also affect the cariogenic potential of the oral environment.[10–12] Thus, plaque and gingival status may also guide about reasonable cariogenicity of food and its effect on oral environment. Earlier in India, children and adolescents used to have three main meals, but globalization and free trade have brought fast-food eating habits, especially in developing nations. Owing to urbanization and the change of lifestyle, meal patterns have their own characteristics. Junk snacks, sodas, pizzas, and convenience foods have been inoculated in the shrinking world. Food manufacturers and franchisers have taken advantage of this opportunity to produce food that are high in fats and calories and low in nutritive values. In children and adolescents worldwide, important health problems are dieting, snacking, and breakfast skipping, and they are found to be associated with nutritional inadequacies and obesity.[13] This was observed in the present study among government schoolchildren of urban areas. Studies have shown that socioeconomic status (SES) is related to children food habits and meal patterns.[14,15] In developed and developing countries, skipping meals and snack consumption is common among girls of low SES.[16] In comparison to this, adolescents of high SES have shown lower consumption of meat and fat products and higher consumption of vegetable and fibrous food.[6]

In the present study, necessary care was taken to select only those children who were born and reared in the same area. This suggests that all the sampling units were exposed to the same environment of the study area.

Nutritional, Plaque, and Gingival Status According to Area of Residence

- Nutrient scores (NS): In comparison to urban schoolchildren, scores were found to be lower in rural schoolchildren, and results were statistically significant in both the seasons in urban areas. This was consistent with the study carried out by Gupta and Saxena[4] and Mazengo et al.[17] and Gaur et al.,[18] where nutritional deficiencies were observed in rural schoolchildren compared to urban schoolchildren.
- Plaque status: In comparison to rural schoolchildren, scores were found to be higher in urban schoolchildren, and results

were statistically significant in both the areas. Similar findings were reported by Blay et al.[8]

- Gingival status: In comparison to rural schoolchildren, scores were found to be lower in urban schoolchildren. Findings were in contrast to study by Mazengo et al.[17] due to increase intake of fiber-rich diet in rural areas.

Nutritional, Plaque, and Gingival Status According to Type of Institution

- Nutrient scores (NS): Study samples of private schools (urban areas) had higher scores than the other counterparts, and on comparison, scores were relatively higher among private schoolchildren belonging to urban areas.
- Plaque status: Similarly, these scores were higher among private schoolchildren but were not statistically significant.
- Gingival status: Study samples of private schools are found to have higher scores than other counterparts, and it was statistically not significant.

Dietary Patterns, Plaque, Gingival Status According to Area of Residence

Plaque scores: These scores were found to be lower in urban schoolchildren compared to rural, and it was statistically significant.

Gingival scores: Similarly, these scores were higher among private schoolchildren but were not statistically significant.

Food group score (FGS): In urban areas, these scores were higher and statistically significant compared to rural counterparts.

Nutrient score (NS): Similar to FGS, these scores were higher and statistically significant in urban study samples compared to rural counterparts.

Sweet scores were higher among rural schoolchildren in winter compared to rural samples.

Dental health diet scores were found to be lower in both the areas, and thus, all schoolchildren require nutritional counseling residing in both rural and urban areas.

Dietary Patterns, Plaque, and Gingival Status According to Type of Institution

Plaque scores of study samples of private schools (urban areas) had higher scores than the other counterparts, and differences were not statistically significant.

Similarly, gingival scores were higher among private schoolchildren but were not statistically significant.

In urban areas, FGSs were observed higher and statistically significant among samples of private schools.

Whereas NSs were higher among private schools and were not statistically significant.

Sweet scores were observed higher in government schoolchildren belonging to rural areas, whereas scores were higher in private schoolchildren belonging to urban areas.

Dental health diet scores were found to be lower in both institutions, and thus, all schoolchildren require nutritional counseling belonging to the government and private institutions.

As compared to private schoolchildren, FGSs were lower in government schoolchildren, and it was highly statistically significant in urban areas. In private schoolchildren, NSs were found to be higher in comparison to government schoolchildren, but results were statistically not significant. Sweet scores were found to be higher in government schoolchildren of rural areas, whereas scores were higher in private schoolchildren of urban areas. Dental health diet scores were found to be lower in both the institutions, and thus, all schoolchildren require nutritional counseling belonging to government and private institutions.

Conclusion

Basic oral health survey and nutritional counseling are recommended among study samples, irrespective of area and season. Interventional dietary counseling should be a part of all preventive oral care programs and should be undertaken with a team of health supervisors at school level. The right to make healthy choices in the form of classroom programs should be framed for susceptible age groups.[6] Referral checkups to tertiary health centers should be prioritized in school dental health programs.

Suggestions and Recommendations

For a successful oral health promotion at community level, effective communication at all levels of prevention should be made viable. It is recommended that consumption of solid retentive sugar should not exceed 15 kg/person/year.[19–21] In order to make people adopt easy choices, the healthy choices community leader and health physicians should offer guidelines and provide suggestions on daily calorific requirements of food along with timely visits to the dentist.[2] Community reinforcement, including optional services by mass media and local grocery stores, can promote positive reinforcement in adopting a healthy lifestyle.[22] Under the umbrella of school dental health initiatives, school feeding programs should be tailored regularly for adopting preventive strategies to halter dental caries and early tooth loss for schoolchildren, irrespective of the area and type of institution.

References

1. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Public Health Nutr 2004;7(1A):201–226. DOI: 10.1079/phn2003589
2. Moynihan PJ. The role of diet and nutrition in the etiology and prevention of oral diseases. Bull World Health Organ 2005;83(9):694–699.
3. Tai B, Du M, Penag B, et al. Experiences from a school based oral health promotion programme in Wuhan city, PR China. Int J Pediatr Dent 2001;11(4):286–291. DOI: 10.1046/j.1365-263x.2001.00281.x
4. Gupta V, Saxena S. Nutritional status of school children in rural and urban areas of Bikaner in western Rajasthan. Ind J Pediatr 1997;44(357):301–308. DOI: 10.1007/BF02756662
5. Sogi GM, Bhaskar DJ. Dental caries and Oral Hygiene status of schoolchildren in davangere related to socio-economic levels: an epidemiological study. J Ind Soc Pedo Prev Dent 2002;20(4):152–157.
6. Shi Z, Lien N, Kumar BN, et al. Socio demographic differences in food habits and preferences of school adolescents in Jiangsu Province, China. Eur J Clin Nutr 2005;59(12):1439–1448. DOI: 10.1038/sj.ejcn.1602259
7. King JM. Patterns of sugar consumption in early infancy. Comm Dent Oral Epidemiol 1978;6(2):47–52. DOI: 10.1111/j.1600-0528.1978.tb01119.x
8. Blay D, Astrom AN, Haujorden O. Oral hygiene and sugar consumption among urban and rural adolescents in Ghana. Community Dent Oral Epidemiol 2000;28(6):443–450. DOI: 10.1034/j.1600-0528.2000.028006443.x
9. Rugg-Gunn AJ, Edgar WM, Geddes DA, et al. The effect of different meal patterns upon plaque pH in human subjects. Brit Dent J 1975;139(9):351–356. DOI: 10.1038/sj.bdj.4803614
10. Rugg-Gunn AJ, Edgar WM, Jenkins GN. The effect of altering the position of a sugary food in a meal upon plaque pH in human subjects. J Dent Rest 1981;60(5):867–872. DOI: 10.1177/00220345810600050201

11. Lagerlof F, Dawes R, Dawes C. The effects of different concentrations of sucrose, fructose, and glucose on ph changes by streptococcus mitior in an artificial mouth. J Dent Res 1985;64(3):405–410. DOI: 10.1177/00220345850640030201
12. Hussein I, Pollard MA, Curzon ME. A comparison of the effects of some extrinsic and intrinsic sugars on dental plaque pH. Int J Pediatr Dent 1996;6(2):81–86. DOI: 10.1111/j.1365-263x.1996.tb00217.x
13. Abraham E Nizel, Athens S Papas. 3rd edition. Philadelphia, PA19106. W.B. Saunders Company; 1989.
14. O'Sullivan DM, Thibodeau EA. Caries experience and mutans streptococci as indicators of caries incidence. Pediatr Dent 1996;18(5):371–374.
15. Merchant AT, Dehghan M, Behnke-Cook D, et al. Diet, physical activity and adiposity in children in poor and rich neighborhoods: a cross-sectional comparison. Nutr J 2007;6(1):1–7. DOI: 10.1186/1475-2891-6-1
16. Qorbani M, Kasaeian A, Rafiemanzelat AM, et al. Social inequalities in meal skipping patterns among children and adolescents: the CASPIAN-V study. Obesity Sci Prac 2021;7(6):690–698. DOI: 10.1002/osp4.527
17. Mazengo MCSoderling E, Alakujala P, et al. Flow rate and composition of whole saliva in rural and urban Tanzania with special reference to diet, age, and gender. Caries Res 1994;28(6):468–476. DOI: 10.1159/000262022
18. Gaur A, Sharma M, Sharma R, et al. Quantifying dietary diversity by using food group scores among schoolchildren of Jaipur: a seasonal longitudinal study. Int J Clin Pediatr Dent 2021;14(3):376–382. DOI: 10.5005/jp-journals-10005-1975
19. Neumark Sztainer D, Hannan PJ, Story M, et al. Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents. J Am Dent Assoc 2003;103(3): 317–322. DOI: 10.1053/jada.2003.50048
20. Newbrun E. Sugar and dental caries: a review of human studies. Science 1982;217(4588):418–423. DOI: 10.1126/science.7046052
21. Sreebny LM. The sugar caries axis. Int Dent J 1982;32(1):1–12.
22. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Pub Health Nutr 2004;7(1A):201–226. DOI: 10.1079/phn2003589