Association of Dietary Behaviour with Demographic and Socio-economic Factors and Physical Activity among Rural Adolescents: A Cross-Sectional Study

Anjali Kumari[1], Monika Jain[2]

[1]Junior Research Fellow, [2]Professor, Food Science and Nutrition Division, Banasthali Vidyapith, Rajasthan, India

Abstract

Purpose: This study aimed to investigate the association of dietary behaviour with demographic characteristics, physical activity and socio-economic variables among rural Indian adolescents.

Methods: A cross-sectional study was undertaken among 100 school-going adolescents (43 boys, 57 girls) of 13-17 years, residing in the rural area of Aligarh district (India). Dietary behaviour assessment was carried out using a pretested self-administered structured questionnaire. Food frequency questionnaire and 24-hour diet recall were used to collect data regarding food groups and nutrients intake. Binary logistic regression model was used for the association of dietary behaviours with demographic and socio-economic variables and physical activity.

Results: The mean age of participants was 14.78±1.26. Daily consumption of breakfast was associated with the structure of the family. Association between family type and preference for green leafy vegetables was observed. Liking for green leafy vegetables had an association with the occupation of the mother. Physical activity was associated with the dietary behaviour of having sweet after a meal. Inadequate intake of energy, iron, dietary fibre, and zinc was observed.

Conclusion: Dietary behaviours are associated with demographic variables such as the structure of the family, class, occupation of mothers and physical activity, but are not associated with socio-economic factors.

Keywords: *Adolescent; Dietary behaviour; Food groups; Nutrients; Physical activity*

Introduction

Adolescence is considered to be a crucial stage in human life. It is a transition stage, from childhood to adulthood, between 10-19 years of age.[1] This is the formative period of life when maximum physical, cognitive, and socio-emotional growth occurs.[2] Such remarkable growth spurt significantly increases the demand for calories and nutrients such as iron, calcium and vitamins.[3] Healthy dietary intake contributes to optimum physical growth and development but some inadequate dietary food habits such as having a nutrient deficient diet, skipping breakfast and not having timely meals, wide use of fast food and poor

Corresponding author:
Anjali Kumari
Junior Research Fellow, Food Science and Nutrition Division, Banasthali Vidyapith,P.O. Banasthali Vidyapith- 304022, Rajasthan, India
E-mail: anjali.kumari9457@gmail.com

intake of vegetables and fruits, common among adolescents, can have negative consequences.[4] These inappropriate eating behaviours are undesirably influenced by socio-cultural and biological factors, which can lead to increasing rates of malnutrition and early obesity.[5-6] Several empirical studies conducted on nutritional status and diet quality have shown a high prevalence of adverse dietary patterns among adolescents. Mean intake of all major food groups, especially pulses, milk and milk products, sugar and jaggery was lower as recommended by Indian Council of Medical Research (ICMR).[7]Intake of soft drinks and fast food was found to be very high whereas, consumption of fruits and vegetables was found to be very low.[8-9] There was a huge variation in the intake of food groups among participants. The consumption of milk and milk products, beverages and energy dense foods were higher in boys than their girl counterparts. In contrast, the proportion of consumption of cereals, fruits, vegetables and nonvegetarian food products was found to be very high than boys.[10] Overall, inadequate dietary habits in terms of excess intake of nonessential foods and omission of a variety of food groups from the diet may contribute to the progress of health-related problems among nutritionally vulnerable Indian adolescents.[11] Adolescents need a balanced, diversified and adequate diet for preventing and maintaining the long-term health consequences in later life.

Current data on dietary behaviour and food preference among Indian school going adolescents are limited. The present study in selected schools of rural areas of Aligarh city in the state of Uttar Pradesh, India, aimed to evaluate the association between demographic characteristics, physical activity, socio-economic variables, and dietary behaviours of Indian adolescents.

Methods

Study design and population

This community-based cross-sectional study was conducted among 100 school going adolescents (43 boys, 57 girls) of age 13-17 years, residing in rural areas of Aligarh district of Uttar Pradesh, India. The target population for the study was school going adolescents of class 9th to 12th from 2 private schools of the selected area. The sample was selected through simple random sampling method. All schools were randomly selected for this study.All data were collected after approval of the local Directorate of Education and school administration. The study was conducted in conformity to Ethical Guidelines on Human Subjects,[12] as per the revised Helsinki Declaration (2013).

Measurements and data collection techniques

Demographic and socio-economic variables

A pre-designed and pretested questionnaire was used to interview the subjects to elicit information on demographic variables, like gender, age, classetc. Information related to socio-economic variables was asked from parents using Kuppuswamy's socio-economic status scale.[13]

Dietary assessment

A pretested questionnaire based on existing relevant literature and questionnaires on adolescents' healthy eating habits was used to assess the habitual food intake of these adolescents. A total of 30 questions were asked on the consumption of breakfast, eating salad during the meal, skipping of meals, avoid eating fried foods, eating regular meals with your family at home, etc.

Dietary assessment was done using 24-hour diet recall and food frequency questionnaire (FFQ). In 24-hour diet recall, standardized measuring cups were used to remove all the ambiguity on the estimation of the average intake of food.[14] After collecting dietary information from respondents all the recipes were

standardized in the food laboratory of Banasthali Vidyapith. Researcher entered dietary data directly into validated Nutrition Software of India- 'DietCal- A Tool for Dietary Assessment and Planning' version-8.0 (Profound Tech Solution; http://dietcal.in/). Nutrients were calculated using this software. The mean intake of these nutrients was compared with adolescent nutritional requirements.[15] The Nutrient Adequacy Ratio (NAR) was calculated for seven nutrients, including energy, using 24-hour recall data. It was calculated by dividing the subjects' daily intake of nutrient by Recommended Daily Allowance (RDA).[16] The Mean Adequacy Ratio (MAR) was calculated by dividing the sum of all nutrients by the number of nutrients. A value of 1 is considered ideal for both MAR and NAR, it reflects that the individual has taken nutrient in an adequate amount.[17]

A food frequency questionnaire was devised according to the food groups given in the nutritive value of Indian foods.[16] It was used to elicit information on the eating frequency of a particular food item by participants.

Assessment of physical activity

Physical activity index was used to measure health related physical fitness of adolescents.[18] It composed of three measures of physical activity patterns dealing with intensity, duration and frequency.Participants were asked to mark one category for each item. The score was computed by multiplying all these three values. A higher overall activity score (81-100) was reflective of a very active lifestyle and excellent physical activity level.

Statistical Analysis

After collection,all data were analyzed, and appropriate statistical tests were applied using M.S. Excel software and SPSS-20.0. $P < 0.05$ was considered statistically significant. Student's t-test was employed to evaluate the significant difference between the mean intake of food groups and recommended dietary allowances.

In binary logistic regression models, we estimated odds ratios (ORs) with 95% confidence intervals (95% CI) for the association of dietary behaviours with demographic variables, physical activity and socio-economic characteristics, using the category of "male," "12 class," "nuclear family," "non-vegetarian," "working," "lower (V)," " poor" as a reference.

Results

Subject characteristics

A total of 100 adolescents with a mean age of 14.7 (SD=1.2) years participated and 57% of them were girls. The age of subjects ranged from 13 to 17 years. Majority of subjects (61%) were studying at the secondary level (classes 9^{th} and 10^{th}). Nearly a quarter of the heads of the family (26%) obtained high school education and majority of mothers (96%) were housewives, not engaged in any paid activity. In total, 46% of adolescents belonged to upper lower socio-economic status. A significant association ($\chi 2=20.30$; $p=0.000$) was observed between gender and physical activity. Active lifestyle and very good physical activity were reported more amongst the boys as compared to girls.

Association of dietary behaviours with demographic, socio-economic variables and physical activity

Table 1 shows the association between daily consumption of breakfast, consumption of snacks between main meals, junk food as an alternative to breakfast and factors such as age, gender, class, family type, eating habits, occupation of mother, socio-economic class and physical activity. Adolescents who belonged to the joint family were more likely to consume breakfast every day than those who were

belonged to the nuclear family (p=0.01). Adolescents who studied in 9th and 10th standard tended to prefer consumption of snacks between meals (p=0.00; p=0.02). Odds for adolescents who had a habit of consuming junk food as an alternative to breakfast were higher in the case of children who studied in 11th standard (OR=3.56). Adolescents who belonged to the upper lower socio-economic class had increased odds of the consuming snacks between main meals (OR=2.52).

Table 1. Association between daily consumption of breakfast and consumption of snack between main meals and junk food as an alternative to breakfast and factors from logistic regression model

Variables	Daily consumption of breakfast		Consumption of snacks between main meals		Junk food as an alternative to breakfast	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Age	0.76(0.51-1.14)	0.19	1.30(0.92-1.83)	1.34	1.19(0.74-1.91)	0.46
Gender						
Male	1.42 (0.53-3.80)	0.48	1.19(0.48-2.98)	0.69	1.24(0.37-4.09)	0.72
Female (ref.)	-	-	-	-	-	
Class						
9	0.54(0.14-2.02)	0.36	0.14(0.03-0.54)	0.00a	1.68(0.30-9.38)	0.55
10	0.52(0.14-1.93)	0.33	0.25(0.07-0.86)	0.02a	0.78(0.17-3.57)	0.78
11	0.24(0.04-1.38)	0.11	0.40(0.11-1.48)	0.17	3.56(0.33-37.68)	0.29
12 (ref.)	-	-	-	-	-	-
Family type						
Joint Family	0.34(1.23-9.63)	0.01a	1.78(0.73-4.34)	0.20	1.12(0.34-3.73)	0.84
Nuclear Family (ref.)	-	-	-	-	-	-
Eating habits						
Vegan						
Lacto-vegetarian	1.50(0.16-13.8)	0.72	0.49(0.09-2.74)	0.42	6.00(0.87-41.21)	0.06
Lacto-Ovo-vegetarian	0.80(0.07-8.75)	0.85	0.47(0.07-2.98)	0.42	1.91(0.28-13.08)	0.50
Non-vegetarian (ref.)	-	-	-	-	-	-
Occupation of mother						
Housewife	NA	0.99	0.97(0.09-10.5)	0.98	2.33(0.22-24.28)	0.47
Working (ref.)	-	-	-	-	-	-

Cont... **Table 1.Association between daily consumption of breakfast and consumption of snack between main meals and junk food as an alternative to breakfast and factors from logistic regression model**

Socio-economic class						
Upper (I)						
Upper middle (II)	NA	0.99	0.42(0.02-9.36)	0.59	NA	0.99
Lower middle (III)	0.50(0.04-5.63)	0.57	0.70(0.06-7.70)	0.77	NA	0.99
Upper lower (IV)	1.18(0.11-12.42)	0.88	2.52(0.24-26.06)	0.43	NA	0.99
Lower (V) (ref.)	-	-	-	-	-	-
Physical activity						
High	NA	0.99	NA	0.99	0.15 (0.00-2.76)	0.20
Very good	0.35(0.09-1.33)	0.12	0.91(0.33-2.45)	0.85	1.30(0.31-5.35)	0.71
Fair	0.65(0.12-3.36)	0.60	1.89(0.51-7.03)	0.33	1.56(0.17-13.96)	0.68
Poor (ref.)	-	-	-	-	-	-

OR: odds ratio; CI: confidence interval

[a]Significant association

The results examining factors impacting preference to eat green leafy vegetables, skipping meals and enjoying something sweet after a meal are presented in table 2. Association between the family structure and liking for green leafy vegetables was found and presented as: adolescents who belonged to the joint family were more likely to prefer green leafy vegetables than those who belonged to the nuclear family (p=0.02). Adolescents whose mother was housewife were more likely to prefer green leafy vegetables than those whose mother was working (p=0.02). Adolescents who fell in the fair physical activity category were more likely to enjoy something sweet after a meal than those who belonged to the high, very and poor physical activity category (p=0.03). Dietary behaviours had no association with socio-economic status of adolescents.

Table 2.Association between socio demographic variables and selected dietary behavours from logistic regression model

Variables	**Like to eat green leafy vegetables**		**Skipping meals**		**Enjoying something sweet after meal**	
	OR (95% CI)	**P**	**OR (95% CI)**	**P**	**OR (95% CI)**	**p**
Age	1.04(0.70-1.55)	0.81	0.77(0.54-1.09)	0.14	0.77(0.56-1.06)	0.11
Gender						
Male (ref.)	-	-				
Female	2.4(0.81-7.51)	0.11	0.33(0.13-0.81)	0.16	1.70(0.76-3.78)	0.19

Cont... **Table 2.Association between socio demographic variables and selected dietary behavours from logistic regression model**

Class						
9	2.28(0.53-9.83)	0.26	1.25(0.38-4.06)	0.70	3.20(0.91-11.14)	0.06
10	0.57(0.10-3.17)	0.52	2.49(0.72-8.61)	0.14	2.62(0.75-9.07)	0.12
11	1.33(0.25-6.94)	0.73	4.12(0.89-19.00)	0.69	2.80(0.72-10.75)	0.13
12 (ref.)	-	-	-	-	-	-
Family type						
Joint Family	0.21(0.05-0.78)	0.02a	0.80(0.33-1.91)	0.61	2.28(1.00-5.21)	0.49
Nuclear Family (ref.)	-	-	-	-	-	-
Eating habits						
Vegan	NA	0.99	NA	0.99	NA	0.99
Lacto-vegetarian	NA	0.99	0.56(0.06-5.18)	0.61	3.78(0.41-34.23)	0.23
Lacto-Ovo-vegetarian	NA	0.99	0.32(0.03-3.18)	0.33	7.08(0.73-68.6)	0.09
Non-vegetarian (ref.)						
Occupation of mother						
Housewife	0.6(0.00-0.68)	0.02a	0.81(0.81-8.11)	0.85	0.27(0.02-2.69)	0.26
Working (ref.)	-	-	-	-	-	-
Socio-economic class						
Upper (I)						
Upper middle (II)	9.00(0.56-143.88)	0.12	0.55(0.03-8.08)	0.66	1.00(0.09-11.02)	1.00
Lower middle (III)	0.50(0.04-5.63)	0.57	0.83(0.07-8.82)	0.88	0.82(0.10-6.43)	0.85
Upper lower (IV)	0.45(0.04-5.06)	0.51	0.84(0.08-8.89)	0.88	0.84(0.10-6.48)	0.86
Lower (V) (ref.)	-	-	-	-	-	-
Physical activity						
High	NA	0.99	0.37(0.02-6.30)	0.49	NA	0.99
Very good	1.33(0.43-4.13)	0.61	0.78(0.29-2.09)	0.62	0.83(0.34-2.06)	0.70
Fair	1.83(0.41-8.16)	0.42	0.99(0.23-4.21)	0.99	0.09(0.01-0.80)	0.03
Poor (ref.)	-	-	-	-	-	-

OR: odds ratio; CI: confidence interval

[a]Significant association

Dietary assessment

Nutrient intakes derived through the adolescents' diet are shown in table 3. Among adolescents, NAR of energy, protein, fat, calcium, iron and zinc were higher in boys than those in girls, while NAR of dietary fibre and vitamin C were lower in boys than those in girls. NAR of calcium intake according to gender shows that boys had adequate intake, whereas girls had inadequate intake of calcium. MAR results are different by gender that boys had higher MAR than girls. MAR was found to be 1.07 which indicate overall nutrients adequacy in the diet.

Table 3. Nutrient Adequacy Ratio (NAR) of adolescents

Nutrients	Total (n=100)	Boys (n=43)	Girls (n=57)
Energy (kcal/d)	0.84±0.33	0.87±0.33	0.82±0.32
Protein (g/d)	1.39±0.47	1.66±0.87	1.33±0.64
Fat (g/d)	2.34±1.22	2.77±1.25	2.12±1.14
Calcium (g/d)	1.00±0.74	1.42±0.98	0.78±0.43
Iron (mg/d)	0.43±0.45	0.61±0.26	0.37±0.20
Dietary fiber (g/d)	0.68±0.28	0.66±0.27	0.70±0.29
Vitamin C (mg/d)	1.37±1.18	1.31±0.90	1.39±1.31
Zinc (mg/d)	0.52±0.18	0.58±0.18	0.49±0.16
MAR	1.07±0.60	1.23±0.63	1.00±0.75

Recommended consumption of cereals, pulses, sugar and fats and oils was different between age groups, whereas the consumption of fruits, vegetables and milk and milk products was similar. The average daily intakes of green leafy vegetables, roots and tubers and sugars were higher than the recommended dietary intake (RDI) in adolescent girls aged 13-15 years, whereas consumption of cereals, pulses, other vegetables, fruits and fats was lower than RDI in adolescent boys (13-15 years). Overall consumption of milk and milk products was found to be higher in boys than their girl counterparts. The deficit in the consumption of pulses, green leafy vegetables, fruits was higher among girls, compared with boys (16-17 years).

The mean daily intakes of fats and oils and sugar in girls aged 16-17 years and roots and tubers and sugar intakes in girls aged 13-15 years were higher than the recommended dietary intake (RDI). In contrast, intakes of cereals and millets were much lower than recommended in all the age groups. It is worth noting that fats and oils, sugars, roots and tubers were the major food group categories in meeting the total energy. The mean intakes of milk and milk products in boys aged 13-17 years were much higher than the

recommended, whilst the intake of pulses was lower than the recommended among all the subjects. It can be stated that the higher contribution to total protein intake came from milk and milk products followed by pulses.

Discussion

Our findings, akin to the previous study[19]inferred that there were family type-related differences in the dietary habit of daily breakfast consumption. Results showed that family type inequalities in daily breakfast intake exist in India with more likely to eat breakfast daily among adolescents living in a joint family. Our results indicated adolescents who enrolled in 9th and 10th standard were more likely to consume snacks between meals. Several researchers have evaluated different aspects of adolescents snacking such as snacking time,[20] snacking location,[21] effects of snacking on academic performance.[22] A previous study examined that consumption of snacks leads to higher total caloric intake, leading to a greater risk of overweight and obesity among adolescents.[23]

As seen in this study, the structure of the family and occupation of the mother were associated with liking for green leafy vegetables among adolescents. Evidence highlighted that adequate consumption of green leafy vegetables is associated with improved mental health and lowered non communicable disease risk among adolescents.[24-25] Our study found that adolescents who involved in fair physical activity tended to enjoy something sweet after having a meal compared with participants who involved in high and poor physical activity. A cross-sectional survey conducted among adolescents showed that adolescents who performed physical activity for more than 4 hours per week tended to consume more vegetables, beans, cooked vegetables, fruits and milk, but less consumption of sweets among adolescents.[26] Dietary behaviours were not found to be associated with the socio-economic status of adolescents. This was in contrast to many studies including one in which Daeie-Farshbaf et al,[27] found a positive association of dietary pattern with socio-economic status.

The inadequate intake of nutrients such as iron, dietary fibre and zinc is quite evident in the present study. In line with this research, a study conducted among adolescents in Tanzania reported a low intake of micronutrients including vitamin C, calcium, iron and zinc.[28]

Conclusions

Our results demonstrate that demographic characteristics such as types of family, class, occupation of mothers, physical activity are associated with adolescents' dietary behaviours. Daily intake of energy, iron, dietary fibre and zinc is lower than their respective RDAs in the diet of both the female and male adolescents.

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