

## ORIGINAL RESEARCH



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## Impact of school-based nutrition education intervention on consumption of fruits and vegetables among middle school children (age 7-10 years)

Faiza Iftikhar<sup>\*1</sup>, Amina Chughtai<sup>1</sup>, Dr. Sanallah Iqbal<sup>1</sup>, Dr. Sajid Khan Tahir<sup>2</sup>

<sup>1</sup>Department of Food Science and Human Nutrition, the University of Veterinary and Animal Sciences, Lahore

<sup>2</sup>Department of Physiology, University of Veterinary and Animal Sciences, Lahore

### \*Corresponding Author

Faiza Iftikhar ([faizaiftikhar@gmail.com](mailto:faizaiftikhar@gmail.com))

Department of Food Science and Human Nutrition, the University of Veterinary and Animal Sciences, Lahore

### Abstract

To evaluate the impact of school-based nutrition education intervention on the consumption of fruits and vegetables (FV) among middle school children. It was a quantitative study. One-eighty students were selected via purposive sampling and divided into two groups, control (G1= 90) and intervention group (G2=90). The intervention consisted of nutrition education lectures related to the importance, benefits, and consumption of fruits and vegetables. The data collection instruments included knowledge, attitude, and practices (KAP) questionnaire and food frequency questionnaire (FFQ). Subjects were measured at baseline and at 2 months post-treatment. Before the intervention, no significant difference was observed between the intervention and control group regarding knowledge, attitude and practices related to fruits and vegetable consumption ( $P>0.05$ ). However, after the educational intervention, the mean score of knowledge ( $14.20\pm 2.07$ ), attitude ( $5.38\pm 0.99$ ) and practices ( $17.6\pm 2.48$ ) related to fruits and vegetables consumption were significantly higher in intervention group when compared to the control group ( $P>0.05$ ). Consumption of fewer fruits and vegetables included: banana (87.8%), apple (82.2%), mango (77.8%), cucumber (63.3%), vegetable salad (55.6%) and potato (86.7%) were increased in the intervention group after nutrition education intervention. School-based nutrition education intervention on consumption of fruits and vegetables is most likely to be effective to increase nutrition knowledge and modify attitude and practices of children related to fruits and vegetable consumption. Future researches should be conducted on school-based interventions with longer intervention periods and higher sustainability.

**Keywords:** Nutrition education intervention, school going children, fruits and vegetable, knowledge attitude

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### Introduction

Nutrition education is an essential component of nutrition intervention to improve dietary habits, food preferences and to prevent nutritional deficiencies (1). Nutrition education programs are developing for the improvement of nutrition knowledge about sound dietary intake within a community or a particular target population (1). Nutrition plays an important role in physical growth as well as mental development in early life (2).

Nutrition education is very important for the development of lifelong healthy eating behavior (3). Healthy eating behavior may develop during early childhood which will affect child growth and development throughout life. Healthy eating during

early childhood may protect against the initiation of diet-related chronic diseases such as overweight and obesity in later life (4). Healthy eating patterns are important to establish during early childhood because they may continue to adulthood (5).

Schools are the best area for promoting healthy eating pattern among young children and adolescents because they may target a large population in an economically efficient way (6). School-based nutrition education intervention might be improving the nutrition and health of school children, their educational performance and learning abilities (7). In the UK, children spend most of their time in school, therefore, schools are a powerful zone for promoting good healthy behavior among children (8). Moreover, children's

health status and their educational performance are interlinked with each other. Furthermore, the development of a positive and healthy school environment is very important for the health and wellbeing of children (9).

Food habits are very complicated in nature and various factors are involved in their development. Factors that influence food choices include taste, appetite, cost, income, availability, access, education, time, culture, family, peer, meal patterns, mood, stress, attitude, belief and knowledge related to food. Lack of physical activity and inadequate diet both may be the main causes of poor nutritional status in school going children. Health behavior in school going children (HBSC) survey reported that dietary habits of 90% of European children were very poor (10).

Gao *et al.* (2014) observed that children are likely to eat more snacks, soft drinks, and junk food because they spend most of their time away from home and family (11). Mostly, children replace breakfast and lunch with a snack. Children who eat more snacks and eat less amount of good quality food their chances of becoming overweight and obese are may be very high. Dietary habits of Pakistani school going children are very poor. According to one finding, 8% of children skipped breakfast, 43% were eating snacks and 49% were overweight and obese in Karachi primary school (12). In Pakistan, underweight and overweight co-exist in school children. Warraich *et al.* (2009) reported that the prevalence of overweight was 70% and underweight was 63% in Karachi school going children (age 9-12 years) (13).

Fruits and vegetables are very useful for human nutrition and health. They are good sources of vitamins and minerals especially, niacin, folic acid, vitamin c, minerals and dietary fiber (14). Ozaki Y and Christy AA (2006) revealed that intake of carotenoids rich fruits and vegetables are linked with decrease severity of cataract (15). Moreover, fruits and vegetables supply the essential vitamins and minerals that could boost the immune system (15).

Aranceta (2004) reported that excessive intake of fruits and vegetables can be associated with lower risk of diseases such as hypertension, diabetes and cardiovascular diseases (CVD) (16). Furthermore, it can prevent most types of cancers. Fruits and vegetable intake in Pakistani school going children is very low. A study conducted by Hakeem *et al.* (2002) on 8-12 years old rural and urban school going children of Pakistan, finding indicated that consumption of micro-nutrients such as zinc, calcium, folate, thiamine, niacin, and pyridoxine was very low among rural (41%) and urban (43%) children in Sindh Pakistan (17).

Fruits and vegetable consumption are influenced by age, gender, socio-economic status and family origin (18). Wardle *et al.* (2000) revealed that

fruits and vegetables preferences were different among males 3.26 (FVP 2.6) and females 3.26(FVP 3.0) due to male had poorer nutrition knowledge (19).

Different food items like milk, pulses, grains, butter, and green leafy vegetables may be not liked by most of the children (20). Excessive intake of energy drinks, fewer intakes of fruits and vegetables, high consumption of fats enhance the risk of becoming overweight and obese. Watching television has been affiliated with decreased physical activity, overweight and unhealthy dietary behavior among children (age 10-12 years) (21).

Fruits and vegetable intake during childhood may be protective against cancer and childhood illness (22). In a study which was conducted about nutrition and respiratory health in six Central and Eastern European countries over 20,000 children aged 7-11, finding indicated that fruits and vegetable consumption showed strong association with respiratory symptoms such as cough (OR=1.18) and wheeze (OR=1.14) (23). Currie *et al.* (2004) revealed that children in Asia are not meeting the minimum suggested intake goals of fruits and vegetables (24). Moreover, children and adolescent have chances of many diet-related diseases like diabetes due to their unhealthy eating pattern (25). Therefore, it is important to develop and enforce effective programs and policies which will elevate the intake of fruits and vegetables in children.

In Pakistan, school going children have no informative knowledge related to fruits and vegetable intake in their daily diet. Furthermore, children who belong to the lower socio-economic status have lower-level nutritional knowledge instead of those who belong to higher socio-economic status. According to the national nutritional survey of Pakistan 2012-2013, 50% of children are malnourished and 49% are anemic due to poor dietary intake (26). Stunting was commonly found among 10-12 years old children of Pakistan. School-based nutrition education programs based on healthy eating in children are very important because they provide an opportunity to combine nutrition education with changes in school environments and due to school-based program parents may also become involved. It is very important to give nutrition education repeatedly in classrooms with the aim to eat a healthy diet (27).

School-based nutrition education interventions on healthy eating have shown some improvement in developing appropriate knowledge, attitude and dietary behavior in children. The present study aims to analyze the effect of school-based nutrition education intervention towards fruits and vegetable consumption in school going children.

## Methodology

### Study Design

This was a quasi-experimental study, pretest-posttest design. The study was carried out on one hundred and eighty (180) children (Boys=101, Girls=79).

### Selection of participants for study

Three primary schools in Lahore, Pakistan were selected on their willingness to participate in the study. These 3 schools were co-educational, shared similar demographic characteristics for gender, number of students, family socioeconomic status, parental support, and school environment. Overall, 180 students were selected through purposive sampling.

### Sample size

A sample of 180 participants was calculated by the formula given below:

The sample size from each school was calculated by using Selvin's formula  $[n = N/1 + N_n e^2]$  [ $n$  = Sample Size,  $N$  = Total population in this age group,  $N_n$  = Total population in school,  $e^2$  = Margin of error] (28). Fifth-grade and fourth-grade students from each branch of school were selected. Then participants were split into two groups, control group (90) and intervention group (90).

### Tools for Data Collection

The data was collected in a questionnaire form consisting of close-ended questions (KAP). Demographic factors (name, age, gender, and socioeconomic status) were also collected. Weight and height of students were computed to calculate Body Mass Index [weight (kg)/height (m<sup>2</sup>)] (29). Then the Body Mass Index (BMI) of each student has plotted on BMI for age Center of Disease Control (CDC) growth charts.

The data was collected in a questionnaire form consisting of close-ended questions (KAP). In knowledge, attitude and practice questionnaire (KAP), 19 questions were based on knowledge, 6 questions based on attitude and 11 questions based on practices related to fruits and vegetable consumption. The dietary habits of the student were assessed by the use of a Food Frequency Questionnaire. The knowledge, attitude, and practice (KAP) questionnaire was prepared by reviewing other questionnaire applied in similar studies. It was comprised of the following sections: student's knowledge about the importance of fruits and vegetables, attitude towards fruits and vegetables, practice regarding intake of fruits and vegetables.

### Pilot study

The pretesting was done to check the validity of the questionnaire. Random children of age 7-10 years were selected for pretesting. Some questions were omitted after the pretest, because of unclearly in those questions. Those questions were rephrased to make sure the clarity of questions.

### Nutrition education lectures

Nutrition education lectures were developed and delivered by audio-visual method and demonstration to the intervention group. Nutrition education lectures were delivered after the consent of school administration.

The nine nutrition education lectures were delivered to the intervention group. They were separated by one week's time span and each lecture lasted 30 minutes. During the first lecture, the general concept of nutrition and the importance of healthy eating was introduced to the students. In the second lecture my plate was shown, the definition of my plate and different food groups such as milk, vegetable, meat, and fruits were explained. In the third lecture importance of fruits and major nutrients found in the fruits were explained to the students. In the fourth nutrition education, lecture benefits of fruits were explained. In the fifth lecture the importance of vegetables and major nutrients found in the vegetables were describe to the students. Then in the six lecture benefits about the intake of vegetables was explained. In the seventh lecture serving size of fruits that are consumed on a daily basis was explained to the students. In the eighth lecture serving size of vegetables that are consumed on a daily basis was explained to the students. In the last nutrition education lecture advantages of fruits and vegetable juices and disadvantages, soft drinks were explained to the students. **Duration of study**

A post-test was conducted for both groups (G1=control, G2=Intervention) after two months of study, to analyze the impact of nutrition education intervention on knowledge, attitude, and practices of students. Comparisons were made between two groups to check the impact of nutrition education. After two months of study student's height and weight were again computed to calculate Body Mass Index (BMI). The food habits of the students were again assessed by the use of a Food Frequency Questionnaire (FFQ) to analyze any change in nutritional status and consumption of fruits and vegetables after nutrition education.

## Data analysis

The comparison was made to analyze the change about knowledge, attitude, and practices related to fruits and vegetable consumption by using a paired t-test. SPSS version 20 was used for data analysis. Data was represented in the tables and graphs form. Statistical significance was determined at the level of  $P=0.05$ .

## Results

### Demographic

The baseline parameters of the study participants were weight, height, and Body Mass Index (BMI). Baseline characteristics of children were shown in Table-1. The mean age of the study participants was  $9.00\pm 0.50$ , weight  $29.5\pm 2.8$  and height  $148.8\pm 2.7$ . The mean Body Mass Index (BMI) of the study participants was  $18.5\pm 22.1$  indicating that the majority of study participants had normal weight at the time of the study Table-2 shows that according to percentile and frequency distribution of BMI for age, participants of this study were classified as underweight, normal weight, overweight and obese. Percentile and frequency distribution BMI for age boys ( $n=110$ ) was revealed that 44(35.6%) boys lay in normal weight (>5th and <85th), 20(30%) overweight (>85th and <95th) and 8(16%) were obese (>95th). Percentile distribution BMI for age girls ( $n=79$ ) was revealed that 57(64.4%) girls lay in normal weight (>5th and <85th), 18(25%) girls were overweight (>85th and <95th) and 10(13%) girls were obese (>95th).

### Anthropometric measurements of study participants

After two months, the post anthropometric measurements of study participants from two groups (control group and intervention group) were indicated that the mean age, height, and BMI was the same when compared with baseline data.

Table-4 demonstrated that no significant changes were observed in both groups (control group and intervention group).

### Overall Knowledge, Attitude and Practice (KAP) questionnaire score

Table no.3 Illustrated the overall mean knowledge, attitude and practice (KAP) questionnaire score of two groups (control and intervention group) before and after the intervention. After nutrition education intervention on fruits and vegetables (FV) consumption the mean knowledge, attitude and practice score of intervention group  $30.01\pm 6.54$  were higher as compared to mean knowledge, attitude and practice score of control group  $20.73\pm 5.25$ . The p-value of the intervention group ( $p=0.0001^{***}$ ) demonstrated a significant difference in mean score of nutrition knowledge, attitude and practice questions before and after nutrition education. The p-value of control group (0.83) indicated non-significant difference in mean score of nutrition knowledge, attitude and practice questions. The results revealed that school-based nutrition education intervention improved nutrition knowledge related to fruits and vegetables (FV) consumption.

**Table No. 1:** Baseline characteristics of study participants. (N=180)

VARIABLES	MEAN $\pm$ S.D	BOYS (n=101)	GIRLS (n=79)
Age (years)	9.00 $\pm$ 0.50	9.2 $\pm$ 0.59	9.4 $\pm$ 0.58
Weight (kg)	29.5 $\pm$ 2.8	30 $\pm$ 2.9	29 $\pm$ 2.5
Height (cm)	148.8 $\pm$ 2.7	149 $\pm$ 2.8	147.2 $\pm$ 1.7
BMI (kg/m <sup>2</sup> )	18.5 $\pm$ 22	19 $\pm$ 1.3	18 $\pm$ 1.3

**Table No. 2:** Percentile and frequency distribution of study participants (N=180)

BMI	Boys (n=101) f(%)	Girls (n=79) f(%)
Underweight (<5 <sup>th</sup> Percentile)	-	-
Normal weight (>5 <sup>th</sup> Percentile and <85 <sup>th</sup> Percentile)	44(35.6%)	57(64.4%)
Overweight (>85 <sup>th</sup> Percentile and <95 <sup>th</sup> Percentile)	20(30%)	18(25%)
Obese (>95 <sup>th</sup> Percentile)	8(16%)	10(13%)

**Table No. 3:** Overall knowledge, attitude and practice (KAP) questionnaire score (N=180)

VARIABLES	Control (n=90)			Intervention (n=90)		
	Pre-test	Post-test	P-value	Pre-test	Post-test	-value
Weight (kg)	29.6±2.6	29.6±2.6	0.27	30.1±2.88	30.1±2.88	0.34
Height (cm)	149.4±2.1	149.4±2.1	0.23	149.8±1.94	149.8±1.94	0.20
BMI (kg/m <sup>2</sup> )	20.3±2.3	20.3±2.3	0.13	19.0±2.2	19.0±2.2	0.10

\*\*\*highly significant

**Table No. 4:** Anthropometric measurements of study participants

Overall (KAP) score	Control Group			Intervention Group		
	Pre-test	Post-test	p-value	Pre-test	Post-test	p-value
	20.91±5.26	20.73±5.15	0.83	23.18±5.66	30.01±6.54	0.0001***

### Dietary Habits of study participants

Analysis of two months of food frequency revealed that there was an increase in the intake of certain fruits and vegetables (FV) after the delivery of nutrition education lectures. The percentage (%) of fruits and vegetables are illustrated in the following tables. Though there was an increase in the consumption of certain fruits and vegetables they were not statistically significant.

#### Fruits

In group2 (intervention) there was significant change observed in the consumption of fruits like banana (87.8%), apples (82.2%), strawberry (46.7%) and mango (77.8%) after nutrition education intervention.

#### Vegetables

In group2 (intervention) there was significant change observed in the consumption of vegetables like vegetable salad (55.6%), potato (86.7%) and cucumber (63.3%) after nutrition education intervention.

### Discussion

The baseline parameters of this study were age, weight, height and BMI. The results revealed that the mean age of the participants was around 7-10years (9.00±0.50), the weight was 29.5±2.8kg and mean height was 148.8±2.7cm. The body mass index (BMI) revealed that most students had normal weight 18.5±2.2. The BMI of the study sample was also plotted on BMI for age CDC growth charts. According to percentile and frequency distribution, out of total boys (N=110) 44(35.6%) had normal weight, 20(30%) were overweight and 8(16%) were obese. In girls (N=70) 57(64.4%) had normal weight, 18(25%) were overweight and 10 (13%) were obese. Contradicting to present study, a study was conducted in Pakistan to

measure the anthropometric measurements of children. The findings indicated that 5% children were obese and 14% were overweight (30). The possible reasons for overweight and obese children might be that, less physical activity, unhealthy eating patterns, peer group, media and socio-economic status. After two months of nutrition education intervention, post anthropometric measurements had indicated no change in the height, weight and BMI when compared with pre-test. The reasons may be short nutrition education intervention time that contributes to the no changes in anthropometric measurements observed in the study participants.

Overall school-based nutrition education intervention on fruits and vegetables consumption revealed significant changes on knowledge, attitude and practices in children of intervention group after nutrition education lectures as compared to control group. The mean score of correct answers on knowledge, attitude and practices (KAP) before nutrition education was less in both groups (control group 20.91±5.26, intervention group 23.18±5.66). In addition, the mean score of correct answers on knowledge, attitude and practices after nutrition education was high in intervention group (30.01±6.54). Wardle et al (2000) reported that nutrition knowledge is very important to change the behavior, attitude and practices related to food intake among school going children (31). The possible reasons to change in knowledge of intervention group related to fruits and vegetables consumption might be that they gain nutritional knowledge related to fruits and vegetables consumption from lectures which were delivered to intervention group and demonstration from each lecture. The possible reasons of no change in the nutritional knowledge of control group might be that, they receive no lecture and demonstration related to fruits and vegetables consumption.

Powers *et al.*, (2005) study has demonstrated the similar results that school-based nutrition education intervention improves the nutritional knowledge, attitude and behavior of children towards fruits and vegetables consumption in intervention group (32). Contrary to present study Neumark-Sztainer *et al.*, (2003) indicated that availability of fruits and vegetables at home increase the intake of fruits and vegetables (33). Contrary to present study results of Ramussen *et al.*, (2006) revealed that socio-economic position; preferences, parental intake and home availability all were influenced on fruits and vegetable intake (34). Contrary to present study Brug *et al.*, (2008) revealed that availability and opportunity related factors such as knowledge, self-efficacy, parental influence and accessibility of fruits and vegetables were linked with likelihood of fruits and vegetables in children (35). Dietary habits of study participants were also observed before and after nutrition education intervention via food frequency questionnaire.

Analysis of food frequency questionnaire showed that consumption of few fruits and vegetables like apple (82.2%), banana (87.8%), strawberry (46.7%), mango (77.8%), potato (86.7%), cucumber (63.3%) and vegetable salad (55.6%) increased with the passage of time which was no statistically significant. Results from McAleese and Rankin (2007) had demonstrated that school-based nutrition education intervention brings significant change in fruits ( $1.9 \pm 1.4$ ) and vegetables ( $2.6 \pm 1.7$ ) consumption which was rich in vitamin A, Vitamin C and fiber in intervention group children (36). The possible reasons of less consumption of certain kinds of fruits and vegetables explored after nutrition education lectures might be due to following reasons. Firstly, may be due to less availability of fruits and vegetables (FV) at home due to less parental nutritional knowledge or may be due to they can't afford to buy daily fruits and vegetables (FV). Secondly, may be due to their family eating patterns, food preferences, family rules, and family law and culture preferences. Thirdly, may be due to their parental occupational status. Fourthly, may be due to short time period of nutrition education intervention. There was no change observed in the consumption of fruits and vegetables (FV) in control group. The possible reasons might be that, they received no nutrition education lecture related

to importance and benefits of fruits and vegetables consumption, socio-economic status, educational level, poor dietary habits, peer group, family environment, diet related beliefs and attitudes, primary health care practices and availability. The current study demonstrated that school-based nutrition education intervention on fruits and vegetables (FV) consumption improved the knowledge, attitude and practices (KAP) regarding fruits and vegetables consumption in school going children. The limitations of present study are that short nutrition intervention time, parents and teachers were not involved, small sample size and small number of fruits and vegetables measured. For future studies parents must be involved, because home environment brings more change in children knowledge, attitude and behavior related to fruits and vegetables consumption.

### Conclusion

It was assumed that nutrition education lectures have a positive impact on the knowledge, attitude and practices related to fruits and vegetables consumption in school going children. Regarding that, in this study student's fruits and vegetables (FV) intake was lower than the recommended level, both before and after intervention, so an urgent attention should be given to the quality of students' nutrition. This requires future investment in educating parents and society as well as performing more investigations.

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### Disclaimer

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**Table No. 5:** Analysis of FFQ (fruits) from two groups (control and intervention group)

Fruit Group	Control group								Intervention group							
	Never or <than once/week (%)		2-4 per week (%)		5-6 per week (%)		>Once a day (%)		Never or <than once/week (%)		2-4 per week (%)		5-6 per week (%)		> Once a day (%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
<b>Banana</b>	13.5	14.4	11.2	11.1	1.1	1.1	74.1	73.3	10	6.7	12.2	5.6	0	0	77.8	87.8
<b>Apple</b>	14.4	14.4	7.8	8.9	8.9	8.9	68.9	67.7	16.7	3.3	23.3	6.7	2.2	7.8	57.8	82.2
<b>Peach</b>	27	26.7	18	17.7	21.3	20.6	33.7	34.5	32.2	24.4	16.7	17.8	15.6	27.8	25.5	30
<b>Watermelon</b>	27	24.4	10.1	6.7	17.9	7.8	45	51.1	17.8	12.2	15.5	17.7	23.3	31.1	43.3	38.9
<b>Mango</b>	10.1	12.2	14.6	17.8	15.8	13.4	59.5	56.6	11.1	6.7	14.4	4.4	23.3	11.1	51.1	77.8
<b>Strawberry</b>	22.5	26.7	11.2	13.4	20.2	17.7	46.1	42.2	15.6	12.2	18.9	17.8	36.7	23.3	28.8	46.7
<b>Pineapple</b>	55.1	55.6	11.2	14.4	15.7	11.1	18	18.9	36.7	35.6	11.1	10	26.7	30	25.5	24.4

**Table No. 6:** Analysis of FFQ (vegetables) from two groups (control and intervention group)

Vegetable Group	Control group								Intervention group							
	Never or than once/week (%)		2-4 per week (%)		5-6 per week (%)		>Once a day (%)		Never or <than once/week (%)		2-4 per week (%)		5-6 per week (%)		>Once a day (%)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Vegetables salad	28.1	30	12.3	12.2	11.3	12.2	12.3	12.2	31.1	<b>25.6</b>	14.4	14.5	11.1	4.4	43.3	<b>55.6</b>
Spinach <i>bhujia</i>	34.8	35.6	17.9	11.1	12.4	12.2	17.9	11.1	36.7	<b>20</b>	12.2	<b>18.9</b>	10	21.1	41.1	40
Potato	29.2	27.8	13.5	13.4	10.1	10	13.5	13.4	18.9	<b>4.4</b>	11.1	3.3	13.3	5.5	56.7	<b>86.7</b>
Cucumber	31.5	32.2	13.5	13.3	9	8.8	13.5	13.3	17.8	13.3	8.9	6.7	18.9	16.6	54.5	<b>63.3</b>
Ladyfinger <i>bhujia</i>	37.1	37.8	11.2	11.2	18	17.7	11.2	11.2	35.6	<b>16.7</b>	12.2	23.3	22.2	20	30	40
Loki <i>bhujia</i>	60.7	66.7	11.2	10	14.6	11.1	11.2	10	50	<b>21.1</b>	12.2	<b>33.3</b>	12.2	18.8	25.6	26.7
Brinjal <i>bhujia</i>	57.3	16.1	6.7	5.5	18	11.2	6.7	5.5	46.7	35.6	15.6	20	12.2	18.9	25.6	25.6

### Conflict of interest

No conflicts of interest.

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