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DEVELOPMENT AND EVALUATION OF FOOD BEHAVIOUR AND ACTIVITY CHECKLIST FOR ADOLESCENTS (FBACA)

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Abstract

It becomes increasingly important to recognize dietary and physical activity practices adolescents are following in this transitioning environment because this is a critical stage in the etiology of some adult NCDs. **Objectives:** Food Behaviour and Activity Checklist for Adolescents (FBACA) was developed and evaluated to assess quality of diet and activity patterns of school children based on frequency. **Method: Complete socio-economic status, food-behavior, physical activity and 24-hour dietary recall (3day) data was collected from 631 school children aged 8-15 years. Anthropometric measurements were carried out. FBACA was developed and validated on the basis of psychometric properties. Results: FBACA comprised of 20 dietary and physical activity components. FBACA assessed and scored quality of relative dietary and physical activity practices followed.** Socio economic parameters did not have any significant effect on the FBACA scores**. Almost all the subjects were in "need improvement" category.** Highest scores for individual FBACA components were for vegetable consumption followed by fruits and breakfast consumption. **Analysis of psychometric properties of FBACA showed its components conformed to most of the dietary and physical activity guidelines.** Correlation of Total FBACA scores with energy was very low indicating independence of FBACA from energy intakes. **FBACA** uncoupled dietary quality with dietary quantity. Fifteen of twenty components explained 91% of variance in FBACA scores. FBACA was found to be a reliable multidimensional tool. Conclusion: FBACA is a simple, valid and reliable tool for measuring quality of dietary and physical activity practices of school-children. Such tools should be developed for all age groups. General population can be trained to evaluate quality of their own diets using FBACA. It should be used in conjunction with simple behaviour-change communication messages to bring about positive behavioural changes amongst populations and curb the deleterious effects of 'Nutrition Transition'.

Keywords: School-children, Dietary and physical activity practices, assessment, evaluation.

INTRODUCTION

Adolescence is an age of opportunity for children, and a pivotal time to build on their development in the first decade of life, to help them navigate risks and vulnerabilities, and to set them on a path to fulfilling their potential (1). Adolescence though is a time of enormous physiological, cognitive and psychological change, WHO acknowledges that adolescents remain "a neglected, difficult-to-measure and hard-to reach population" (2).

The health of school children is linked to their academic success. Both physical activity and healthy eating may help improve academic achievement (3, 4). Healthy eating and regular physical activity play a powerful role in preventing dual burden of malnutrition amongst adolescents (5, 6).

The quality of adolescents' diet and physical activity practices is of importance because the poor habits established in this stage continue till later stages of life. These habits are the major contributing factors to related health and nutrition outcomes. An evaluation of quality of dietary and physical activity practices would reveal the shortfalls in the healthy behaviour of adolescents.

Most of the countries have developed ~~or are developing~~ National Food Based Dietary Guidelines (FBDG) as well as physical activity guidelines. In addition to the guidelines, there has also been a call in the research and policy communities to develop simple indicators to measure quality of dietary and physical activity practices.

A short food behavior checklist (FBC) was developed to evaluate the impact of nutrition education on fruit and vegetable intake among ethnically diverse women in the Food Stamp Nutrition Education Program (FSNEP) and the Expanded Food and Nutrition Education Program (EFNEP) (7). This short, culturally neutral FBC was found to be a valid and reliable indicator of fruit and vegetable consumption. Compared with the 24-hour dietary recall, it was also less time-consuming to administer, code and analyze, with a reduced respondent burden.

Previous studies have suggested a dual burden of malnutrition amongst adolescents in urban Indian cities. As well as dietary inadequacies and inappropriate physical activity practices have been highlighted by many investigators, but so far no attempt has been made to evolve a system to assess the dietary and physical activity practices of school children in India.

Thus, the Major objective of the present study was to develop and evaluate the Food Behaviour and Activity Checklist for Adolescents in Indian context. The specific objectives wereto review the socio-economic profile, nutritional status, dietary intake of the school children enrolled for the study. To develop a food behavior and activity checklist for adolescents and evaluate the behavior patterns of adolescents regarding dietary and physical activity practices. Also to assess the validity and reliability of the checklist.

METHODOLOGY

Baseline data collection

Three urban schools were randomly selected and all the students (N=631) studying in std. Vth to XIth were enrolled for the study. Consent of the ethical committee was taken prior to conducting the study (Ethical clearance no. F.C.Sc/ FND/ME/90)

Baseline data collection on anthropometric measurements (Height and weight), socioeconomic status and 24- hour dietary recall (3 day) was carried out on all the subjects. To assess the prevalence of malnutrition,

indices namely, BMI for age, Height for age (8) and Weight for age (9) were calculated. Information on the socio-economic profile of the subjects was collected using a pre-tested structured questionnaire.

Development and Evaluation Strategy for Food Behaviour and Activity Checklist for Adolescents (FBACA)

Food Behaviour and Activity Checklist for Adolescents (FBACA) was developed to assess the quality of diet and activity patterns of the adolescent children according to frequency. The FBACA checklist was administered for 7 days to ascertain the trend. Frequencies for breakfast, mid morning, vegetables, fruits, local fruits, intake of processed foods, fried foods, water intake, and for activity patterns according to playtime, leisure time and study time were seen. The frequencies were given scores of 0 to 5. Zero was given to the most undesirable action for any dietary component or activity pattern and a maximum score of 5 was given to the most desirable frequency of food item consumption or activity pattern (Table 1). Different components of foods and activity patterns were included in the checklist and scores were allotted accordingly. FBACA, in the present study, evaluated food consumption pattern and physical activity practices against the recommendations made in *'Dietary Guidelines for Indians'* (10) and *'Consensus physical activity guidelines for Asian Indians'* (11). FBACA consisted of 20 dietary components encompassing all the dietary and physical activity aspects as laid down in the dietary and physical activity guidelines. A sum of all the individual components of FBACA was the Total FBACA score. The maximum total FBACA score was 100. A total FBACA score of 80 implied a 'good' quality practices were being followed. However, a Total FBACA score between 51 to 80 meant the practices 'needed improvement' while a total FBACA score less than or equal to 50 suggested 'poor' quality of dietary and physical activity practices.

Evaluation of content validity examines qualitatively the extent to which an index represents the variety of attributes that make up the quality of dietary and physical activity practices. The key recommendations applicable to adolescents were used from 'Dietary guidelines for Indians- 2010'. These recommendations were linked to related components of FBACA for establishing content validity.

Construct and criterion validity measure how well the index measures diet quality. This is done in different ways.

Firstly, FBACA should be able to assess diet quality independent of diet quantity, as measured by diet's energy value. Because nutrient intake is positively correlated with energy intake, a diet quality index could lead to an overrating of high calorie diets. To evaluate this independence, Pearson correlations of the FBACA total and components cores with the energy intake were seen.

Secondly, the underlying structure of the index was examined through principal component analysis (PCA). On the basis of the correlations among the components, the PCA was used to determine the number of independent factors that compromise the FBACA. The main objective of PCA was to find out whether one or more than one factor accounted for the systematic variation observed in the data.

Table1: Food Behaviour and Activity checklist scoring system

S.No.	Food Behaviour and Activity Checklist For Adolescents (Components)	Max Scores
1	Breakfast Consumption Y/N	5
2	Breakfast Food Item	5
3	Mid Morning Y/N	5
4	Mid Morning Food Item	5
5	Carry Lunch To School	5
6	Vegetable Consumption Y/N	5
7	Green Leafy Vegetables	5
8	Roots & Tubers	5
9	Yellow & Orange Vegetables	5
10	Other Vegetables	5
11	Fruit Consumption	5
12	Any Fruit	5
13	Local Fruits Consumption	5
14	Evening Snacks	5
15	Evening Snacks Food Item	5
16	Outside Food	5
17	Water Intake	5
18	Activity (Playtime Outdoor In School And Home)	5
19	Activity (Leisure Time Watching TV, Computer Or Video Games, Etc.)	5
20	Activity (Study Time)	5
	Overall Score	**100**

FBACA was checked for one form of reliability, internal consistency, the degree to which multiple components within an index measure the same underlying, unidimensional, latent construct, by using Cronbach's coefficient alpha. This statistic is mathematically equivalent to the average of the correlations among all possible split-half combinations of the 20 components of FBACA, and thus captures any systematic variation underlying the components that are measured.

Also to get an understanding of the inter component relationships among components, inter component correlations were observed.

Data was analyzed using Microsoft excel (2010), Epiinfo Version 7 and Statistical Package for Social Sciences (SPSS) Version 20.

RESULTS

Assessment of quality of dietary and physical activity practices of subjects using Food Behaviour and Activity Checklist for Adolescents (FBACA)

Total FBACA Scores

Total FBACA scores for girls were slightly higher than boys (Table 2). This difference was found to be non significant. On further age and sex wise analysis it was found that these score were lowest for girls at the age of 16 to <17 years whereas for boys it was lowest between 9 to <10 years of age. Mean total scores for girls were significantly higher ($p<0.001$) than boys at the age of 9 to <10 years. However, boys had a significantly higher score ($p<0.05$) than girls at the age of 13 to < 14 years and 16 to < 17 years of age. Analysis of variance (ANOVA) revealed that there was no significant effect of age on Total FBACA scores.

Socio Economic Status of the Subjects and Mean Total FBACA Scores

Socio Economic status is known to affect the quality of diet. An attempt was made to see the association between Mean total FBACA scores and the socio economic parameters (Table 3). The highest Total FBACA scores were observed for Christians. However, Analysis of variance showed no significant association between religion and total FBACA scores.

Subjects living in a nuclear family had highest total FBACA scores. Smaller families had higher Total FBACA scores. Subjects living in a family with less than 5 members had a mean total score of 70.52 while the subjects with more than or equal to 5 members in their family had a score of 69.65.

Children of well educated parents (Graduate or above) had higher FBACA scores as compared to others. However, the difference between the two groups was not significant. Working status of the mother had a positive effect on the total FBACA scores.

Ovo-vegetarians had the highest total FBACA scores although the difference between the groups was not significant.

Assessment of the Quality of Dietary and Physical Activity Practices

More females than males had good dietary and activity practices according to FBACA (13% v/s 8%) (Table 4). However most of the subjects i.e. 86% boys and 90% girls needed improvement in their habits. A very small percentage of subjects followed poor dietary and physical activity practices.

Table 2 : Mean Total FBACA Scores Age and Sex wise (N=631)

Age	Boys	Girls	Total
<9	71.08±8.26 (13)	68.50±8.9 (10)	69.96±8.45 (23)
9-9.11	67.23+8.65 (39)	73.71+6.88 (41)***	70.55+8.40 (80)
10-10.11	69.55± 7.65 (88)	70.66±7.46 (53)	69.96± 7.57 (141)
11-11.11	69.95+9.0 (83)	72.33+7.62 (54)	70.89+8.54 (137)
12-12.11	71.27±7.22 (66)	70.3±9.26 (33)	70.95±7.92 (99)
13-13.11	70.98±8.88 (52)*	65.69±8.84(26)	69.22±9.16 (78)
14-14.11	68.77+8.74 (31)	67.77+9.14 (13)	68.48+8.77 (44)
15-15.11	69.8±9.27 (10)	69.11±12.75 (9)	69.47±10.74 (19)
16-16.11	71.0±5.24 (5)*	55.0± 0 (1)	68.33±8.04 (6)
>17	77.0+1.41(2)	72.0+ 4.24 (2)	74.5+3.87 (4)

***significant at p<0.05 ***significant at p<0.005**

Table 3: Socio economic parameters and Mean Total FBACA Scores

Socio Economic Parameter (N=631)	Mean FBACA Score	't' value / 'F' value
Religion		
Hindu (595)	70.19± 8.40	'F'- 1.43
Muslim (10)	71.70± 8.56	
Sikh (16)	67.69±7.95	
Christian (10)	72.8± 5.03	
Type of Family		
Joint (63)	68.94± 7.96	'F'- 1.76
Nuclear(459)	70.57± 8.33	
Extended(109)	69.34± 8.58	
Family Size		
≥ 5 members(234)	69.65± 8.2	't'- 1.27
< 5 members (397)	70.52± 8.43	
Per Capita Income		
≤ Rs. 5000 (321)	71.1± 8.28	't'- 2.78
> Rs. 5000 (310)	69.26± 8.33	
Father's Education		
Graduate or above (352)	70.55± 8.67	't'- 1.19
Intermediate/ Diploma or below (279)	69.75± 7.92	
Mother's Education		
Bachelor degree or above (251)	70.83± 8.03	't'- 1.54
Intermediate/ Diploma or below (380)	69.78± 8.55	
Mother's Occupation		
Housewife (568)	70.03± 8.44	't' – 1.51
Working (62)	71.71±7.42	
DietaryHabits		
Vegetarian (358)	70.08±8.07	'F' – 0.24
Non-Vegetarian (196)	70.18±8.88	
Ovo-Vegetarian (77)	70.81±8.29	

None of the subjects above 16 years of age followed good quality practices. Eighty five to 100 % of the subjects needed improvement in their practices at all ages.

Mean Total FBACA Scores and the Nutritional Status of the Subjects.

As shown in Table 5 on comparing the total scores with the nutritional status no significant

Table 4: Quality of diet and physical activity practices of the study subjects

Quality of Practices	Boys	Girls	Total
Good	8.2(32)	12.8(31)	10 (63)
Need Improvement	86.4 (209)	90.2 (351)	88.7(560)
Poor	0.8 (2)	1.5(6)	1.3(8)

difference between the undernourished and normal subjects was observed. However the total FBACA scores for the undernourished subjects were lower than their well nourished counterparts.

Table 5: Total FBACA score according to the nutritional status

Nutritional Status	Total FBACA scores Mean±SD	't' value
WAZ		
<-2 SD	69.03±6.69	0.78
=-2 SD	70.25 ±8.42	
HAZ		
<-2 SD	69.33 ± 9.65	0.40
=-2 SD	70.21 ± 8.32	
BAZ		
<-2 SD	69.40 ± 8.49	0.80
=-2 SD	70.29 ± 8.33	

Individual component scores

Table 6 shows the individual component scores of the subjects. Breakfast consumption received a high score (4.6) although the breakfast items did not get good scores (2.15) as most of the subjects had a habit of having milk only for breakfast. Mid morning scores were quite high indicating a regular consumption of food during recess (4.53). Higher mid morning item scores (4.14) indicate the foods eaten were also healthy as most of the subjects used to carry "roti –sabji" in tiffin. Lunch (tiffin) scores (4.3) were also high thus most of the subjects consumed foods brought from home during recess.

The highest individual scores were for vegetable consumption (4.9) indicating a regular consumption by the subjects on almost all the days. However vegetable consumption was highest for roots and tubers(4.33) followed by other vegetables (3.71). Fruit consumption (4.81) was also reported to be quite high.

Higher evening snack consumption score (4.08) indicated a regular habit of having some food item in evenings but lower scores for evening snack items (0.9) shows unhealthy foods being consumed as snacks.

An average outside food score (3.02) indicates that the subjects were not in a regular habit of consuming outside food. A good water intake score indicates satisfactory water intake by the subjects.

Playtime score of 2.68 shows, that average time for play was between 30-50 minutes daily. Leisure time score(2.34) implies that on an average leisure time was between ½to 1½ hour daily whereas study time (2.05) daily was between 8-10 hours including 5 hours of school time.

There was no significant difference in the mean individual FBACA component scores of both the sexes.

Frequencies of Individual FBACA component scores

Figure 1 shows the scatter plot for the frequencies of various individual component

Table 6: Mean FBACA component score

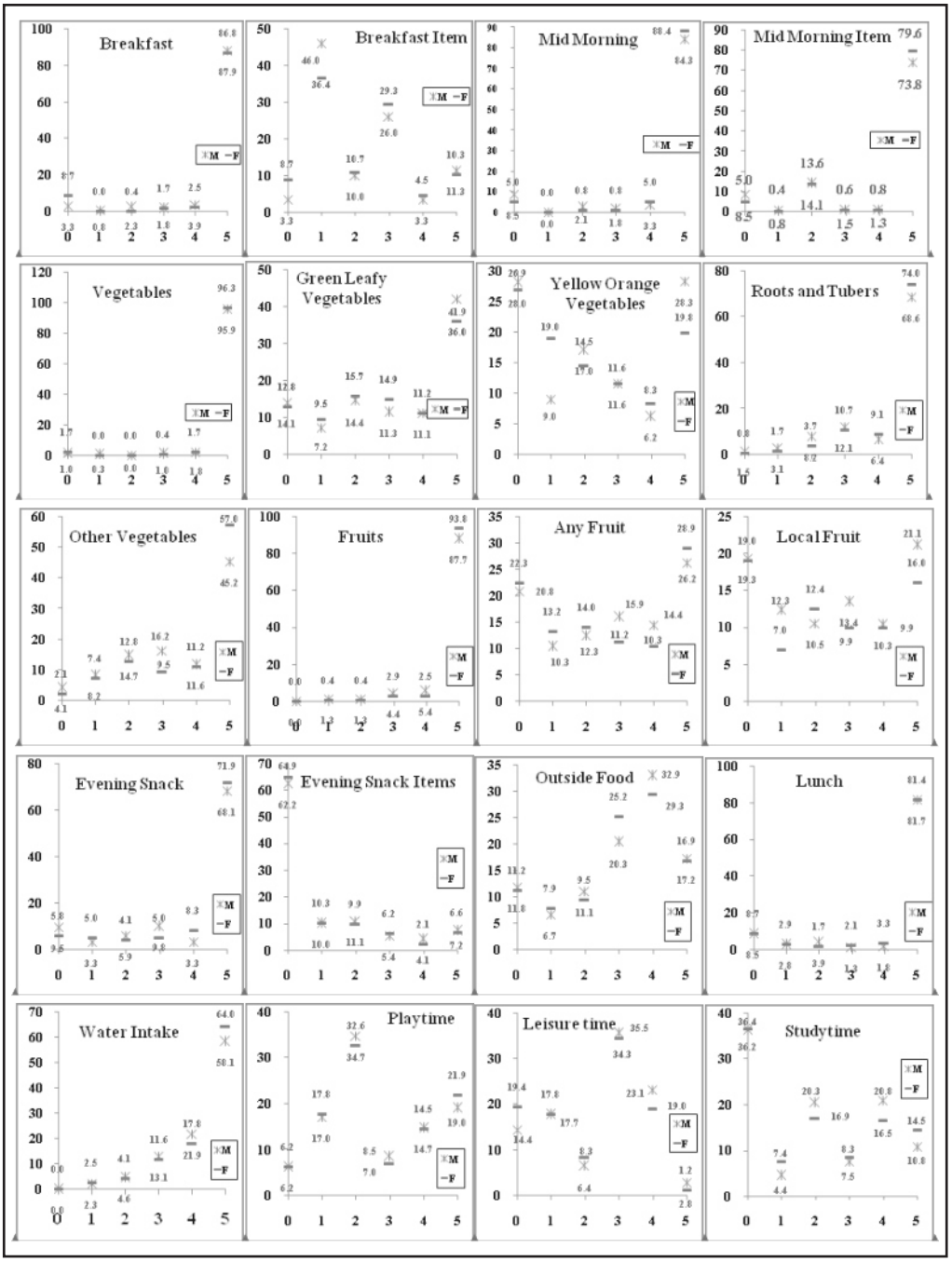
FBACA Components	Mean Score (Mean ± SD)			Max Score
	Boys (N= 389)	Girls (N= 242)	Total (N= 631)	
Breakfast Consumption	4.66 + 1.08	4.5 +1.43	4.6 + 1.23	5
Breakfast Item	2.14 + 1.41	2.16 + 1.45	2.15 + 1.43	5
Mid Morning	4.44 +1.45	4.66 + 1.14	4.53 +1.34	5
Mid Morning Item	4.05+ 1.68	4.29+1.47	4.14+ 1.61	5
Carry Lunch	4.3 ±1.59	4.33 ±1.57	4.31 ±1.58	5
Vegetables	4.9 ±0.59	4.89 ±0.66	4.9 ±0.62	5
Green Leafy Vegetables	3.24 ± 1.86	3.10 ± 1.80	3.18 ±1.84	5
Yellow and orange Veg	2.44 ± 1.98	2.15 ±1.87	2.33 ± 1.94	5
Roots and Tubers	4.25±1.27	4.48 ±1.03	4.33 ±1.19	5
Other Vegetables	3.59 ±1.56	3.91±1.48	3.71 ±1.54	5
Fruit Consumption	4.77 ± 0.71	4.89 ± 0.48	4.81 ± 0.63	5
Any fruit	2.71 ±1.88	2.61 ±1.95	2.67 ±1.91	5
Local fruits	2.86 ± 1.95	3.10 ±1.97	2.95 ±1.96	5
Evening Snack Consumption	3.99 ±1.69	4.21 ±1.52	4.08 ±1.63	5
Evening Snack Item	1.01 ±1.57	0.9 ±1.5	0.97 ±1.54	5
Outside Food Consumption	3.07 +1.57	3.05+1.55	3.06 + 1.56	5
Water intake	4.29 + 1.01	4.37 +1.01	4.32 +1.01	5
Playtime	2.66 +1.54	2.71 +1.60	2.68 +1.56	5
Leisure time	2.44 +1.45	2.19 +1.46	2.34 +1.46	5
Study time	2.05 +1.84	2.05 +1.9	2.05 +1.86	5
Total Score	69.94±8.3	70.61±8.45	70.2±8.35	100

scores. Breakfast consumption was reported by 87% girls and 88% boys on ≥ 5 days/ week. Forty six percent boys and 36% girls consumed tea/coffee along with biscuits for breakfast while 26% boys and 29% girls consumed milk with biscuit for ≥ 5 days.

Mid morning food consumption was reported by 84% and 88% boys and girls respectively for ≥ 5 days during the last 7 days. Around three fourths of boys and girls consumed Cereals along with vegetable or pulses or milk as mid morning food item. This explains a high mean for mid morning item score.

Ninety six percent subjects reported vegetable consumption for ≥ 5 days. Majority of the As

Figure 1: Scatter plot showing FBACA scores for Individual Components
X-Axis: FBACA Scores Y Axis: Percent Subjects



subjects consumed roots and tubers for 5 or more days. A regular consumption of yellow orange vegetables was reported by nearly 40% of the subjects. As high as 94% girls and 88% boys reported fruit consumption for $\geq$ 5 days in the past week whereas local or seasonal fruit consumption was less.

Around 70% subjects consumed evening snacks for 5 or more days. Zero score was given to 65% boys and 62% girls for evening snack item which means that these subjects were consuming unhealthy foods like fried foods, namkeen, farsan, bakery items etc. as snacks in the evenings for $\geq$ 5 days. Forty six percent girls and 50% boys reported outside food consumption for 4 or more days. This score mainly included foods eaten by them in the canteen, outside school, after tuition classes or with friends and family outside the house. Eighty one percent of the subjected reported of carrying tiffin to school. Water intake of $\geq$ 8 glasses per day was reported by 64% girls and 58% boys. Nearly 7% of the subjects had water intake $\leq$ 4 glasses per day. More than half of the subjects played for 40 minutes or less while one third of the subjects played for 50 minutes or more daily.

Around 35% of the subjects reported their leisure time to be between ½ to 1 hour daily which included mostly TV viewing, computer or video games. Leisure time of 2 hours or more was reported by 14% boys and 19 % girls on a daily basis.

Thirty six percent subjects reported to be studying for 11 or more hours daily. This study time includes their 5 hours of school. Six to seven hours of study time was reported by 11% boys and 15% girls. This explains the low overall mean study time score.

Evaluation of Psychometric properties of the Food Behaviour and Activity Checklist for Adolescents (FBACA)

Validity

Content Validity

The key recommendations applicable to adolescents were used from 'Dietary guidelines for Indians- 2010'. These recommendations are linked to related components of FBACA and are shown in Table 7. All the components that relate to diet and physical activity quality are reflected in FBACA. By design FBACA alongwith dietary habits covers physical activity and water intake.

Construct and Criterion Validity

FBACA Component scores and their correlations are shown in Table 8. As expected the individual components had very low correlations with energy. Eleven out of 20 components had negative correlations with energy intakes. The highest positive correlation was observed for Lunch score (0.11) with energy. Correlation of Total FBACA scores with energy was very low (-0.02) indicating independence of FBACA from energy intakes.

Figure 2 shows the scree plot for PCA of FBACA and it was found that multiple factors underlie FBACA. About 63% of the variance is shown by the first eight components of FBACA. The flat line appears between eight and seventeen components.

The scree plot reveals that there are at least 8 factors with eigenvalue more than 1. Therefore it was estimated that no single linear combination of components of FBACA accounted for a significant proportion of the covariation in the dietary and physical activity practices of the subjects in the present study (Figure 2).

Table 7: FBACA Components mapped to Dietary Guidelines for Indians

Dietary Guidelines – Key recommendations	FBACA Components	Comment
• Eat variety of foods to ensure a balanced diet	• Breakfast item • Mid morning item • Vegetables • Green leafy vegetables • Yellow and orange vegetables • Roots and tubers • Other Vegetables • Fruits • Any fruit • Seasonal fruit • Evening snack Item	FBACA assesses the frequency of various dietary practices and ensures a variety of foods are consumed. Evening snack, mid morning food item and outside food consumption takes into account the healthy and unhealthy practices.
• Eat plenty of vegetables and fruits	• Vegetables • Green leafy vegetables • Yellow and orange vegetables • Roots and tubers • Other Vegetables • Fruits • Any fruit • Seasonal fruit	These components cover the recommended intakes for vegetables and fruits based on their frequencies for FBACA.
• Ensure moderate use of edible oils and animal foods and very less use of ghee/ butter/ vanaspati	• Evening snack Item	Higher intakes of fried foods as evening snacks resulted in lower scores for FBACA
• Overeating should be avoided to prevent overweight and obesity		FBACA does not measure energy intakes because it assesses quality rather than quantity. Consumption of unhealthy foods frequently also leads to lower FBACA scores.
• Exercise regularly and be physically active to maintain ideal body weight	• Play time • Leisure time • Study time	FBACA measures the frequency of various activities as per the guidelines for Indian Adolescents.
• Ensure the use of safe and clean foods		By design FBACA does not address food safety.
Dietary Guidelines – Key recommendations	**FBACA Components**	**Comment**
• Practice right cooking methods and healthy eating habits		FBACA does not include healthy eating habits and methods of cooking.

Reliability

Test retest and inter-rater reliability is the most widely recognized forms of reliability. FBACA was developed to be identical for identical practices that are recalled, recorded and coded the same way. The test retest measurement error in this case could be attributed to respondent recall or data collection and processing. Inter-rater reliability was not needed as no judgment was required for scoring. Thus, these two reliabilities were perfect.

For FBACA Cronbach's Alpha was 0.17. The Cronbach's Alpha was expected to be low because quality of dietary and physical activity practices is known to be a complex and multidimensional construct. Also because there is no consistency in individuals meeting all the dietary and physical activity standards used to assess quality of dietary and physical activity practices. Therefore, internal consistency was not a necessary characteristic of FBACA.

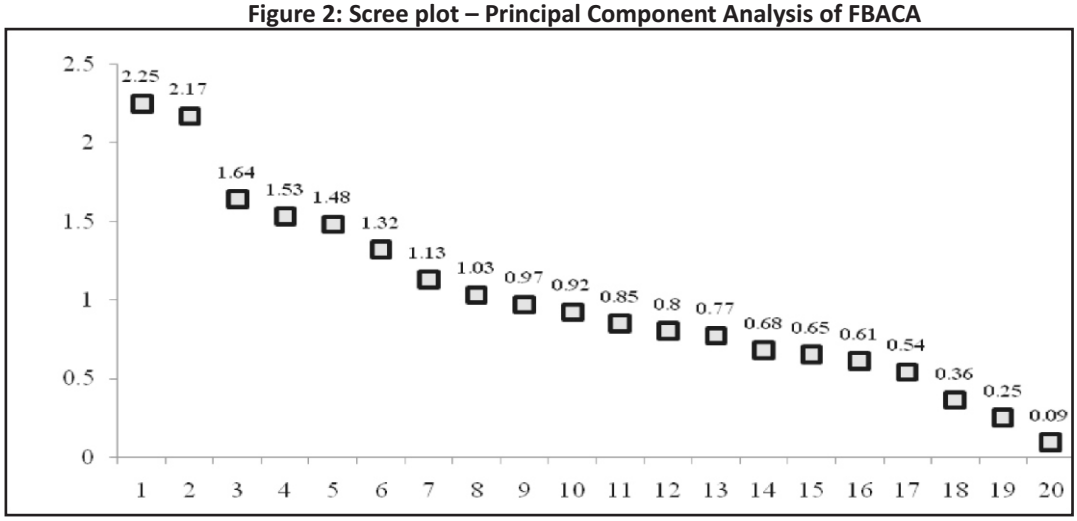
The component score most highly correlated with the total FBACA score was Vegetables (0.55). None of the component score was negatively correlated to the total FBACA score. The correlations of the components ranged from 0.02 to 0.55.

Table 8: Correlations of 7-day FBACA components and total score

Component	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total Score
1	1																				
2	0.33	1																			
3	0.09	0.5	1																		
4	0.04	0.12	0.72	1																	
5	0.004	0.05	0.04	0.11	1																
6	0.09	0.15	0.08	0.16	0.25	1															
7	0.10	0.05	0.13	0.11	0.19	0.38	1														
8	-0.03	0.01	0.04	0.06	0.32	0.07	0.10	1													
9	0.09	0.08	0.05	0.13	0.21	0.18	0.20	0.21	1												
10	0.02	-.04	0.05	0.03	-.03	-.05	0.07	0.07	0.04	1											
11	0.04	-.04	0.01	0.04	-.03	-.01	0.05	0.02	-.04	0.12	1										
12	-0.6	.04	-.01	-.04	.01	-.01	-.07	02	0.03	0.33	-.8	1									
13	-.13	-.03	-.01	-.02	-.03	0.07	0.04	0.01	0.03	0.01	-.09	.08	1								
14	0.06	-.01	-.02	-.03	0.04	-.04	-.01	-.02	-.03	0.01	0.20	-.19	-.62	1							
15	0.02	-.05	000	0.02	0.05	0.01	-.004	05	-.01	-.01	0.09	-.10	-.19	0.25	1						
16	-.06	-.04	-.06	-.12	-.02	-.02	-.13	-.01	-.01	-.01	-.11	0.13	0.17	-.13	01	1					
17	.06	.03	-.02	.02	-.00	0.00	-.05	0.03	-.04	-.01	.07	05	.10	-.06	04	.001	1				
18	02	.02	06	.06	.05	.001	.02	001	-.02	-.01	.03	-.02	0.11	-.06	0.01	0.07	0.19	1			
19	-.01	.00	-.00	.02	-.03	-.012	-.04	.02	-.03	-.02	-.07	04	-.04	.01	-.01	02	-.12	-.33	1		
20	02	.01	-.01	-.02	-.08	-.04	-.05	-.06	-.04	-.01	.06	-.08	-.03	-.03	-.05	-.01	-.16	-.15	.19	1	
Total Score	27	.31	40	.45	33	.55	.54	35	.45	.24	.09	03	0.11	.05	0.20	0.12	0.09	0.18	0.11	0.16	1
Energy	03	-.02	-.07	-.01	-.08	-.001	-.03	-.003	.001	.03	.08	-.03	.06	.05	01	.11	.05	.01	.01	-.02	.01

Significant at p<0.005 **Significant at p<0.01** **Significant at p<0.05**

Figure 2: Scree plot – Principal Component Analysis of FBACA



DISCUSSION

FBACA was developed for the adolescents in the present study based on the frequency of dietary and physical activity practices in the past week. FBACA was found to be a valid and reliable tool in assessing the quality of practices followed by the subjects regarding diet and physical activity. However, similar checklists have not been developed in India. Blackburn et al (7) developed a Food Behaviour Checklist (FBC) for fruits and vegetables consumption, it was evaluated among ethnically diverse women in the Food Stamp Nutrition Education Program (FSNEP) and Expanded Food and Nutrition Education Program (EFNEP). FBC was found to be a valid and reliable indicator of fruit and vegetable intakes.

YHEI (Youth Healthy Eating Index) was developed by (12) for children and adolescents. YHEI was an adaptation of HEI as it used FFQ (Food frequency questionnaires instead of 24 hour recalls). Both HEI and YHEI were useful in predicting dietary quality.

In order to bring a change in the dietary and physical activity practices, it is very important to assess their quality first. Thus, FBACA, developed in the present study should be used to assess the quality of dietary and physical activity practices being followed by adolescents. This can be followed by targeting various strategies for improvement in the practices.

Conclusion: Food Behaviour and Activity Checklist for Adolescents (FBACA was developed with 20 dietary and physical activity practices. Mean FBACA scores were found to be 70.20$\pm$ 8.35 and were higher for girls than boys. Most of the subjects (89%) were in the 'need improvement' category while around 10% subjects had good dietary and physical activity practices as per the FBACA scores. Socio economic parameters did not have any significant effect on the FBACA scores. Highest scores for individual FBACA components were for vegetables consumption followed by fruits and breakfast consumption. FBACA was found to be a valid and reliable tool for measuring quality of dietary and physical avtivity practices.There is need to develop new tools like FBACA for all age groups and implement it at

population levels, to see the degree of conformation to the dietary guidelines.

Another implication to be drawn from the present study is that with a little information general population can also be trained to evaluate the quality of their own dietary and physical activity practices using FBACA. Steps should be made in this regard as to make these tools more accessible to the population.

Thus, to conclude simple dietary tools like FBACA - to assess the quality of dietary and physical activity practices of adolescents should be used along with simple behaviour change communication (BCC) messages to bring about positive behavioural changes amongst populations.

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