WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 1, 1640-1650. Research Article ISSN 2277– 7105

AN INTERVENTIONAL STUDY ON PREVALENCE OF FOOD ADULTERANTS AND IMPARTING AWARENESS OF ITS HEALTH IMPACT TO RURAL POPULATION IN FIELD PRACTICE AREA OF MYSORE MEDICAL COLLEGE, MYSORE

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Article Received on
21 Nov. 2020,

Revised on 11 Dec. 2020,
Accepted on 31 Dec. 2020

DOI: 10.20959/wjpr20211-19578

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ABSTRACT

Background: Food consumed could be adulterated with a variety of adulterants. This study was conducted in Hosakote taluk of Karnataka, where the high school children were given questionnaires to obtain information about their knowledge, attitudes and practices regarding food safety and food adulteration. Food samples were brought by the children which were tested using the food adulteration kit and results were reported. Awareness was created regarding harmful effects of adulteration and simple way of detecting them at home. **Methods:** Total of 112 students was given questionnaires. 50 students brought food samples from households, which were tested by the food adulteration kit by CFTRI, Mysore. Information pamphlets were printed in English and in regional language and circulated among children to create awareness among students and their family. **Results:** 32% students were found to be underweight, 64% normal, 4% in the overweight and obese. 78% of students were aware of the existence of food adulteration. 95% of the above thought it was harmful but did not know about simple home detection methods. 24% samples brought by students were found adulterated. Commonly adulteration was seen in milk where water was mixed. Second was rice being adulterated with sand, twigs and husk and excessive food coloring seen in few samples of savouries. **Conclusion:** Though students are aware about the practice of food adulteration, most of them lack practical knowledge on how to detect and avoid it. Children should be made aware of the ill- effects of excessive food coloring and harmful

additives and guided towards making safer food choices.

KEYWORDS: Adulteration, Awareness, Children, additives.

INTRODUCTION

The persistent rapid increase in human population leads to the global surge in demand for food resources, and it will continue undiminished for at least for next few more decades. These requirements and competition for resources, whereby world's population estimates are in the region of around 8 billion, will affect the world's ability to produce enough food, leading to concerns over future food security. Shortage of potable and irrigation water, fossil fuels, climate change, other potential issues which includes the threat of deliberate contamination of the food or water supply by biotracing of harmful pathogens in food chains also exists in addition to continued concerns regarding quality, authenticity and adulteration, challenge which will doubtless increase concurrent with population pressures.

According to the Food and Safety Standards Authority of India (FSSAI), the technical definition of food adulteration is: "The addition or subtraction of any substance to or from food, so that the natural composition and quality of food material is affected". Food adulteration can be intentional when done to add volume, texture; taste or stability to the items or it can be due to carelessness or poor maintenance of the facility/logistics on the part of the food manufacturer/ distributor. It is the social evil practiced to increase the quantity or to replace the quality ingredients to make a profit. Various detection techniques on adulteration include electrochemical detection, electronic noses and tongues, ultrasound, Nano sensors, thin film sensors, nanoparticle detection systems, and well- established techniques such as DNA detection and protein quantification via ELISA. These techniques allow us to measure, monitor and analyze food systems at all stages from farm to fork.

An adverse consequence of food adulteration is more severe especially in rural areas mainly due to lack of awareness. Food adulteration can be a potential source of health hazards and can cause severe long-term damage to human health. Chemicals like formalin are applied on fish, fruit, meat and milk that causes different types of cancers, asthma and skin diseases.[1,2]

Similarly, harmful colouring dyes, calcium carbide, urea, etc., are also added in order to make the food attractive. Some of the permitted preservatives are being used in excess of permissible limits. They can affect multiple organs of human body causing cancer like colon,

peptic ulcer diseases, and chronic liver diseases including cirrhosis and liver failure, electrolyte imbalance and eventually kidney failure.[3] Moreover, heart diseases, blood disorders, and bone marrow abnormality are also linked to specific adulterants. The exposure to food adulterants leads to increase in chances of malignancy and neurological impairment or brain functions. Several skin problems are reported which are associated with food adulteration.[4]

According to FSSAI, predominantly common adulterated foods include milk and dairy products, edible oils, cereals, *atta*, condiments, coffee, tea, pulses, confectionery, vinegar, *besan*, curry powders, spices, etc. Food safety is a major problem with rampant instances of adulteration and contamination of essential foods.

To estimate the types and burden of food adulteration in the study area, using Adulteration Detection kit, developed at CSIR-Central Food Technological Research Institute, Mysore and to document the anthropometry of the study population.

OBJECTIVE

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METHODS

This was an analytical cross selection study conducted in rural field area of government medical college, Mysore, Hoskote taluk for the period of 2 months. In collaboration with CSIR- Central food technology research institute, Mysore. We included the families through high school children in the study area. All high school children and teachers of study area as per the proposal 350 participating high school students were expected from classes 6^{th}, 7^{th}, 8^{th}, 9^{th} and 10^{th}, However, later it was learnt that the 2 government school of hoskote taluk did not accommodate students of classes 9^{th} and 10^{th}. Therefore all students of classes 6^{th}, 7th, 8^{th} were considered for study coming to a total of 112. Among the attending students of above mentioned classes no exclusions were made. Permission was obtained from block education officer and block resource coordinator for school visits in the study area.

School visit was done for appraisal and sensitization of teachers and students about food adulteration and study of conception pattern of population for selection of common foods

towards the evolution towards the evaluation of adulterants. This was done with help of questionnaires which were prepared in English and in local language. Questionnaires were filled by students to acquire knowledge about prevailing knowledge, attitude, and practice of rural population regarding food adulteration. Information regarding per-capita income, buying practice and commonly consumed food, the recent history of food born illness in the house hold was also obtained from the questionnaire. Heights and weights of students were recorded using measuring tape and weighing machine.

Again the school was visited for collection of identified commonly consumed food samples brought by the students (the adulteration kid developed at the keep of food safety and analytical quality control laboratory , CSIR- CFTRI, Mysore was used to find adulterants in food such as milk, spices, cereals, oils and snacks by using simple protocol given in the manual). Particularly two methods were adopted for testing adulteration such as physical/ manual and chemical methods. Physical method which includes adulteration of Bengal gram dal (semicircular shaped) with kesari dal (wedged shaped) and adulteration of mustared seeds (smooth surface with yellow core when pressed) with argemone seeds (rough grainy surface and white core when pressed) Checking for added exclusive artificial color shacking seeds like mustard in water and observing the color in the water (chemical method was adopted using the adulteration kit developed). In order to educate and discuss the findings of ill effects adulterants on health school was revisited. Handouts in regional language with pictorial demonstration were distributed to create lasting awareness among wider population in community. Students and teachers were given pamphlets on simple tests to detect adulteration in common food, which was demonstrated earlier. The kits were given to school authorities for any future use or demonstration. The students gave us their feedback and it was encouraging to see the interest and enthusiasm they expressed towards gaining knowledge about food adulteration.

RESULTS

Totally 112 students were involved in the survey whereas 53% were female and 47% were male aged between 11 and 13 studying in class 6^{th}, 7^{th} and 8^{th}. All the attending students of above mentioned classes participated in the study. There was no exclusion.

Tables below describes the height for age, weight for age, weight for height (BMI) of the participated students.

Table 1: Statistical findings of heights recorded for age.

Age (in years)	Maximum Height (in cms)	Minimum Height (in cms)	Average Height (in cms)	Median Height (in cms)
11-12	145	136	140	139
12-13	156	133	143.4	146
13-14	162	128	145	144

Table 2: Statistical findings of weights recorded for age.

Age (in years)	Maximum Weight (in kgs)	Minimum Weight (in kgs)	Average Weight (in kgs)	Median Weight (in kgs)
11-12	36.3	23.2	31.9	36.3
12-13	44.5	23.2	32.6	32.2
13-14	76.5	25.6	35.5	33.6

On plotting the calculated BMI of the students on the CDC growth charts, separately for age and sex, and using the table provided to assess their weight status category.

Table 3: Weight category with percentile range based on CDC BMI for age chart.

Weight status category	Percentile range
Underweight	Less than the 5th percentile
Normal or Healthy Weight	5th percentile to less than the 85th percentile
Overweight	85th to less than the 95thpercentile
Obese	Equal to or greater than the 95th percentile

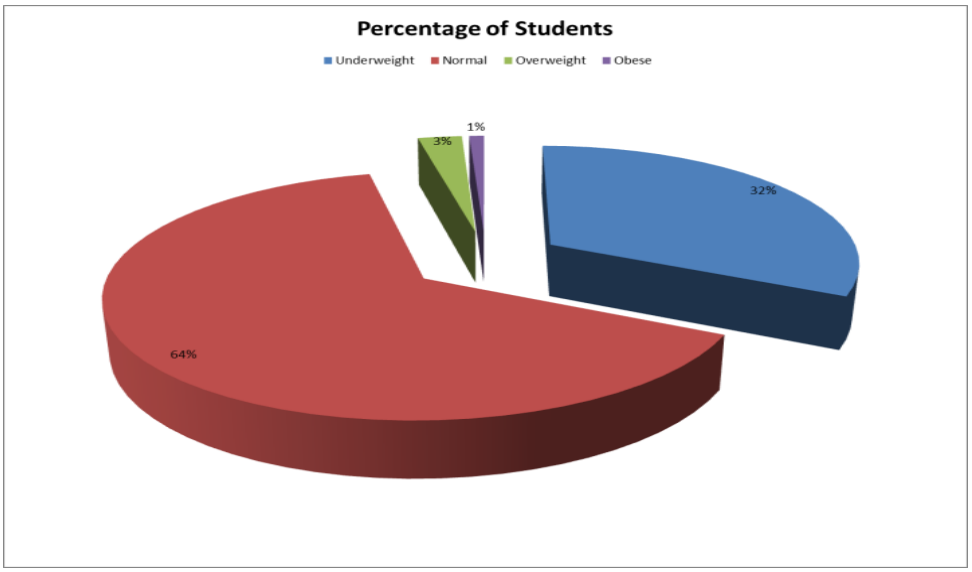
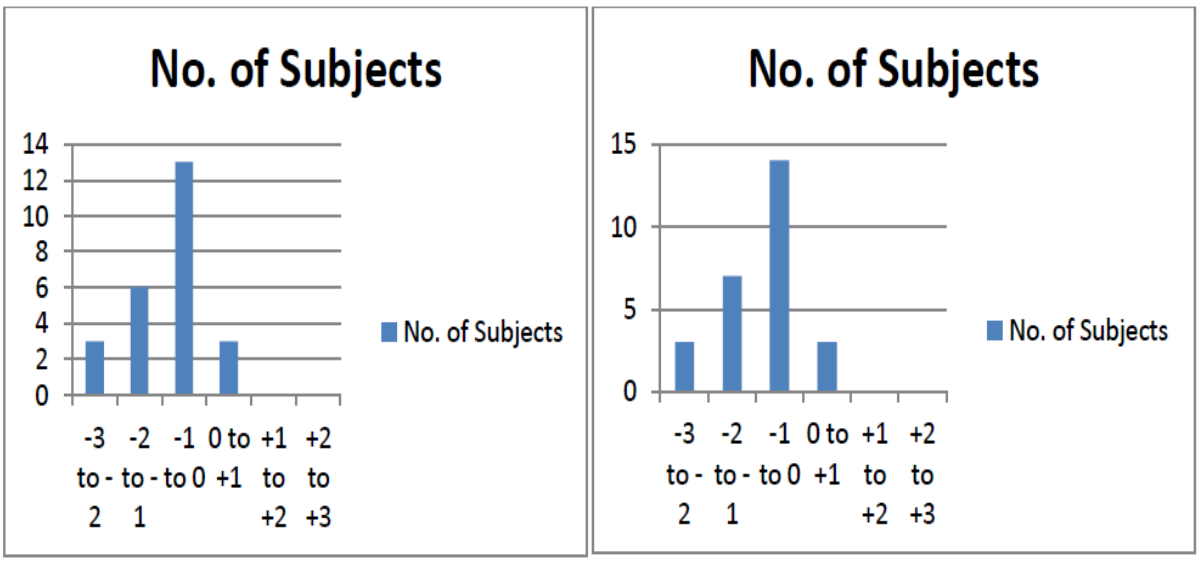


Fig. 1: Pie chart on weight status category of students based on CDC- BMI for age chart.

Based on WHO growth charts the Z score (S.D) of recorded heights separately for age and sex is plotted below Figure 2: Bar graph of standard deviation of recorded heights of females and males between 11-12 years based on WHO growth charts.



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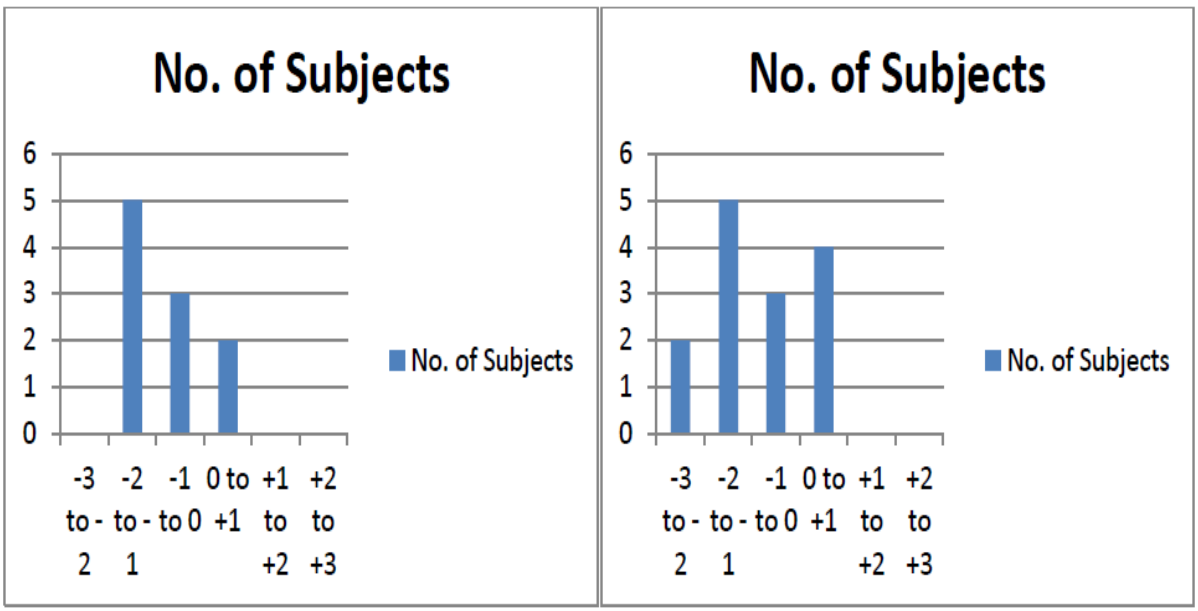

Figure 3: Bar graph of standard deviation of recorded heights of females and males between 12-13 years based on WHO growth charts.

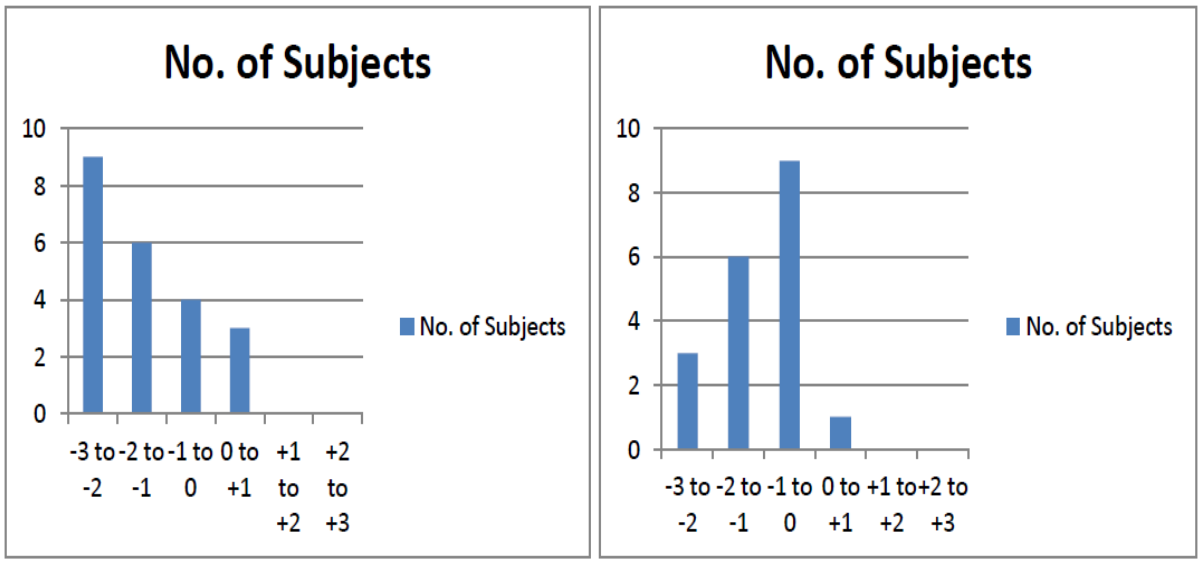

Figure 4: Bar graph of standard deviation of recorded heights of females and males between 13-14 years based on WHO growth charts.

Table 4: Describes the parents' occupation. Approximate family income ranged between Rs.10, 000 and Rs.12, 000 per month. The Per Capita Incomes average PCI recorded was Rs.2021.6 per month.

Sl. No.	Occupation of head of the family	Percentage of parents
1.	Professional	0%
2.	Semi professional	0%
3.	Clerical or shop owner	18.5%
4.	Skilled worker	12.8%
5.	Semi skilled worker	30.2%
6.	Unskilled worker	38.5%
7.	unemployed	0%

Most students consumed at least 1 glass of milk on a daily basis. 55% of students consumed at least 1 egg per week. All families bought their groceries from Local Grocers. 78% of students were aware of the existence of food adulteration where 95% of the above thought it was harmful. The probable reasons for food adulteration were to reduce cost, increase durability of food, make food taste and look better. Most commonly adulterated food items are Milk, Dal and Oil. Only 2% of the students felt that if food smelled and looked fine, it is always safe to eat. 9 cases with fever, 2 cases with vomiting and loose motion and 3 cases with Dengue problems were reported in the families of the surveyed students in the past 2 months. When asked whether food safety was taught at school, 97% answered in affirmative.

Totally 50 samples were brought by the children were tested qualitatively using the food adulteration kit for presence of food adulterants. Out of which 12 samples were found to be adulterated. Most of the adulteration was seen in milk where water was mixed. Coming second was rice being adulterated with sand, twigs and husk followed by excessive food coloring seen in few samples of savouries.

Table 5: Result of adulteration detection tests performed on food samples brought by participating students.

Food sample	Number of samples brought	Unadulterated	Adulterated	Adulterant found
Milk	11	6	5	Water, cane sugar
Edible oil	4	4	0	none
Ghee	4	3	1	vanaspati
Namkeen Mixture (savouries)	6	4	2	Excessive food colouring-metanil yellow
Spices-chilly powder	5	5	0	none
Rice	12	9	3	sand, twigs, husk, grit
Dal	8	8	0	none

DISCUSSIONS

68.8 % of Indian population lives in rural areas (Census of India 2011 report). We tried to survey families of one such village through the high school students attending either of the two government schools in the area. The village had a total population of 8743. Around 2000 families resided in the village. 53% of the school students interviewed were female, which was unforeseen in our expectations. It was delighting to know that the villagers did not discriminate between the genders and paid importance to female education and literacy.

Children belonging to the age group 11,12 and 13 years were interviewed and their heights and weights were recorded as part of the study. On plotting the heights on WHO growth charts 2007 to obtain the z scores, it was found that in the age group of 11-12 years, most of the girls and boys fell under the standard deviation of 0 to -1. In the age group of 12-13 years, most of the children's heights had a standard deviation of -1 to -2 while in the age group of 13-14 years, most of the girl's heights were of the standard deviation -2 to -3 signifying severe stunting, while the boy's heights were in the range of 0 to -1 standard deviation in this age group.

This indicates that with the increase in age, there was downward (negative) deviation of heights from normal. This was more marked in females, signaling towards the increased nutritional demands of growth and puberty not being met adequately.

On calculating the BMIs of all the students and plotting them on the CDC charts of BMI for age separately for boys and girls, one third of the subjects were found to be underweight, which further goes in the direction of inadequate nutrition. Only 4% of students belonged to the category of overweight and obese, indicating that the other spectrum of malnutrition was not much of a problem.

In this village, more than two third of the parents of the students attending school were unskilled and semiskilled workers, while the rest were skilled or clerical in occupation. No professional workers were recorded. The average calculated per capita monthly income was Rs 2021.6. Most families belonged to middle class or lower middle class according to Revised Modified BG Prasad socioeconomic classification scale, 2016 for rural population[5] Household tap in almost all households signifies good living conditions and indicates a good status of hygiene and sanitation.

Handful cases of vomiting, loose stools and fever were observed in the family members of participating students, which may or may not be food or water borne. 3 cases of dengue were recorded in the past 2 months from the participating families which could be due to unawareness about the preventive measures.

Most of the groceries are bought from local vendors and grocers which mostly sells loose and unbranded goods. The number of students aware about practices of food adulteration and their reasons has surpassed our expectations.

Most of the children agreed that food which looked attractive need not be safe for consumption but were not aware how to confirm it. This could be because a topic of food safety and nutrition is being taught to them as a part of their school curriculum but practical hands-on knowledge is not available. Students were enthusiastic throughout the study and of the opinion that they got a lot of new information through this exercise.

In the exercise of detection of adulterants among the commonly consumed foods by the villagers, students took interest and brought some samples which we tested using simple tests and taught the children some physical tests of detecting adulteration at home.

Many samples of milk were found to be adulterated with water, which could be one of the causes for rampant reduction in heights and BMIs of children from expected.

In the tests performed by us, samples of oil, dal etc was found to be unadulterated which shows a good level or awareness among the village dwellers and honesty on part of local vendors. Excessive food coloring was found in some samples of namkeen mixtures which could have effects on health in the long run and children were made aware of them.

CONCLUSION

At the end of this study it can be concluded that the physical growth of children in the rural setting of the study site is not up to the expected level for children of their age group. Significant levels of stunting and malnutrition are seen and this should be tackled by diet supplementation and nutritional awareness.

Most children are aware about the practice of food adulteration but unaware of some simple methods to detect it themselves. Adequate practical knowledge should be included in school curriculum so children are spared from the evils of food adulteration. Since food coloring was detected in food samples favorite to children, they should be made aware of its ill effects and guided towards making healthier choices to safer and unadulterated foods.

We should work towards making and propagating simple food adulteration home kits which should be commonly available in households, both urban and rural for frequent use. More research should be directed towards advanced scientific adulteration detection methods like electrochemical detection, electronic noses and tongues, ultrasound, Nano sensors, thin film sensors and nanoparticle detection systems. This is significant because it is easier to tackle the evils of food adulteration and its health effects when detected at an early stage and by intervening at grassroots levels.

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