

Accepted : September, 2010

Food adulteration and practices in urban area of Varanasi

ANITA SINGH, SHUCHI RAI BHATT AND SHEENDRA M. BHATT

ABSTRACT

Currently food malpractices are increasing in various metro cities of India and all the measures taken by agencies are failed to detect rapidly and many times it becomes late when the adulteration is detected. Most bad scenario is the adulteration of the branded items of the children's and in the women such as milk cheese, ghee and oils. Therefore, Study for food practices and safety measures was done in selected area of Varanasi which was also validated by the wetlab methods. For this objective, questionnaire was prepared and distributed among the selected people depending on their age group, sex and educational background. Statistical tests were carried out on the basis of frequency of male and female respondents obtained in total respondents (N = 300). Chi square test was carried out and the calculated values were compared with value of t test (0.05) and on this basis, conclusions were drawn. Result showed that regardless of the age, income and religion, all of the groups were well aware of the food adulteration and educated people were less prone to the effect. In term of adulteration any how all the stores contained adulterated food, however branded items contained less %age of adulteration than local items. This may be caused due to inactive agencies or longer process of legal system. Studies show that there was lag in following the food practices by all the ages beside having good knowledge of food practices.

Key words : Food choice, Food adulteration, Food practices

INTRODUCTION

Now a days several reports were accounted in various food items such as milk, spices, ghee oil. Adulteration in food is normally present in its most crude form, prohibited substances are either added or partly or wholly substituted. In India normally the contamination/adulteration in food is done either for financial gain or due to carelessness and lack in proper hygienic condition of processing, storing, transportation and marketing. This ultimately results that the consumer is either cheated or often become victim of diseases. Such types of adulteration are quite common in developing countries or backward countries. However, adequate precautions taken by the consumer at the time of purchase of such produce can make him alert to avoid procurement of such food (Agmark, India). It is equally important for the consumer to know the common adulterants and their effect on health.

Adulteration most often includes artificial colours, sand, marble chips, stones, mud, other filthy material talc, chalk powder, water, mineral oil, vegetable oil, argemone

seeds etc. There are various techniques to detect the adulterants such as chemical method or with help of sensitive instruments such as lactometer.

Generally food security for the urban people is closely related to many factors like their age, religion, marital status, economical status (purchasing power, knowledge of food items brands, food items bought from retailer, stockiest, local market, or from supermarket. These and all other factors like scarcity of clean water for cooking, drinking, washing, lack of hygienic aspects, due to lack of awareness and improper sanitation in food preparation has great impact on health. Beside this, bad practices, poor hygiene environments and lack of awareness lead to spread of various communicable diseases via the food system.

According to Howes *et al.* (1996), attitude, is also an important factor besides knowledge in following good practices. Howes *et al.* (1996) and Powell *et al.* (1997) have indicated that although training may bring about an increased knowledge of food safety; this does not always

result in a positive change in food handling behaviour. It has been suggested that this disparity between knowledge and practice occurs because of lack of attitude. Recently KAP model was designed (Rennie, 1995) which assumes that an individual's behaviour or practice (P) is dependent on their knowledge (K) and suggested that the mere provision of proper information may lead to a change in attitude (A) and consequently a change in the practices. It has been suggested that this model has flaw in its assumption that knowledge is the main precursor to behavioral change (Ehiri *et al.*, 1997). According to Nidhi and Priti (2009), education, family income and occupation are other major factors that effect extent of awareness and overall education shows highest impact.

In term of socio-economic impact, Turrell (1998) reported that there is approximately 10% of the socio-economic variability in healthy food purchasing behaviour. This may be due to reporting bias, differential exposure to healthy food as a consequence of the variable impact of health promotion campaigns, structural and economic barriers to the procurement of these foods and subculturally specific beliefs, values, meanings, etc. sometimes other barriers also operate such as cost and quality of food items for purchasing healthy foods at the shops (Mead *et al.*, 2010).

The present study was planned to find out food adulteration practices followed and awareness against food adulteration for people of different ages, religion, economic status, marital status and by homemakers and overall impact in improving food quality in Varanasi city of Uttar Pradesh (urban area) since there are increasing reports of food adulteration in the news for various food items in Uttar Pradesh; not only in local food items but also in branded items. Therefore, factors affecting purchasing decisions like their religion culture (Makela, 2000) and the perception about food quality may reduce the malpractices of food adulteration.

Culture offers beliefs, customs, and knowledge, as well as a sense of identity, order, and security. It defines social structure, decision-making practices, and communication styles. Transmitted formally and informally from one generation to the next, culture dictates behavior, etiquette, and protocol. Therefore its effect can't be neglected.

Objective of the study:

– Extent of awareness of food adulteration in various items including spices (coriander red chilli etc) and milk items such as ghee and oil either through TV or other sources and strategies to identify them and their validation.

– Their overall impact on health

MATERIALS AND METHODS

Research design:

Survey method was used in the present study with a structured type questionnaire (by the schedule cum interview method) as the data collecting instrument. A stratified sampling was done from May 2007 to June 2008 on food adulteration, safety knowledge and practices of urban consumers in Varanasi district of Uttar Pradesh. Before finalizing the questionnaire, the questionnaire was pilot tested on 30 participants (10% of 300 respondents) and minor modifications were made to the questions. A pilot or preliminary samples were generally drawn from the population and the statistics computed from this sample were used in determination of the sample size.

The revised questionnaire was divided into following sections: Personal information of respondent's, specific knowledge of respondents about materials of different commodities, knowledge of consumer rights regarding food adulteration. The sampling included 160 female and 140 male respondents. Respondents were basically from household related to kitchen activity. Each questionnaire took 50 min to administer. Data were collected on weekends and weekday afternoons when a member of the particular target group would most likely be at home. Answers were graded by giving the tick mark on schedule for the right answers.

Age group selected for study were 18-25, 26-35, 36-45 and >46 including both M and F respondents while education background were selected from below matric to graduate. For buying practices tendency data were collected for food items selection from retailer, stockiest, local market, or from supermarket. While for kitchen practices, various food items were selected for study such as cereal, pulses (arahar dal) oil, ghee and items used in spices such as coriander, red chilli and their overall impact on the health.

Data analysis:

Based on literature survey, a list of relevant variables was prepared. A questionnaire were prepared to capture the relevant variables, which was initially pre-tested data were collected from 300 respondents in Varanasi, Uttar Pradesh. The data obtained were fed in the master chart and then analysis was done with the help of Excel add-in statistic solver and XL stat 9.0. XLSTAT 9.0 software (XLSTAT Version 2009 Addinsoft USA 1995-2009). Mean responses SD, and percentages of responses in each category were calculated and presented in a tabular form. Pearson chi square was used in the evaluation of the

hypothesis. The data were then analyzed by chi square test and student t-test. On the basis of the response, the observed and expected frequency were calculated for chi-square value and on the basis of degree of freedom in row and column, t 0.05 value was compared for decision of Null hypothesis and impact of age and education on buying practices, water quality practices and their impact on health was determined. Cronbach alpha coefficient of internal consistency was used to estimate the reliability of the questionnaire. Alpha coefficients of 0.76 are considered to be acceptable. Finally validation of the result was done by the testing various food materials collected from three selected regions in the laboratory by physical and chemical methods.

Validation of results :

Laboratory test results of food material collected from different sample were tested by method suggested by agmark India. All sample testings were done by researcher in Biotechnology Department Sri Agrasen K. P. G. College, Bulanala, Varanai and every sample was taken from three different area-Orderly Bbazaar, Sigra and Lanka and testing was done in triplicate

Observation:

Observation are shown in Tables 1-4 and food adulteration and food buying practices are shown in Fig. 1-10.

RESULTS AND DISCUSSION

The findings of the present study have been discussed in the following sub heads :

Demographic profile and socio-economic status of respondents:

For data collection respondents of different age group

were selected ranging from 16 years to 56 years. Data in Table 1 shows that majority of the age group (35%) involved in study as age range 26—35 (one third) while people of age range >35 are 21% while age range from 16-25 and >56 are in equal percentage 23%. Statistically data are insignificant (p>0.05). It may be due to tradition pattern in the family which follows to occur in joint family. But in nuclear family this trends breaks and thus age may vary. Mean and SD calculated for male and female was 28±17.3 and 32± 16 while total man and SD was 60±32.6. Mean difference between male and female is not much different. Statistically observed chi (χ^2) for both male (3.2) and female (2.8) respondents are less than expected (DF4 χ^2 , 9.48) on the basis null hypothesis is accepted which proves the hypothesis that majority of population in urban area is young.

Data reveals that young female (16-35) populations are about 59 % while, middle aged women are 35-45 are 19%, while other represent only minor percentage (17, and 4.5% respectively). Young Male population makes major contributions in buying the food from market (Williams *et al.*, 1992). In over 90% of households in India, it is the women who are involved in the preparation of meals (NIN, 2006). Earlier studies conducted on adults have indicated that food safety knowledge tends to increase with age and practice: (Bruhn and Schutz, 1999; Unusan, 2007).

Data collected to know educational status of respondents are ranging from illiterate to post graduate in the joint and nuclear family. Data in Table 2 show that majority of the educated people (44%) were graduate out of which male were approx 48% and female 40%. Percentages of post graduate and intermediate were low (almost similar 13-14% in both male and female).

Percentage of High School educated female were higher (26.2%) than male (18.5%) while illiterate were only 6-7%. Statistically data were insignificant (p>0.05).

Table 1: Age group of respondents

Sr. No.	Age group	Respondents				Total	
		Male		Female		(N)	(%)
		(N)	(%)	(N)	(%)		
1.	16-25	26	18.5	44	27.50	70	23.3
2.	26-35	55	39.2	50	31.25	105	35.0
3.	36-45	32	22.8	31	19.37	63	21.0
4.	46-55	18	12.8	28	17.43	46	15.3
5.	56 and more	9	6.4	7	4.375	16	5.3
Total		140	100	160	100	300	100
Mean ±SD		28 ± 17.3		32 ± 16		60 ± 32.6	
χ^2 (Observed)		3.2		2.8		6.0	

DF 4 P**>0.05(0.199) NS

Table 2 : Educational status of respondents

Sr. No.	Educational status	Respondents				Total	
		Male		Female		(N)	(%)
		(N)	(%)	(N)	(%)		
1.	Illiterate	8	5.7	11	6.8	19	6.3
2.	> High school	26	18.5	42	26.2	68	22.6
3.	Intermediate	20	14.3	21	13.1	41	13.6
4.	Graduate	67	47.8	64	40.0	131	43.6
5.	Post graduate	19	13.5	22	13.7	41	13.6
Total		140	100	160	100	300	100
Mean \pm SD		28 \pm 22.7		32 \pm 21		60 \pm 43.3	
χ^2 (Observed)		1.724		1.508		3.232	

DF 4 P***>0.05(0.52) NS

It means that food practices are still can't be linked with literacy means beside education in both male and female population they still are not following the required food practices.

Mean differences were almost very less (4 \pm 1.5) which shows almost both men and women are equally educated and at least 47% male and 40% male have better education up to graduate level. Illiterate population was very low (8-11% only) P>0.05 which may be due to other factor such as income, and family structure. Statistically observed chi (χ^2) for both male (1.724) and female (1.508) respondents were less than expected (DF4 χ^2 , 9.48) on the basis Null hypothesis is accepted that majority of the female are educated.

In one study it was found that well-educated people are generally belong to high income group (Neuman 1994, Subba Rao, 2007; Sudershan, 2008). In many societies women are more informed about appropriate methods of food handling and storage than men. Better educated consumers often recognize the importance of food safety and younger respondents have shown the greatest need for additional education on food safety (Bruhn and Schutz, 1999; Sudershan *et al.*, 2007). Baker (2003) found that women, having higher education level and members of households with young children were the most likely to have an extreme risk avoidance response. Food

mishandling is thought to be more acute for young adult men and individuals with an educational level beyond high school than other groups (Altekruse *et al.*, 1999). It was observed that women, more so those with higher educational levels, were more likely to check food labels than men (FSAI, 2003; Yang *et al.*, 2000).

In a previous study of the food-handling practices and food safety knowledge of 4th- and 5th-grade students in west-central Illinois, a need for education in safe food handling in the primary grades was identified (Barclay *et al.*, 2001).

The data of family structure have been depicted in Table 3. Data shows majority of the people in urban population of Varanasi (75%) belonged to nuclear family out of which male were approx. 81% and female 70%. Percentage of joint family was low (only 25% out of which 18% male and 30% female). Statistically data were found to be significant (p<0.05) with good mean difference of 10. This means that type of family structure has significant effect over food practices. It is expected that joint family has lesser option of good food practices and thus nuclear family has significant contribution in following good food practices. It is understood that bigger family run by customs and often health factors are omitted because of making budget to make food available for all the family members. Also, in bigger family often less people are linked with

Table 3: Mode of family respondents

Sr. No.	Mode of family	Respondents				Total	
		Male		Female		(N)	(%)
		(N)	(%)	(N)	(%)		
1.	Nuclear	114	81.4	112	70.0	226	75.3
2.	Joint	26	18.5	48	30.0	74	24.6
Total		140	100	160	100	300	100
Mean \pm SD		70 \pm 62.2		80 \pm 45.2		150 \pm 170.4	
χ^2 (Observed)		2.799		2.449		5.248	

DF 1 P***<0.05(0.022)

Table 4: Economical status of family respondents

Sr. No.	Economical status	Respondents				Total	
		Male		Female		(N)	(%)
		(N)	(%)	(N)	(%)		
1.	LIG (<1000)	7	5.0	21	13.1	28	9.3
2.	MIG (1000-3000)	89	63.5	121	75.6	210	70.0
3.	HIG (>3000)	44	31.4	18	11.2	62	20.6
Total		140	100	160	100	300	100
Mean ±SD		46 ± 41		53 ± 58.6		100 ± 96.6	
χ^2 (Observed)		11.489		10.053		21.542	

earning most of the children and females are dependent on earning members for their other needs.

Statistically observed chi (χ^2) for both male (2.799) and female (2.449) respondents were less than expected (DF1 χ^2 , 3.84) while total observed value were greater than expected on the basis Null hypothesis is rejected that food practices changes with family structure. It can be evident from next discussion about economical status of the family.

Economical status of family is presented in Table 4. Economical background were classified as LIG (income <1000 pm) MIG (100-3000 pm) while income more than >3,000 pm were classified as HIG. Data show that majority of the people belonged to MIG (70%) out of which male were approx. 64% and female 76%. Percentage of HIG came next (20% out of which 31% male and 11% female). Statistically data were found to be highly significant ($p < 0.05$). It means pattern of food practices was highly linked with family income. It is obvious since branded items are costly due to following many food standards and norms. Also income helps in managing the food item properly and according to individual need of different family members due to various household facilities. Income is also linked with education. More educated will be people will hope to learn and follow the good food practices as is shown previously by chi χ^2 value ($3.2 < 9.48$ df 4).

Statistically observed chi (χ^2) for both male (11.489) and female (10.053) respondents are more than expected (DF2 χ^2 , 5.99) while total observed value (21.542) are also greater than expected on the basis Null hypothesis is rejected that income have indirect effect over following good food practices.

According to Zugarramurdi (2003), people are increasingly concerned about nutrition, food safety at a reasonable cost. According to Nidhi and Priti (2009), education, family income and occupation are major factors that effect extent of awareness but overall education has highest impact. Hamilton (2009) concluded that there are connections between the poverty narrative and the family decision making individual control in purchasing and

budgeting decisions.

Studies of adulteration in different food commodities: Cereals:

Studies was done to know about the cereal choice of people and the adulterants observed by them. Data in Fig. 1, show that majority of the people (57%) found all type

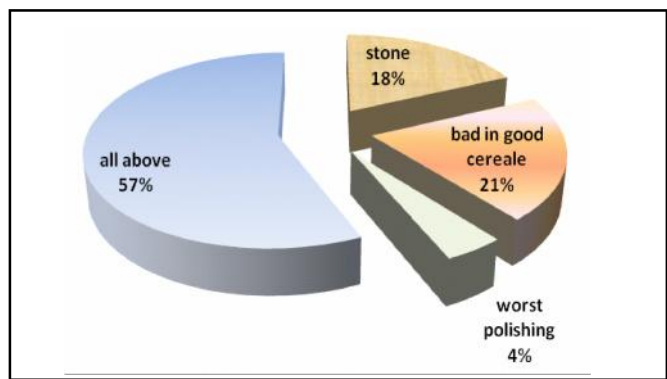


Fig. 1: Cereal adulterants

of adulterations in cereals out of which male were approx. 51% and female 61%. While 21% felt that there was inferior quality cereals mixed with good one while 18% of all found that there was stone in cereals (23% male and 14% female). Only 4-5% reported about worst polishing of cereals.

Statistically data were found to be moderately insignificant ($p > 0.05$) which may be due to difference in buying practices of people due to various factors such as income, age and family structure as has been discussed earlier. Observed chi (χ^2) for both male respondents (2.947) and female (2.947) and total observed value (5.525) (DF3 χ^2 , 7.8) reveals that hypothesis is accepted that majority of the cereals available in the market are fortified with all types of adulteration which has direct linked with people's health. Data also revealed that though people want good quality food products but they are not getting it due to malpractice done by the product sellers. It also reflects that government people are not performing

checking operations or people have not taken any step to check them and thus though they are well aware of the malpractices but they had learned to live with such vicious menace to human being.

Similar observation has been made by Neelkanta and Anand (1992) which commented sadly that people prefer to absorb and endure the wrong done to them rather than fight against injustice. This is because consumers do not know the ways and means of facing them confidently. In this regard other survey was conducted related to method of their identification of adulteration regarding cereals. In another word, it may be due to variation in buying practices which is effected by various factors like income, age, education and availability. Since, buying practices involves the determination by market agencies of kind, qualities and quantities of goods, desired by consumer. Buyer has to find out the desired qualities of goods sold at satisfactory prices. Effective buying requires a specialized knowledge of content of goods, their resources and their use (Kotler, 1990).

Our survey result show that majority of the people (95%) detected adulterations in cereals by seeing external feature of cereals out of which male are approx. 98% and female were 91%. While rest detect cereal adulteration after cooking (3%) or during washing of cereals just before cooking (1.3%). other only 1% was unable to detect adulteration. Statistically data were found to be moderately significant (<0.05). It means that without going to much test people can identify the presence of adulterants in cereals on the basis of external features. It also means that identification behaviour is similar in most of the people without involving other factors such as age, education, mode of family structure, or religion.

Statistically observed chi (χ^2) for both male respondents (4.645) and female (4.064) respondents were less than expected (DF3 χ^2 , 7.8) which means that adulteration have direct effect over health and food practices. It is also evident by χ^2 , total observed value (8.70) which was greater than expected (on the basis Null hypothesis, rejected) that people can't detect adulteration in cereals. People actually know about adulteration practices, but they are not directly responsible for the cause.

Malpractices like adulteration, short weights and measures, high prices, false and deceitful advertisement and packaging are pervading the market even when government of India claim to have passed maximum legal laws protecting consumers than any other country in the world. Though government has passed several acts and laws to protect consumers and seek redressal of their grievances they are not in a position to utilize their

knowledge or are simply ignorant of these (Gupta and Ogale, 1988). Validation result show different type of rice was adulterated with stone in all the sample tested.

Pulses:

To confirm the hypothesis that there is adulteration in every type of other grains surveyed was conducted. Result show that majority of the people purchased pulses from shop (59%) out of which male were approx. 68% and female were 51%. While, rest obtained it from their own form, (21%) or from based on suitability (20%). Statistically data were found to be moderately insignificant (>0.05). This may be due to difference in buying practices of people. It is understood that before reaching grains to buyers they undergo various hands and under various people related with market. So the source of obtaining cereal is via shops which are for making profit and they are totally taking advantage of neutral law enforcement agencies. Also people often buy cheap products not branded one which has more chance of adulteration. This hypothesis is also supported by observed chi (χ^2) for both male respondents (8.826) and female (7.723) respondents which were higher than expected (DF2 χ^2 , 5.9) and total observed value (16.5) was also much greater than expected on the basis Null hypothesis was rejected that people

Therefore, it was hypothesized that adulteration malpractices may be linked with heavy demands of specific pulses. So, respondents were asked about uses among different pulses like Aarahar dal, Channa/matar dal, Urad dal, Mung, or Masoor dal from the shop. Since majority of the people (47%) used Aarahar dal among different pulses, out of which male were 37% and female were 54%, while other (23%) used Urad dal (26% female and 21% male) after Aarahar while other pulses were less preferred by respondents; Mung (16%), Masoor (12%), and least of all were Chana/Matar dal (2%). Statistically data were found to be moderately significant (<0.05). Statistically observed chi (χ^2) for both male respondents (5.229) and female (4.576) respondents were less than expected (DF4 χ^2 , 9.48) but total observed value (9.805) was greater than expected on the basis Null hypothesis was rejected that adulteration are linked with specific pulses.

Fig. 2 show the presence of adulterants in Arhar dal. It is clearly evident that majority of the people (35%) experienced of mixing of all type of adulterants in Aarahar dal while (28%) felt that there was mixing of lathyrus and (20%) felt that there was yellow colour in Aarahar dal. For all type of adulterants male were 39% and female were 31%. While other (35%) female and (21%) male observed mixing of Lathyrus in Aarahar dal. Statistically data were

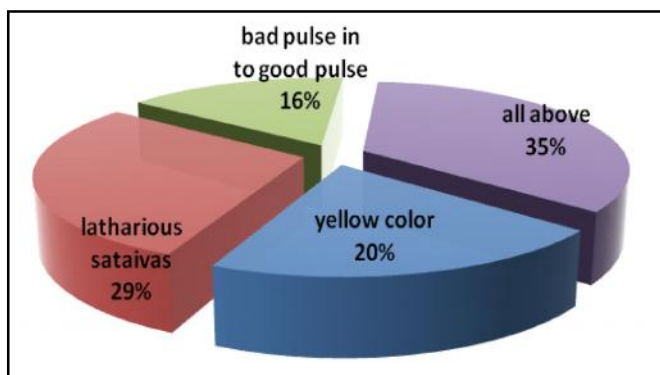


Fig. 2 : Adulterants in Arhar dal

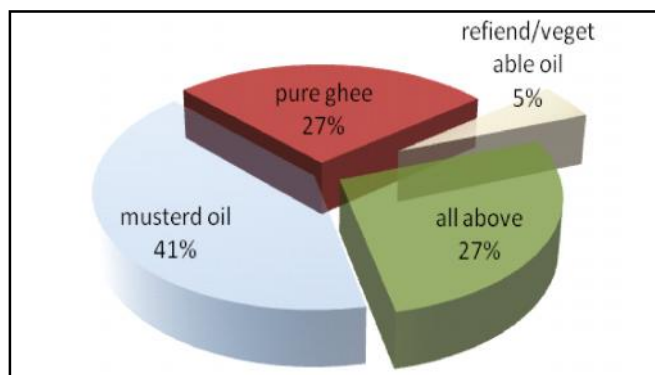


Fig. 3 : Adulterated edible oil

found to be moderately insignificant (>0.05). This may be due to absence of clear identification instruments for checking adulterations in pulses.

Statistically observed chi (χ^2) for both male respondents (3.860) and female (3.377) respondents were less than expected (DF3 χ^2 , 7.8) but total observed value (7.23) was also less than expected on the basis Null hypothesis was accepted that adulteration was directly related with choice of consumer and heavy demand and less availability may be one factor that directly effecting the practices of shopkeeper.

Since people health are directly dependent on quality of pulses since pulses are the major source by which vegetarians gets the protein essential for majority of people of every age specially for growing and studying children's. Validation result show that pulses contain inferior pulses, synthetic colour, Lathyrus and stone in the entire sample tested.

Edible oils:

Majority of the people (52%) use all types of oil for different purposes out of which male were 59% female 46%) while (32%) were using mustard oil (26% male and 37% female) and only 8% respondents were using other oil for cooking. Statistically data were found to be moderately significant (<0.05). It means that good health are significantly linked with the quality of edible oils used at home which is clearly evidenced by some instances of food adulteration especially that of edible oils with argemone (*Argemone mexicana*) oil leading to deaths of hundreds of people (Singh *et al.*, 2000).

Majority of the people observed adulteration in mustard oil (41%), out of which both male and female were 41% while (27%) observed adulteration in all edible oil (24% male and 30% female) and other 27% respondents observed adulteration in ghee (31% male and 22% female). Only 5% respondents found adulteration in refined oil (Fig. 3).

Statistically data were found to be moderately insignificant (>0.05). This may be linked with heavy use of edible oil or choice of people for buying cheap products which for making profit often fortified with other inferior oils having same color or physical property. Statistically observed chi (χ^2) for both male respondents (2.240) and female (1.960) respondents were less than expected (DF3 χ^2 , 7.8) but total observed value (4.201) was also less than expected on the basis Null hypothesis was accepted that there were malpractices in edible oil and almost every oil was found to be adulterated with inferior quality oil.

This hypothesis gets strength by survey which shows that there is adulteration in mustard oil and pure ghee and majority of the people (97%) observed adulteration in mustard oil and ghee out of which 99% male and (96%) female observed adulteration in mustard oil. Only 3-4% respondents observed absence of any adulteration. Statistically data were found to be significant (<0.05).

Statistically observed chi (χ^2) for both male respondents (2.056) and female (1.799) respondents were less than expected (DF1 χ^2 , 3.84) but total observed value (3.855) was more than expected which shows that there is meaningful difference and thus Null hypothesis was rejected that only some specific oils were found to be adulterated. It means malpractice has become routine of the life of the people and both manufacturers as well as shopkeepers were following it ruthlessly. This fact is well strengthen by the data represented in Fig. 4 about adulterants in pure ghee.

Fig. 5 show that majority of the people (male 59% and female 63%) observed that vegetable oils were mostly mixed with ghee while other feel that animals fat are mixed (male 37% and female 32%). Only 4% respondents felt that ghee is adulterated with other adulterants. Statistically data were found to be highly insignificant (>0.05) which may be unavailability of any direct measures on the basis they can test these facts. Statistically observed chi (χ^2) for both male respondents (0.380) and female (0.332)

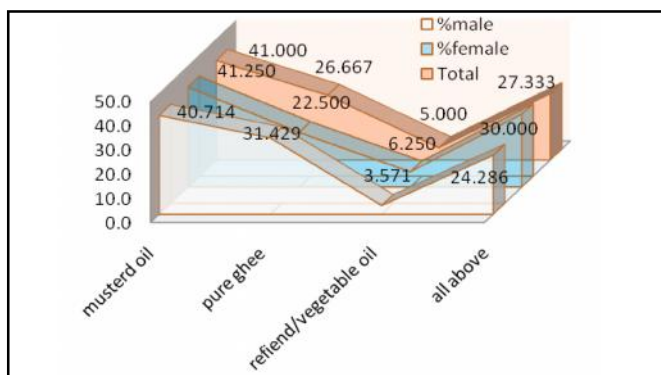


Fig. 4 : % of adulterants in pure ghee

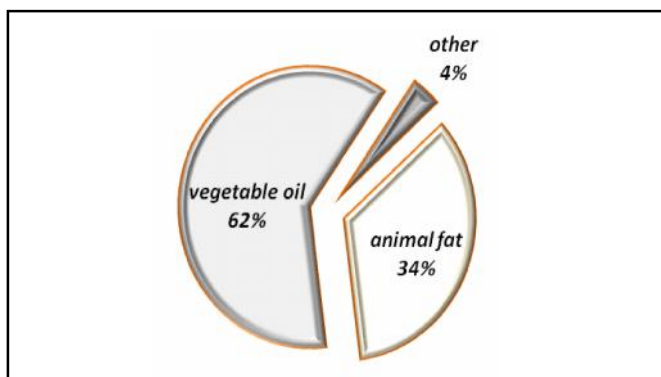


Fig. 5 : Adulterants in pure ghee

respondents were less than expected (DF2 χ^2 , 5.99) but total observed value (0.712) was also much lower than expected on the basis Null hypothesis was accepted that difference is not significant and fact that ghee is adulterated with many types of adulterants and directly effecting the health of the peoples. Validation result displayed show that deshi ghee was adulterated with vegetable oil. Test also showed that vegetable oil contained castor oil and argemone in all samples. Another test showed adulteration of starch in Paneer in all samples.

Spices:

Adulterants in spices were included in the survey and results showed that majority (male 99% and female 97%) of the people felt that there adulterants in spices, while only 2% respondents felt that there were no adulterants in spices. Statistically data were found to be highly insignificant (>0.05) which may be due to chance factor. Spices are generally used to give taste in the food, therefore their cost is high. To make them cheaper adulteration malpractice is followed. Statistically observed chi (χ^2) for both male respondents (0.775) and female (0.678) respondents were less than expected (DF1 χ^2 , 3.84) but total observed value (1.453) was also much lower than expected on the basis Null hypothesis was accepted

that there was adulteration in the spices .

Fig. 6 shows the result of adulterants in coriander powder. Data showed that majority of the people 58% (male 63% and female 52%) observed there was horse dung as adulterant in coriander, while leaf powder was observed by 24% respondent (male 20% and female 28%) while 5-7% respondents observed soil as adulterant in coriander. Only 13% respondents observed that there was no adulterant in coriander. Statistically data were found to be just insignificant (>0.05) which may be due to difference in buying practices of people which is effected by various factors such as age , income and education and choice of shop. This hypothesis is again evident by statistically observed chi (χ^2) for both male respondents (3.933) and female (3.441) respondents were less than expected (DF3 χ^2 , 7.8) but total observed value (7.374) was also much lower than expected on the basis Null hypothesis was accepted that coriander was adulterated.

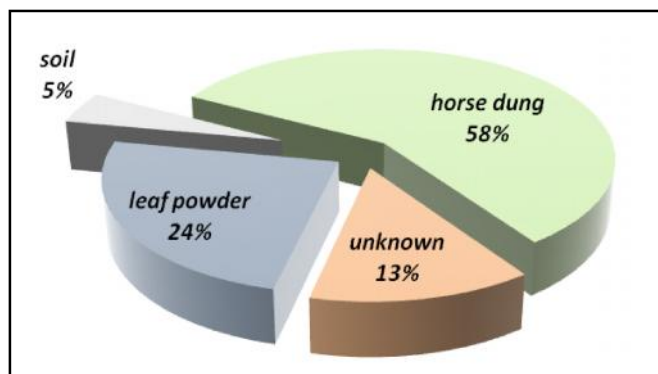


Fig. 6 : Adulterants in coriander powder

Fig. 7 shows the presence of adulterants in red chilli powder. Data show that majority of the people (85%) observed that there was brick powder as adulterant in red chilli powder (male 44% and female 41%) while sand was

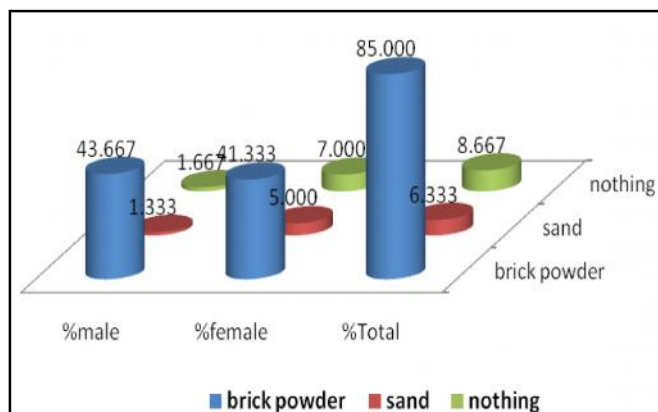


Fig. 7 : Adulterants in red chilli powder

observed by 6% respondents (male 1% and female 5%) while 8% respondents observed that there was no adulterant in red chilli powder. Statistically data were found to be highly significant (<0.05) which means that there was significant adulteration in every component of spices. Statistically observed chi (χ^2) for male respondents (8.075) were more than expected while female (7.066) respondents were less than expected (DF3 χ^2 , 7.8) while total observed value (15.141) was also much higher than expected on the basis Null hypothesis was rejected that only few component of the spices may be adulterated. Further, another major component of food was surveyed that if turmeric powder is also adulterated. Data show that majority of the people (99%) observed that there was adulterant in turmeric powder (male 100% and female 97%). Only 1.3% respondents observed that there was no adulterant in turmeric powder. Statistically data were found to be just insignificant (>0.05) which means that it may be due to choice variation for specific manufacturers. Some local manufacturers may adopt these practices due to lack of testing by government officials while good manufacturer may not follow this practices.

Statistically observed chi (χ^2) for both male respondents (1.892) and female (1.655) respondents were less than expected (DF1 χ^2 , 3.84) while total observed value (3.547) was also much less than expected on the basis null hypothesis was accepted that there was adulterant in all type of item present in shop. Therefore, next survey was concentrated on query that which type of adulterant is present in the turmeric powder.

Fig. 8 shows that majority of the people (78%) observed there was addition of yellow colour as adulterants in turmeric powder (male 81% and female 75%) while other respondents observed (11%) observed that there was mixing of arrowroot in turmeric powder (male 13% and female 9%) while other (7%) observed that there

was soil in the turmeric powder. Only 3% respondents observed that there was no adulterant in turmeric powder. Statistically data were found to be just insignificant (>0.05) which again indicate that this deviation is due to lack of specific testing tool that can quantitatively or qualitatively predict about the adulteration.

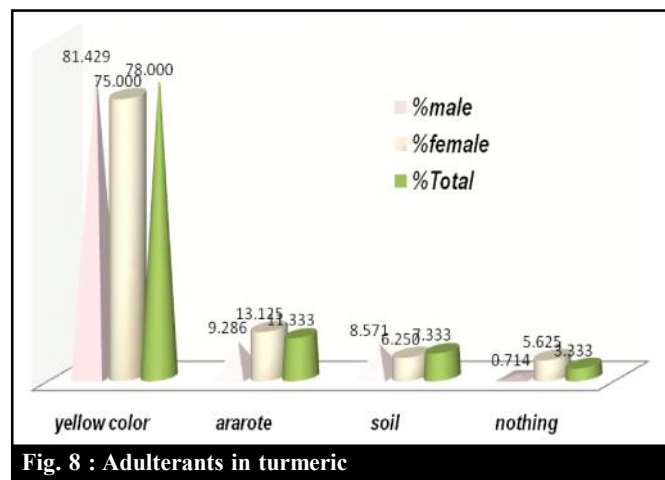
Statistically observed chi (χ^2) for both male respondents (3.415) and female (3.903) respondents were less than expected (DF3 χ^2 , 7.8) while total observed value (7.317) was also much less than expected on the basis Null hypothesis was accepted that there was synthetic colour used in the turmeric .

The variety of synthetic colours, developed in the middle of the nineteenth century, were reliable and economical method of partly restoring the original shade of the foods (that would otherwise be virtually dull) and also were used as a competitive substitute to the natural colourants (but were more expensive) (Achaya, 1984; Rao, 1990). Turmeric is the basic ingredient of all our Indian cooking. Any Indian dish is not complete without it, but it may be adulterated with, lead chromate. Lead chromate is one of the most toxic salts of lead. It can cause anemia, paralyses, mental retardation and brain damage in children and abortion in pregnant women. Validation result shows adulteration of horse dung / foreign particle in coriander in all samples and adulteration of synthetic colour in red chilli in all samples. Adulteration of arrowroot and synthetic colour was found in turmeric in all samples.

Legal awareness:

Majority of the people (96%) agreed that they can complain against adulteration as a consumer (96% male, 96% female), while rest (4% respondents) was not sure about it. Statistically data were found to be moderately significant (<0.05). Statistically observed chi (χ^2) for both male respondents (0.004) and female (0.003) respondents was lower than expected (DF1 χ^2 , 3.84) while total observed value (0.007) was also lower than expected on the basis Null hypothesis was accepted that people were well aware of food adulteration law.

Instead new finding was observed Fig. 9 that majority of the people (79%) never took action against shopkeeper for adulteration instead they Took other food in exchange (78% male, 81% female), while 12% respondent's returned the food (male 11%, female 12%). Rest 6% took action and other 3% given warning only. Statistically data were found to be moderately insignificant (>0.05) which may be due to difference in knowledge practices and awareness perception. Statistically observed chi (χ^2) for both male respondents (2.725) and female (2.384) respondents was lower than expected (DF3 χ^2 , 7.84) while total observed



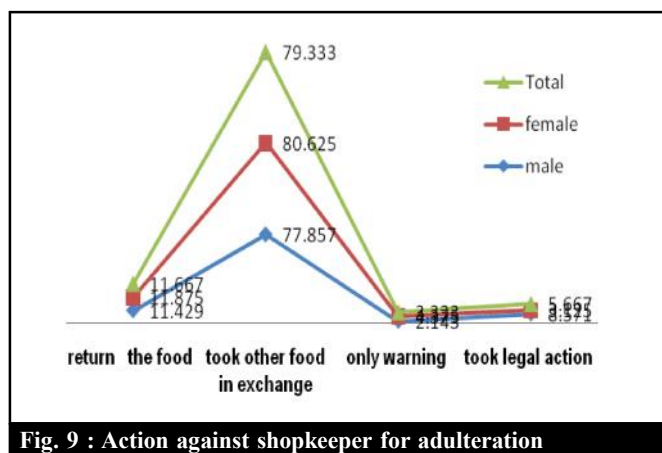


Fig. 9 : Action against shopkeeper for adulteration

value (5.110) was also lower than expected on the basis null hypothesis was accepted that people attitude towards food adulteration is of ignorance. It may be due to lack of proper food safety knowledge.

Survey shows majority of the people (71%) know about it from TV (71% male, 71% female), while 14% respondent's know it from news paper (male 21%, female 8%). Rest 11% from people and other 4% from other sources. Statistically data were found to be highly significant (<0.05). Statistically observed chi (χ^2) for both male respondents (8.592) was higher than expected and female (7.518) respondents was lower than expected (DF3 χ^2 , 7.84) while total observed value (16.109) was much higher than expected on the basis null hypothesis was rejected people are lacking sufficient knowledge of food safety behavior.

According to Howes *et al.* (1996), attitude, is an important factor besides knowledge which ensures trend of food borne illnesses. A number of studies (Howes *et al.*, 1996; Powell, 1997) have indicated that although training may bring about an increased knowledge of food safety this does not always result in a positive change in food handling behavior. It has been suggested that this disparity between knowledge and practice occurs because much of the existing training, particularly formal certificated training, is designed using the KAP model (Rennie, 1995). This approach assumes that an individual's behavior or practice (P) is dependent on their knowledge (K) and suggests that the mere provision of information will lead directly to a change in attitude (A) and consequently a change in behaviour. It has been suggested that this model is flawed in its assumption that knowledge is the main precursor to behavioral change (Ehiri *et al.*, 1997).

Role of media:

Further analysis was done about the effect of watching "Jago Grahak Jago" program. Fig. 10 shows

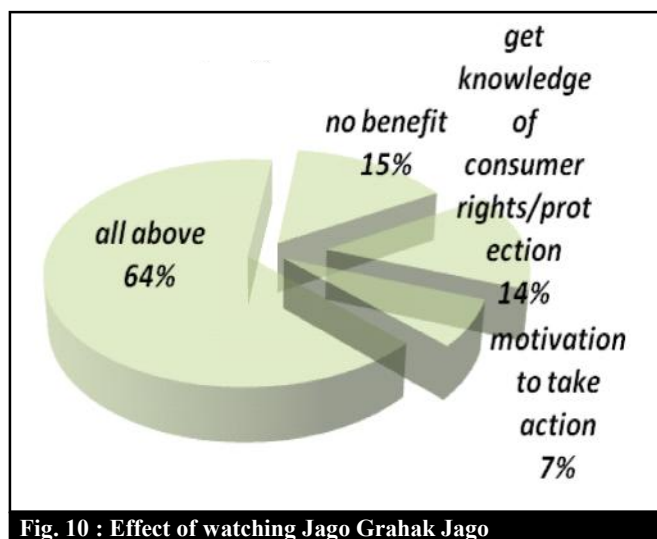


Fig. 10 : Effect of watching Jago Grahak Jago

that majority of the people (65%) knew about it from TV (68% male, 61% female), while 15% respondents about all the factors, rest 14% responded that it was beneficial (12% male and 16% female) and other 7% got various knowledge about it. Statistically data were found to be highly insignificant (>0.05) which may be due to difference in attitude or unavailability of resources to know the details of the facts. Also this may be linked to complexity of laws and unsupportive behaviour of the food authorities which are part of the society and silently observing the malpractices for some personal benefits.

Statistically observed chi (χ^2) for both male respondents (1.272) and female (1.113) respondents was lower than expected (DF3 χ^2 , 7.84) while total observed value (2.385) was much lower than expected on the basis null hypothesis was accepted that there was little effect of watching "Jago Grahak Jago" programme telecasted on TV. The reason may be that majority of them lack of time or facility such as TV or electricity and no interest in joining them, as it will yield no results. According to Kishitwaria *et al.* (2004) which concluded that mass media can effectively be used to promote information and awareness especially to educate respondents belonging to middle income group. Mass-media can also play an effective role for masses belonging to different socio-economic categories also. Parameshwar (1988) analyzed that unless consumer awareness' is created, the efforts of the government and voluntary organizations can't achieve the desired results.

Food standards:

Majority of the people (83%) knew about food standards (81% male, 85% female), while 17% respondents didn't know it (male 19%, female 19%).

Statistically data were found to be highly insignificant (>0.05). It may be due to difference in socio-economic status and education of people. Statistically observed chi (χ^2) for both male respondents (0.420) and female (0.367) respondents was lower than expected (DF1 χ^2 , 3.84) while total observed value (0.787) was much lower than expected on the basis Null hypothesis was accepted that people knew about different food standards.

Further, majority of the people (72%) knew that ISI is main Indian food standard (80% male, 64% female), while 18% respondents about FAO (male 13%, female 22%). Rest 7% responded about AGMARK and 3% responded all of the above. Statistically data were found to be highly significant (<0.05). Statistically observed chi (χ^2) for both male respondents (4.905) and female (4.291) respondents was lower than expected (DF3 χ^2 , 7.84) while total observed value (9.196) was higher than expected on the basis null hypothesis was rejected that people have good understanding about the food standards.

Impact on health:

Majority of the people (80%) reported stomach problem (74% male, 86% female), while rest 3% respondents observed skin and 1% reported about some physical problem, while other 16% were having no idea of adulteration. Statistically data were found to be just insignificant (>0.05) which may be due to illness because of various other bad practices such as bad quality water uses, bad practices of food handling and lack of knowledge of good food practices. This fact is supported by statistically observed chi (χ^2) for both male respondents (3.871) and female (3.387) respondents was lower than expected (DF3 χ^2 , 7.84) while total observed value (7.258) was also lower than expected on the basis Null hypothesis was accepted that food adulteration was only cause of bad impact and major illness.

Bad food practices are often linked with various food borne diseases. Those at greatest risk for food borne illnesses are the elderly, pregnant women, infants and young children, and those with compromised immune systems (Mead *et al.*, 1999; Fischer *et al.*, 2005). One in every five individuals in the U.S.A. falls into one of these at-risk categories. The elderly are a group particularly vulnerable to foodborne illnesses and death (Smith, 1998) such as morbidity and mortality from foodborne-induced gastroenteritis. Many elderly live in assisted living facilities where food is provided by caregivers. As described by Linton *et al.* (1998) there are many food handling errors that can cause food borne illness in food retail establishments, including poor personal hygiene and cross-contamination.

Conclusion:

The urban people of Varanasi mostly had income of medium range and lives in nuclear family and male and female have 40-50% education. The young people are there in majority and linked with mostly buying of food materials not directly linked with handling of food materials. Majority of them like to purchase it from stockiest. Majority of the people found all type of adulterations in cereals and detected it by seeing external feature of cereals, while rest detected cereal adulteration after cooking or during washing of cereals just before cooking.

Majority of the people use Aarahar dal among different pulses such as Urad dal, Mung, Masoor, and experienced of mixing of all the factors such as mixing of Lathyrus, or yellow color in Aarahar dal.

Majority of the people observed adulteration in mustard oil while (27%) observed adulteration in all edible oils and other observed adulteration in ghee and that was also proved in validation test. Majority of the people observed illness due to adulteration in mustard oil and ghee.

Majority of the people felt that there was adulterants in spices, and also observed horse dung as adulterant in coriander, while some detected leaf powder, while 5-7% respondents observed soil as adulterant in coriander. Majority of the people observed brick powder or sand in red chilli powder

Majority of the people agreed that they can complain against adulteration and they are well known to consumer protection and consumer forum. Majority of the people accepted that they never filed any complaint against the shopkeeper and never took action against shopkeeper. Majority knew about it from TV or from news paper while rest (11%) from people and other 4% from other sources. They used to see TV program "JAGO GRAHAK JAGO" and are well aware of food standards ISI FAO and AGMARK.

Limitation of the study:

It was not possible to tell the quantities of adulterants present beyond prescribed limit or beyond toxicity level in different food products so that people can avoid such food products.

Recommendations:

On the basis of observation of the present study the following recommendation have been suggested

- Selection of food materials should be on the basis of health and quality labeled with government standard norms and they should complaint to authorities at once after detection of adulteration.

- There should be regular camp to educate people about various adulterations and their impact on health.
- There should be regular education awareness programme for school going children's and college level students.
- There should be awareness programme for food vendors at street for food hygiene and food safety.
- Government officers should perform routine checks of various food commodities and should involve researchers at universities for lab testing and result should be published in leading news paper.
- There should be complaint boxes at important places for the ease of consumers.
- There should be licensing scheme essential for every shopkeeper who are involve in selling food products.
- There should be at once action including cancelling of license of such shop keepers that used to sell such products.

REFERENCES

- Achaya, K.T.** (1984). *Everyday Indian processed foods*. P. Delhi: National Book Trust, Delhi (154-162).
- Altekruse, S. F., Yang, S., Timbo, B. B. and Angulo, F. J.** (1999). A multi-state survey of consumer food-handling and food-consumption practices. *American J. Preventive Medicine*, **16**: 216-221.
- Baker, G. A.** (2003). Food safety and fear: Factors affecting consumer response to food safety risk. *Internat. Food & Agribusiness Management Review*, **1**: 1–11.
- Barclay, M., Greathouse, K., North, T., Swisher, M. and Cale, L.** (2001). Food-handling knowledge and practices of 4th- and 5th-grade students: A key to better sanitation. *J. Child Nutrition & Management*, **25**: 72-75.
- Bruhn, C. M., and Schutz, H.G.** (1999). Consumer food safety knowledge and practices. *J. Food Safety*, **19**: 73–87.
- Ehiri, J. E., Morris, G. P., and McEwen, J.** (1997). Evaluation of a food hygiene training course in Scotland. *Food Control*, **8**: 137–147.
- Fischer, A.R.H., De Jong, A.E.I., De Jonge, R., Frewer, L.J. and Nauta, M.J.** (2005). Improving food safety in the domestic environment: The need for a transdisciplinary approach. *Risk Anal.*, **25**: 503–517.
- FSAI.** (2003). Consumer attitudes to food safety in Ireland. Food Safety Authority of Ireland;. Available at: http://www.fsai.ie/industry/surveys/Consumer_Attributes.pdf. Accessed May 13, 2008.
- Gupta, M. and Ogale, N.** (1988). Educational needs of consumers regarding consumer protection laws. *J. Res., H.A.U. Hissar*, **18**(3): 236-241
- Gupta, Nidhi and Panchal, Priti** (2009). Extent of awareness and food adulteration detection in selected food items purchased by home makers. *Pak. J. Nutr.*, **8**: 660-667.
- Hamilton, Kathy** (2009). Consumer decision making in low-income families: The case of conflict avoidance. *J. Consumer Behaviour*, **8**: 252-267.
- Howes, M., McEwen, S., Griffiths, M. and Harris, L.** (1996). Food buying practices of unemployed Food handler certification by home study: Measuring changes in knowledge and behaviour. *Dairy, Food & Environmental Sanitation*, **16**: 737-744.
- Kaferstein, F.K., Motarjemi, Y. and Bettcher, D.W.** (1997). Food borne disease control: A transnational challenge. *Emerg. Infect. Dis.*, **3**(4): 503–510.
- Kishtwaria, J., Sharma, A., Vyas, N. and Sharma, S.** (2004). Consumer awareness regarding legislation organisations and consumer protection laws. *J. Soc. Sci.*, **8**(1): 69-72
- Kotler, P.** (1990). *Marketing management*, 6th Ed., Prentice-Hall of India Private Limited, New Delhi, pp: 196-201.
- Linton, R.H., Mcswane, D.Z., and Woodley, C.D.** (1998). A comparison of perspectives about the critical areas of knowledge for safe food handling in food service establishments. *J. Environ. Health*, **60**(8) : 8-15.
- Makela, J.** (2000). Cultural definitions of the meal. In : *Dimensions of the meal: The Science, Culture, Business, and Art of Eating*. Meiselman HL, Ed. Gaithersburg, Md., Aspen Publishers, pp. 7–18.
- Mead, P. S., Slutsker, L., Dietz, V., McCaig, L. F., Bresee, J. S., and Shapiro, C.** (1999). Food-related illness and death in the United States. *Emerging Infectious Diseases*, **5**(5): 607–625.
- Neelkanta, B.C. and Anand, H.B.** (1992). Educating the Consumer. *Social Welfare*, **37**(11-12): 5-6.
- Newman, L.W.** (1994). Analysing qualitative data. *Social research methods-qualitative and quantitative approaches*. Massachusetts: Allyn and Bacon.
- NIN** (2006). KAPB Study on food and Drug safety in India—A report. Food and drug toxicology Research Centre, National Institute of Nutrition (NIN), Hyderabad, India.
- Parmwshvar, K.R.** (1988). Protect consumer against quality trichsters. *Yojana*, **32**(5): 29-31.
- Powell, S. C., Attwell, R. W. and Massey, S. J.** (1997). The impact of training on knowledge and standards of food hygiene—a pilot study. *Internat. J. Environmental Health Res.*, **7**: 329–334.
- Rao, B.S.N.** (1990). Food additives – consumer's viewpoint. *Indian Food Industry*, **9**: 14–19.
- Rennie, D.M.** (1995). Health education models and food hygiene education. *J. Royal Soc. Health*, **115**: 75-79.

- Singh, N. P., Anuradha, S. D., Dhanwal, D. K., Singh, K., Prakash, A. and Agarwal, S. K.** (2000). Epidemic dropsy- A clinical study of the Delhi outbreak. *J. Assoc. Physicians India*, **48**(9): 877-880.
- Smith, J.L.** (1998). Food borne illness in the elderly. *J. Food Prot.*, **61**: 1229-1239.
- Subba Rao, G.M., Sudershan, R.V., Pratima Rao, Vishnu, M. and Polasa K.** (2007). Food safety knowledge, attitudes and practices of mothers: findings from focus group studies in south India. *Appetite*, **49**: 441-449.
- Sudershan, R.V., Naveen Kumar, R., Kashinath, L., Krishna, T.P. and Polasa, K.** (2007). Microbiological risk assessment of poultry products sold in various localities of Hyderabad. In: *Nutrition Society of India*. Abstracts Book of the 39th National Conference of the Nutrition Society of India, 15-17th November, 2007. Hyderabad.
- Sudershan, R.V., SubbaRao, G. M., Rao, P., VardhanaRao, M. V., and Polasa, K.** (2008). Food safety related perceptions and practices of mothers – A case study in Hyderabad. *India Food Control*, **19**(5): 506-513.
- Turrell** (1998), Socio-economic differences in food preference and their influence on healthy food purchasing choices. *J. Human Nutrition & Dietetics*, **11**: 135-149.
- Unusan, N.** (2007). Consumer food safety knowledge and practices in the home in Turkey. *Food Control*, **18**(1): 45-51.
- Williams, D.M., Gravani, R.B. and Lawless, H. T.** (1992). Correlating food safety knowledge with home food preparation practices. *Food Technol.*, **49**: 28.
- Yang, S., Angulo, F. J. and Altekruze, S. F.** (2000). Evaluation of safe food handling instructions on raw meat and poultry products. *J. Food Protect.*, **63**(10): 1321-1325.
- Zugarramurdi, A.** (2003). Import requirements and quality costs, In : FAO Report of the Expert Consultation on International Fish Trade (FAO Fisheries Report No. 744). Rio de Janeiro, Brazil.

Address for correspondence :
ANITA SINGH
 Department of Food and Nutrition, Faculty of Home Science,
 Sri Agrasen Kanya Autonomous P.G. College,
 Parmanandpur, VARANASI (U.P.), INDIA

Authors' affiliations :**SHUCHI RAI BHATT**
 Department of Food and Nutrition, Faculty of Home Science,
 Sri Agrasen Kanya Autonomous P.G. College,
 Parmanandpur, VARANASI (U.P.), INDIA

SHEEENDRA M. BHATT
 Department of Food and Nutrition, Faculty of Home Science,
 Sri Agrasen Kanya Autonomous P.G. College,
 Parmanandpur, VARANASI (U.P.), INDIA

