RESEARCH ARTICLE

Quantifying Dietary Diversity by Using Food Group Scores among Schoolchildren of Jaipur: A Seasonal Longitudinal Study

Anupama Gaur[1], Meenakshi Sharma[2], Rajesh Sharma[3], Nikhil Marwah[4]

Abstract

Need of the study: Most dentists are concerned that their patients are consuming a record number of sugar-filled sodas, sweetened fruit drinks, and other stuff that affect their oral environment. Children are invariably the victims of these foodstuffs. These items generally have very little nutritional value, albeit their commercial value. Thus, dietary habits and the choice of food among children and teens are important factors that determine how quickly they may develop oral diseases. Thus, to design good intervention programs and preventive strategies, information on food habits and dietary intake of the target population is very important.

Aim and objective: To determine dietary diversity using food group score (FGS) among 12–15 years schoolchildren of urban and rural areas of Jaipur.

Materials and methods: Jaipur district is divided into 13 Tehsils. Based on a simple random number table, Bhanpur (Rural) and Central Jaipur (Urban) were selected for the present study. Food group scores were calculated from the 5-day diet diary of the study subjects.

Results: Scores were found to be higher in winters as compared to the summer season and this difference is observed to be highly statistically significant. Scores were found to be higher in urban schoolchildren as compared to rural and the difference was highly statistically significant among urban schoolchildren in winters. Scores were found to be higher among private schoolchildren as compared to government and this difference was highly statistically significant among schoolchildren belonging to urban areas.

Conclusion: There is a need for nutritional counseling and basic oral health care in the study area irrespective of the season. The dietary diversity of children is determined by social, psychological, and economic factors. Thus, counseling should be given accordingly in conjunction with a team of health professionals including physicians, dieticians, and dentists under the supervision of parents, guardians, and schoolteachers and management.

Keywords: Food group scores, Nutritional counseling, Schoolchildren, Seasonal variation.

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Introduction

The food in Rajasthan is as diverse as the state itself. In some areas, it is simple and basic while in others it is exotic and elaborate. As it normally happens, the cooking is influenced by the land, the lifestyle of its inhabitants, and the availability of ingredients in the region. Thus, contributing food patterns comprises mainly of plant origin, which in turn is largely seasonal dependent, thereby affecting the food availability and dietary patterns. In addition, food habits also change due to extreme temperature changes ranging from 7 to 45°C. According to Ayurveda, with the changes in season, our body needs different foods to adjust itself to the outside environment. In winters along with consumption of routine fruits and vegetables, sweets cuisines containing jaggery/*gur* are highly increased as they are believed to have warming properties. Similarly, in summer seasons along with routine fruits and vegetable consumption of *lassi* (sweetened yogurt) and *chaach* (buttermilk) are increased as these are believed to possess excellent coolant properties.[1]

The present study thereby elicits the diversity in food consumption patterns leading to dietary inadequacies. Such dietary

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inadequacies have been considered as predominant etiological factors in the causation of all deficiency diseases.[2]

Materials and Methods

Study Design

A comparative longitudinal study was conducted in two different seasons (winter and summer) to access and compare nutritional status among study subjects.

Study Area

The state of Rajasthan covers 342,239 sq km in the northwestern region of India. Jaipur is situated in the northeastern part of the state. Jaipur district is divided into 13 Tehsils, and covers an area of 11,117.8 square km and a population of 5,251,071, with a rural population of 2,659,004 and urban 2,592,067 and a population density of 471 persons per square km. Based on a simple random number table, Bhanpur (Rural) and Central Jaipur (Urban) were selected for the present study. The climate of Rajasthan can be broadly divided into four seasons: pre-monsoon/summer, monsoon, post-monsoon, and winters. In Jaipur city, the the maximum average temperature in summers ranges between 33°C and 45°C, whereas, the minimum temperature ranges between 24°C and 27°C. Similarly, in winters, the maximum average temperature ranges between 20°C and 24°C, and the minimum temperature ranges between 7°C and 10°C.

The list of the schools was collected from the Department of District Education Office, Jaipur (D.D.E.O., Jaipur) and Shiksha Sankul, Jaipur.

Pilot Study

A pilot study was conducted during December 2009, involving 135 subjects of 12–15 years schoolchildren of rural and urban Jaipur to determine variation in nutritional status and its effect on plaque and gingivitis. The pilot study also helped in determining the feasibility of the study and to get acquainted with the study work.

Study Sample

Study Population

The study participants comprised of schoolchildren of age-group between 12 years and 15 years residing in rural and urban areas of Jaipur city. In a rural area study, participants comprised of 230 schoolchildren and urban area comprised of 276 schoolchildren.

Sampling Procedure

A list of schools of Jaipur tehsils belonging to the rural and urban areas was collected from the Department of District Education Office, Jaipur (D.D.E.O., Jaipur), and Shiksha Sankul, Jaipur, and using simple random sampling (SRS) one tehsil was selected with the help of random number table. Simple random sampling was used for the selection of study samples with replacement.

Inclusion Criteria

- Schoolchildren in the age-group of 12–15 years.
- Parents of those children who gave the consent.
- Schoolchildren who were continuous residents since birth were selected.
- The schoolchildren who were present on the scheduled date of the investigation were included.
- Consisting of schoolchildren of >500 in each school.

Training and Calibration

The clinical examination for every subject was comprehensively carried out by a single investigator. To assess the intra-examiner reliability, the investigator applied a 5-day diet diary and plaque and gingival index on 35 selected subjects and recorded the findings. The same subjects were randomly called on different days and the investigator repeated her examinations on them. These values reflected a high degree of conformity in observation.

Organizing the Survey

Ethical Clearance and Obtaining Approval from the Authorities

Before scheduling the present study, the required ethical clearance was obtained from the Research Review Board Jaipur Dental College to conduct the study, and permission was taken from the concerned schools' authorities by producing a letter (Bonafide certificate) from Jaipur Dental College authorities and D.D.E.O., Jaipur 1 and 2.

Scheduling

The interview and examination of a single subject took about 10–15 minutes on most of the occasion. A detailed schedule of the survey was prepared well in advance. The investigator visited the study area at least 4 days a week during the study period. The examination was conducted on the school premises outside the class of the study subject.

The survey was carried out in the winter and summer seasons using a specific pro forma designed in English and Hindi which consisted of two parts.

General Information

The first part consisted of general information of the schoolchildren regarding their name, age, gender, class, and school name. Information about 5-day dietary intake including weekends, plaque, and the gingival index was recorded. Dietary pro forma were collected on the 6th day.

Clinical Examination

The second part consisted of clinical oral examination which was carried out during the winter and summer seasons.

- Assessment of plaque status by using plaque index (Silness and Loe in 1964).[1]
- Assessment of gingival status by using gingival index (Loe and Silness in 1963).[3]
- Assessment of food group score (FGS).

Step 1 (Recording of 5-day Diet Diary)—Abraham E Nizel in 1989

Study subjects were instructed to list whatever they ate and drink for consecutive 5 days including weekdays. The time when the meal or snacks were eaten, the amount ingested (in household measures), how the food was prepared, and the number of teaspoons of sugar added were asked to list to ascertain their average 5-day dietary intake.

Food Group Evaluation Chart

Food group/ recommended adult servings	*Portion size considered one serving*	*Number of servings*	*Points*
Milk (milk and cheese)/3	8 oz (1 c)m milk	___ × 8 =	(highest possible score = 24)
	1.5 oz Cheddar cheese		
	1.5 slice American cheese		
	8 oz (1 c) yogurt		
Meat (m, fish, poultry, dry beans, nuts)/2	2–3 oz lean cooked meat, fish, or poultry	___ × 12 =	(highest possible score = 24)
	2 eggs		
	4 tbsp peanut butter		
	1 c cooked dry beans or lentils		
Fruits and vegetables	0.5 c cooked fruit or vegetable	___ × 6 =	(highest possible score = 24)
Vitamin A: (dark green and deep yellow fruits and vegetables)/1	1 medium raw fruit or vegetable		
	0.5 medium grapefruit or melon		
	4 oz (0.5 c) juice		
Vitamin C: (juice and citrus fruits)/1		___ × 6 =	(highest possible score = 24)
Other/2		___ × 6 =	(highest possible score = 24)
Bread and cereals (enriched or whole grain)/4	1 slice bread	___ × 6 =	(highest possible score = 24)
	3/4 c dry cereal		
	1/2 c cooked cereal, rice, noodles, or macaroni		

Food Group Score

72–96	Excellent
64–72	Adequate
56–64	Barely adequate*
56 or less	Not adequate

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

Foods in the diet diary that have been sweetened with added sugar or were concentrated natural sweets (honey, raisins, figs, and so forth) were circled by the examiner. Uncircled foods or mixed food dishes were classified into one or more of the underlying appropriate food groups. For each serving of these foods listed in the food intake diary, a checkmark was placed in the appropriate food group block.

Then, the number of checks was added and multiplied by the number shown below. The maximum number of points credit for the milk and meat groups was 24 each and for the fruit–vegetable and bread–cereal groups was 24 each. All the points were added and the sum computes the FGS (96 is the highest score). If the total score for a food group was greater than the highest possible score, recording of the highest possible score was done.

Statistical Analysis

The Statistical Package for Socio Science (SPSS), version 10 was used for analysis. The Chi-square test was used to compare proportion and one-way analysis of variance method was used to compare means.

Results

Plaque scores were found to be higher in the winter season (4.21 ± 2.66) as compared to summer (4.00 ± 2.42), but this difference was not statistically significant (>0.05) (Table 1 and Fig. 1).

In the rural area, plaque scores in winters were found to be higher in govt schools as compared to the urban area (Tables 2 and 3, Figs 2 and 3).

Table 1: Mean plaque scores according to season

	Mean ± SD			
Parameter	*Summer*	*Winter*	*p value*	*Significance*
Plaque scores	4.00 ± 2.42	4.21 ± 2.66	>0.05	NS

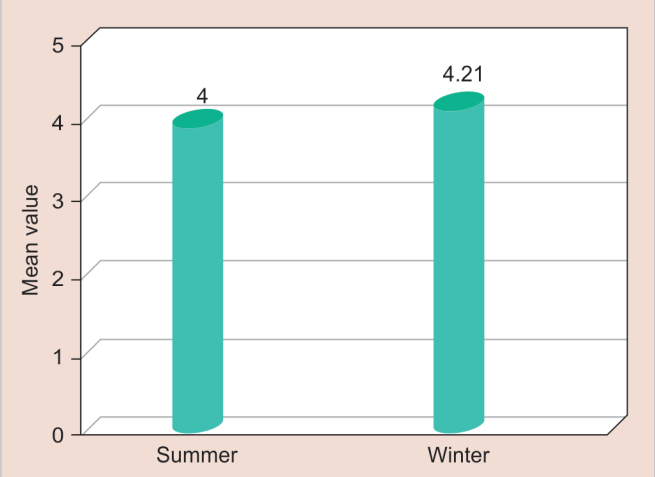

Fig. 1: Mean plaque scores according to season

Table 2: Comparison of plaque index (PI) according to season among study participants in the rural area

	Mean ± SD			
Season	*Govt. school (n = 82)*	*Pvt. school (n = 129)*	*p value*	*Significance*
Summer	3.66 ± 1.56	4.90 ± 2.50	<0.05	Sig.
Winter	3.85 ± 1.81	5.46 ± 2.26	<0.05	Sig.

Table 3: Comparison of plaque index (PI) according to season among study participants in the urban area

	Mean ± SD			
Season	*Govt. school (n = 195)*	*Pvt. school (n = 48)*	*p value*	*Significance*
Summer	3.48 ± 2.49	4.29 ± 2.50	<0.05	Sig.
Winter	3.51 ± 2.82	4.17 ± 3.08	<0.05	Sig.

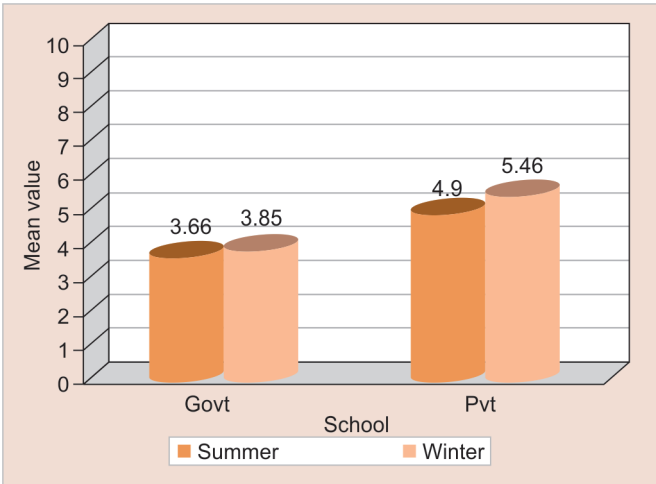

Fig. 2: Comparison of plaque index according to season among study participants in the rural area

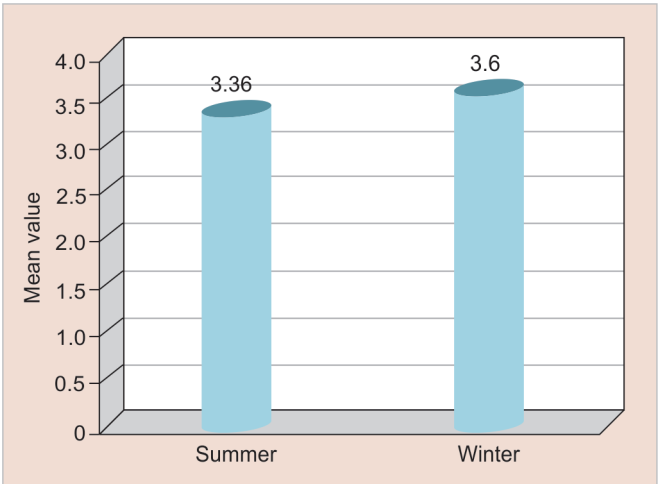

Fig. 4: Mean gingival scores according to season

Table 5: Comparison of the gingival index (GI) according to season among study participants in the rural area

	Mean ± SD			
Season	*Govt. school (n = 82)*	*Pvt. school (n = 129)*	*p value*	*Significance*
Summer	3.43 ± 1.73	4.54 ± 2.77	<0.05	Sig.
Winter	3.51 ± 2.38	4.62 ± 2.80	<0.05	Sig.

Gingival scores were also found to be higher in winter as compared to summer (Table 4, Fig. 4). In the rural area, gingival

Table 4: Mean gingival scores according to season

	Mean ± SD			
Parameter	*Summer*	*Winter*	*p value*	*Significance*
Gingival scores	3.36 ± 2.81	3.60 ± 3.21	>0.05	NS

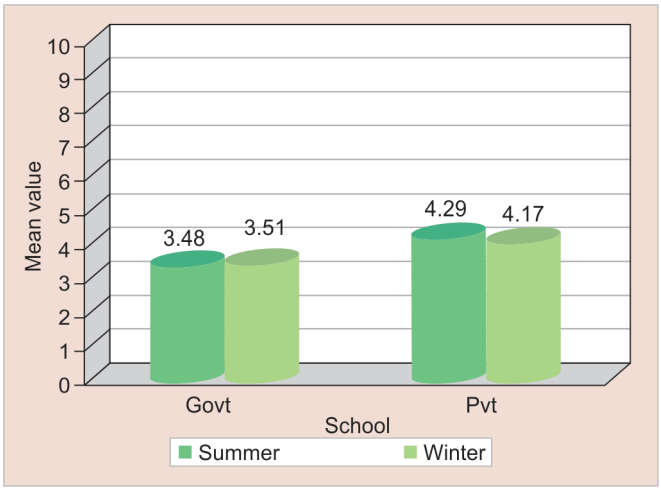

Fig. 3: Comparison of plaque index according to season among study participants in the urban area

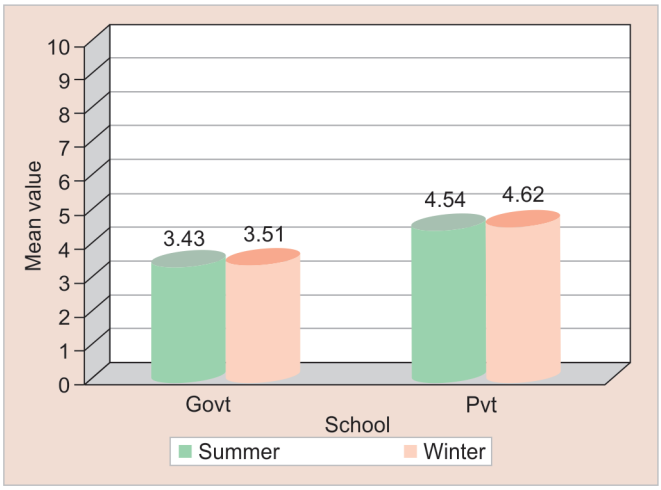

Fig. 5: Comparison of the gingival index according to season among study participants in the rural area

Table 6: Comparison of the gingival index (GI) according to season among study participants in the urban area

	Mean ± SD			
Season	*Govt. school (n = 195)*	*Pvt. school (n = 48)*	*p value*	*Significance*
Summer	2.52 ± 2.91	3.44 ± 2.70	<0.05	Sig.
Winter	2.87 ± 3.50	3.65 ± 3.49	<0.05	Sig.

scores were also found to be higher in govt schools as compared to private schools in winter (Tables 5 and 6, Figs 5 and 6).

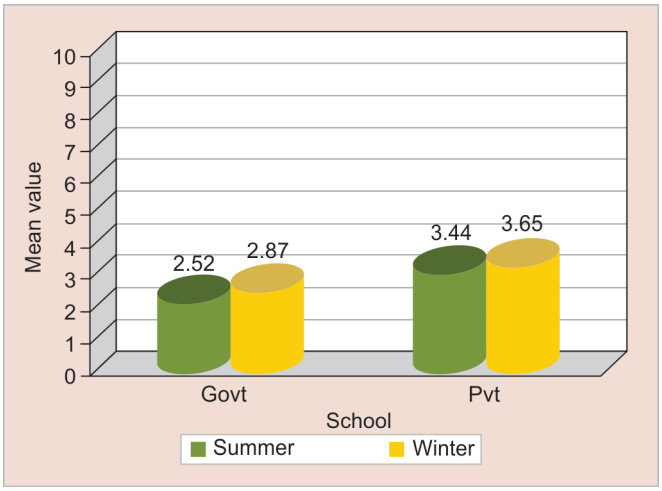

Fig. 6: Comparison of gingival index according to season amongst study participants in urban area

Table 7: Mean food group scores according to season

	Mean ± SD			
Parameter	*Summer*	*Winter*	*p value*	*Significance*
Food group scores	28.72 ± 6.10	31.07 ± 7.34	<0.001	HS

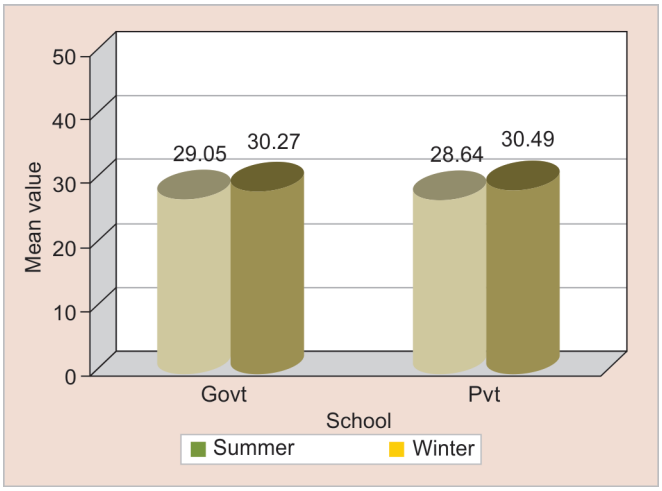

Fig. 8: Comparison of food group score (FGS) according to season amongst study participants in rural area

Table 8: Mean food group scores (FGS) according to season among study participants in the rural area

	Mean ± SD			
Season	*Govt. school (n = 82)*	*Pvt. school (n = 129)*	*p value*	*Significance*
Summer	29.05 ± 7.06	28.64 ± 5.90	>0.05	NS
Winter	30.27 ± 10.07	30.49 ± 7.04	>0.05	NS

Food group scores were found to be higher in the winter season as compared to summer and this difference was found to be highly statistically significant (Table 7, Fig. 7).

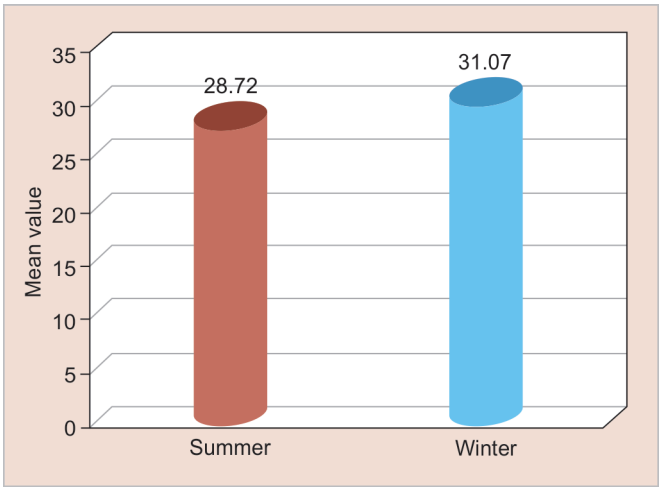

Fig. 7: Mean food group scores according to season

Table 9: Mean food group scores (FGS) according to season among study participants in the urban area

	Mean ± SD			
Season	*Govt. school (n = 195)*	*Pvt. school (n = 48)*	*p value*	*Significance*
Summer	27.98 ± 5.62	31.38 ± 5.98	<0.001	Sig.
Winter	30.74 ± 6.06	35.37 ± 5.81	<0.001	HS

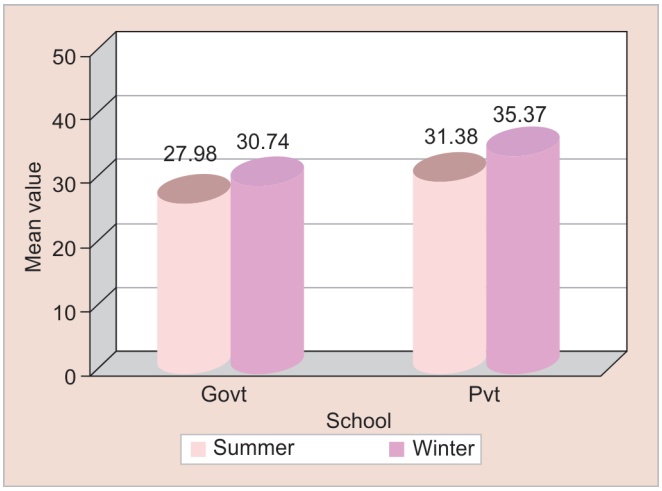

Fig. 9: Comparison of food group score (FGS) according to season amongst study participants in urban area

Mean FGSs were found to be significantly higher among private schoolchildren in the urban area as compared to rural area (Tables 8 and 9, Figs 8 and 9).

Discussion

India is a diverse country with many regional cultures; each region has its own food specialties, primarily at the regional level and also at the provincial level. These differences can come from local culture and geographical location, whether the region is close to the sea, desert, or mountains. Indian cuisine is also seasonal with

priority placed on the use of fresh produce. These Indian cuisines are characterized by spices, herbs, fruits, and vegetables due to the widespread practice of vegetarianism in Indian society.

Rajasthan is the largest state of India territorially, encompassing its economy which is primarily agricultural and pastoral. As it normally happens, the cooking is influenced by the land, the lifestyle of its inhabitants, and the availability of ingredients in the region. Three major crops grown here are wheat, corn, maize, bajra, and millet, along with pulses, sugarcane, and oilseeds, all belonging to plant seasonally dependent origin.

According to Ayurveda with the changes in season, our body needs different foods to adjust itself to the outside environment. In Jaipur city, due to contrast seasonal variation in the city, the food availability and consumption varies accordingly. Likewise in winters along with consumption of routine fruits and vegetables, sweets cuisines containing jaggery/*gur* are highly increased as they are believed to have warming properties. Similarly, in summer seasons along with routine fruits and vegetable consumption of *lassi* (sweetened yogurt) and *chaach* (buttermilk) are increased as these are believed to possess excellent coolant properties. Sweets are an integral part of Rajasthani food which are not merely used as desserts but are consumed before and even along with the meal. *Churma, gajak*, and *ghevar* are some of the popular sweets consumed in Rajasthan especially during the winter season. These sweets are solid and retentive in nature and thereby decrease the oral clearance time thus, affecting the oral environment.

Thus, the present study considers pieces of evidence about the seasonal in dietary patterns, and its effect upon a plaque and gingival status among schoolchildren of age-group 12–15 years in Jaipur city, belonging to a different area of residence and institution.

Few dietary studies[4,5] have been designed to investigate the effect of intake patterns of food items upon the environment of teeth. These food patterns show seasonal as well as geographic variations due to the availability of food during pre-harvest, harvest, and post-harvesting of crops.

Petersen presented a risk factor model for oral diseases, suggesting that socio-environmental factors include behavioral and attitudinal factors which in turn has an impact on clinical and subjective oral health outcome.[6] Sociodemographic factors such as place of residence, age, gender, family income, education, and individual factors in terms of oral health behavior might also influence oral health outcome. Thus, research on the socioeconomical and socio-regional distribution of oral health-related behaviors (i.e., behaviors detrimental or conducive to oral health) is of interest for several reasons. The most important one is the possibility of identifying targets for preventive oral health programs at the individual and community levels.[7]

Hence, an attempt is made to study possible side effects of diet on the oral environment and possible variations in dietary parameters according to season. The present study discusses the literature under the following headings:

Plaque, gingival, and nutritional status according to season:

- **Plaque status:** Scores were found to be comparatively higher in the winter season as compared to summer. This could be attributed due to more consumption of sweet snacks which are solid, sticky, and more retentive in nature that adheres to the tooth surface for a longer duration.
- **Gingival status:** Scores were also found to be higher in the winter season as compared to summer. The reason could be due to increased intake of retentive sweet snacks which adhere to the tooth surface for a longer duration.
- **Nutrient scores:** Scores were found to be higher in summer as compared to the winter season, but the difference observed was not statistically significant. Observations were, in contrast, to study by Kuitha HN, Van Steveren WA, Veermen W, Hautyast JG in 1995[8] in which intake of vitamin A, riboflavin, thiamin, and calcium was increased during post-harvest months. This could be possible due to sweet items containing jaggery/gur are increased in the market and school canteens as they are believed to have warming properties.

Conclusion

It can be said that there is a need for nutritional counseling and basic oral health care in the study area irrespective of the season. The dietary patterns of children are determined by social, psychological, and economic factors. Thus, counseling should be given accordingly in conjunction with a team of health professionals including physicians, dieticians, and dentists under the supervision of parents, guardians, and schoolteachers and management.

School health surveys of this kind not only provide required information but also an opportunity to make a health appraisal of schoolchildren but provide ample data to throw light on related general and oral health status.

Suggestions and Recommendations

- Childhood is a critical time when skills and attitudes are taking shape. Once formed they are deeply ingrained and are resistant to change. Thus, as health care professionals it is our duty to identify risk problems and lay preventive and educational strategies wherever and whenever required.
- Among the study participants, the nutrient score was higher in summer and sweet scores were found to be higher in winter, and this difference was highly statistically significant. Which clearly depicts the variation in food availability and dietary patterns in the study area.
- Key behaviors and determinants to be addressed through the intervention should be identified periodically to develop a matrix of educational objectives.[9]
- So firstly, effective communication techniques should be developed between the counselor, schoolchildren, parents, teachers, and management to enhance changes.
- It is necessary that people eat the right type of food in a particular season so that it contains the vital nutrients required by the body, which will also help healthy growth and maintenance of their teeth. As people have different dietary needs at various stages of their life depending on the levels of their physical activity. The family physician or a registered dietician is the best person to offer guidance as also to provide suggestions on our daily calorific requirement of food. Visit a dentist at appropriate intervals may also help the cause instead of waiting for an oral disease to strike.[10]
- Eating habits and the choice of food among children and teens are important factors that determine how quickly youngsters may develop oral diseases.[11] The saliva produced by the salivary glands contains a sticky thin layer of bacteria or a substance forming plaque that hampers the oral integrity. Thus, it is advisable to brush teeth well twice a day with fluoride toothpaste that has an IDA seal of acceptance. Similarly, daily

flossing is also advisable to remove plaque from under the gums and between teeth.

- Consumption of solid or retentive sugar-containing foods should be limited as they are more cariogenic and hampers the oral environment as compared to liquid or non-retentive sugar-containing food items.[6] It is recommended that sugar consumption should be reduced to 15 kg/person/year or below.[12]
- Inclusion of more foodstuffs especially fruits, vegetables, milk, and milk products in the daily diet of schoolchildren is recommended for improving their nutritional status.
- Limit the number of between-meal snacks. And choose only nutritional snacks that are low in sugar, i.e., try and maintain a healthy diet.
- Government should design school feeding programs for improving nutritional status both in rural and urban areas.
- Knowledge about the Food Guide Pyramid should be imparted to parents, teachers, and schoolchildren to promote healthy nutrition in children, as a general guide to daily food choices, with an emphasis on the five major food groups, all of which are required for good health.[11]
- The provision of fruit and vegetables on the school campus is an outstanding element. Additionally, optional components for community reinforcement include mass media, school health services participation, and the implication of grocery stores in the project and school canteens.
- Program activities including guided classroom activities, computer-tailored messages for children, activities to be completed at home with the family and family targeted specific actions should be targeted in both rural and urban schoolchildren.[13,14]
- Nutritional counseling and health education to mothers and schoolteachers should be imparted regularly which forms an important component of health services and which will help to decrease the effect of ignorance and faulty practices. Diet counseling is an important preventive and supportive service.[9]

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