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Food Adulteration: Awareness and Consumer Perception among Urban Households of Kanpur, Uttar Pradesh

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Abstract

Food adulteration poses a significant public health risk in India, compromising the safety and nutritional quality of commonly consumed food items. This study aimed to assess the knowledge, awareness, and practices related to food adulteration among residents of Kanpur, Uttar Pradesh.

A total of 120 respondents who regularly purchased food for household consumption were selected using probability sampling and a simple random cluster method. The sample size was calculated using the RAOSOFT sample size calculator assuming a 95% confidence level, 5% margin of error, and 10% response distribution. Data were collected through a pretested questionnaire covering respondents' understanding of food adulteration, commonly adulterated items, adulterants used, and traditional household detection methods.

The results indicated that most respondents (76.7%) correctly understood the concept of food adulteration. Milk, cereals, pulses, edible oils, red pepper, and jaggery were frequently reported as adulterated.

Traditional detection methods such as handpicking, water tests, visual inspection, and boiling tests were widely practised, though awareness of chemical-based detection methods was limited. Only 60% of respondents were aware of regulatory authorities such as FSSAI.

Overall, the findings suggest satisfactory general awareness about adulteration and its health risks, but highlight the need for targeted consumer education and public awareness programs to improve detection practices, regulatory knowledge, and ensure safer food consumption.

Keywords:
Food safety, Consumer awareness, Detection methods, Public health

1. Introduction

Food is one of the basic necessities of life, and its quality directly affects human health and well-being. However, in recent years, food adulteration has emerged as a significant public health concern in India. Food adulteration refers to the deliberate addition or substitution of inferior, harmful, or unauthorized substances in food items to increase quantity, enhance appearance, or reduce cost [1, 2, 3, 4]. Such practices not only degrade the nutritional value of food but also pose serious health risks, including digestive disorders, chronic illnesses, and, in severe cases, life-threatening conditions. In urban markets like Kanpur where demand for food products is high and food supply chains are complex, the risk of adulteration in commonly consumed items such as milk, cereals, pulses, edible oils, red pepper, and jaggery is particularly high. Awareness about food adulteration, its detection, and preventive measures among consumers plays a crucial role in minimising exposure to harmful substances. Understanding the knowledge, attitudes, and practices of residents regarding food adulteration can help policymakers and health authorities design effective awareness programs and food safety interventions. Therefore, this study aims to assess the knowledge and awareness of food adulteration among residents of Kanpur, Uttar Pradesh, focusing on commonly adulterated food items, traditional detection methods, and preventive practices. The findings of this study are expected to contribute to public health awareness and promote safer food consumption habits in the community.

2. Materials and Methods

The study was conducted in Kanpur, Uttar Pradesh. A total of 120 respondents from the Kalyanpur block who regularly purchased food items for household consumption were selected as the sample. In this study, a sample size was estimated using the RAOSOFT sample size calculator [5]. The sample size was calculated assuming a confidence level of 95%, a 5% margin of error, and a response distribution of 10%. Probability sampling was used in this study to ensure a good representation of the population. A simple random sample of clusters was employed in selecting participants from the population.

3. Data Collection Tools and Procedures

A pretested questionnaire was designed for data collection regarding socio-demographic profile, respondents' knowledge of food adulteration, adulterants normally used to adulterate food items, and the means of detection at the household level. Participants were provided with all necessary consent forms to read and fill upon agreement to participate in the study. The questionnaires were effectively administered and collected, as the researchers personally took them to the participants and administered them one-on-one, translating the content of the questions to people who could not read or understand them.

4. RESULTS

Socio demographic characteristics of respondents

General information and socio-demographic characteristics of the respondents was collected through a questionnaire and it was found that the majority of the respondents belonged to the 31–40 years age group, accounting for 45 per cent (n = 54) of the total sample while those aged 51 years and above formed the smallest group, representing 9.2 per cent (n = 11). This distribution indicates that most respondents were in their economically active and decision-making age group. In terms of sex distribution, the sample was almost equally represented, with 61 females (50.8 per cent) and 59 males (49.2 per cent). This near-equal participation of male and female respondents provides balanced gender representation in the study. A large proportion of respondents were graduates, constituting 60.8 per cent (n = 73) of the total sample (Table 1).

Respondent's knowledge about food adulteration

Table 1. Socio-demographic characteristics of the respondents

Characteristics	Parameters	Frequency	Percentage
Age	18–30	30	25%
	31–40	54	45%
	41–50	25	20.8%
	51 and above	11	9.2%
Sex	Male	59	49.2%
	Female	61	50.8%
Education	Illiterate	2	1.7%
	High School	1	0.8%
	Intermediate	29	24.2%
	Graduate	73	60.8%
	Post Graduate	15	12.5%

The level of knowledge of respondents regarding food adulteration was surveyed and the findings indicate that a majority of the respondents possessed a fairly good understanding of food adulteration and its implications. More than three-fourths of the respondents (76.7%) agreed that food adulteration refers to the addition of harmful or inferior substances to food items, indicating a clear conceptual understanding among most participants. However, a small proportion either disagreed (13.3%) or were unsure (10%), suggesting that a segment of the population still lacks clarity on the basic definition of food adulteration. With regard to commonly adulterated food items, 73.3% of

respondents agreed that milk, spices, pulses, and cereals are frequently adulterated in local markets. This reflects awareness based on everyday market experiences in Kanpur Nagar. Nevertheless, 15% disagreed and 11.7% were not sure, highlighting variation in perception among consumers. Knowledge about the substances used for adulteration was also relatively high, as 70.8% of respondents acknowledged that water, chemicals, and artificial colours are commonly used as adulterants. Despite this, nearly one-third of respondents either disagreed (16.7%) or were uncertain (12.5%), pointing to partial gaps in specific technical knowledge. A high level of awareness was observed regarding the health impact of adulterated food. About 79.2% of respondents agreed that consumption of adulterated food can cause serious health problems. This finding suggests that health concerns are a major factor influencing consumer awareness and attitudes. Only 11.7% disagreed, while 9.1% were not sure. In terms of identifying adulteration, 65% of respondents believed that changes in colour, taste, or smell could help detect adulterated food. However, a considerable proportion either disagreed (20%) or were unsure (15%), indicating limited confidence in detection methods and a reliance on visible or sensory cues rather than scientific testing. Awareness about regulatory mechanisms appeared comparatively lower. Only 60% of respondents were aware that the Government of India has laws and authorities such as the Food Safety and Standards Authority of India (FSSAI) to control food adulteration. About 21.7% disagreed and 18.3% were not sure, reflecting inadequate dissemination of information regarding food safety regulations and enforcement agencies. Finally, a substantial majority (75%) agreed that checking food labels and expiry dates helps in preventing the purchase of adulterated food. This suggests a positive attitude towards safe food practices among consumers. However, 15% disagreed and 10% remained unsure, indicating the need for greater consumer education on label reading and informed purchasing. **Common Adulterated Food Items**

The findings indicate that a wide range of food items consumed daily are perceived to be adulterated with various harmful or inferior substances. Among cereals, the most frequently reported adulterant was stones and sand, identified by 78 respondents (65%). This was followed by the presence of husk or chaff (51.7%) and insect-damaged or mouldy grains (45%). The addition of chalk powder was reported by 37.5% of the respondents. These findings suggest that cereals sold in the local markets of Kanpur are often adulterated with physical impurities, likely due to poor handling and storage practices. In the case of pulses, stones and dirt were reported as the most common adulterants by 58.3% of the respondents, followed by artificial colours (48.3%) and weevil-infested or damaged pulses (43.3%). About one-third of the respondents (33.3%) were aware of the mixing of Khesari dal (Lathyrus sativus) with pulses, which is a serious concern due to its known toxic effects on health (Table 3). With regard to edible oils, a majority of respondents (60%) reported the mixing of cheap vegetable oils with pure oils, indicating economic adulteration. Argemone oil, particularly in mustard oil, was reported by 38.3% of the respondents, while mineral oil adulteration was noted by 28.3%. The use of artificial colouring agents was reported by 24.2% of respondents. These findings reflect significant awareness among consumers about oil adulteration, especially in commonly used cooking oils. For red pepper, brick powder emerged as the most commonly perceived adulterant, reported by 56.7% of respondents. This was followed by red oxide or artificial red dyes (49.2%), sawdust (34.2%), and talc or chalk powder (30%). The high frequency of colour-based adulterants highlights the misuse of visual appeal to deceive consumers. In the case of jaggery, flour adulteration was reported by 45.8% of respondents, followed by soil (40.0%) and artificial yellow colour (32.5%). Arrowroot adulteration was reported by 26.7% of respondents. These adulterants not only reduce the nutritional quality of jaggery but also pose health risks when consumed regularly. Among all food items, milk showed the highest level of perceived adulteration. A large majority of respondents (76.7%) reported the addition of water, making it the most common adulterant. Chemical adulterants were reported by 47.5% of respondents, followed by starch (36.7%) and soya milk (23.3%). This indicates serious concerns regarding the safety and quality of milk available in local markets of Kanpur.

Detection of Food Adulteration by Respondents Different traditional and household methods used by respondents to detect food adulteration in commonly consumed food items were recorded. The findings indicate that a large proportion of respondents relied on simple, experience-based techniques rather than laboratory or chemical tests, reflecting practical knowledge developed through daily food handling practices. In the case of cereals, the most frequently used method was the handpicking method, reported by 70.8 per cent of respondents, which involves manually removing visible impurities such as stones and husk. This was followed by visual inspection (65%), suggesting that respondents primarily depend on physical observation to judge cereal quality. The water test was used by about half of the respondents (51.7%), while the sun-

Table 2. Awareness regarding food adulteration

Statements	Parameters	Frequency	Percentage
Food adulteration means the addition of harmful or inferior substances to food items.	Agree	92	76.7
	Disagree	16	13.3
	Not sure	12	10
Milk, spices, pulses, and cereals are commonly adulterated food items in local markets.	Agree	88	73.3
	Disagree	18	15
	Not sure	14	11.7
Substances such as water, chemicals, and artificial colours are used to adulterate food.	Agree	85	70.8
	Disagree	20	16.7
	Not sure	15	12.5
Consumption of adulterated food can cause serious health problems.	Agree	95	79.2
	Disagree	14	11.7
	Not sure	11	9.1
Food adulteration can be identified by changes in colour, taste, or smell of food.	Agree	78	65
	Disagree	24	20
	Not sure	18	15
The Government of India has laws and authorities, such as FSSAI, to control food adulteration.	Agree	72	60
	Disagree	26	21.7
	Not sure	22	18.3
Checking food labels and expiry dates helps in preventing the purchase of adulterated food.	Agree	90	75
	Disagree	18	15
	Not sure	12	10

drying method was less commonly practised (37.5%), possibly due to time and space constraints in urban settings like Varanasi. For pulses, visual examination emerged as the most common detection method, used by 68.3 per cent of respondents, followed closely by the water soaking test (61.7%). These methods help identify stones, damaged grains, and artificial colouring. Nearly half of the respondents (49.2%) reported rubbing pulses between fingers to detect polish or adulterants, whereas taste testing after cooking was the least preferred method (34.2%), likely due to the risk involved. Regarding edible oils, respondents adopted a variety of methods. The smell test was the most widely used (60.8%), indicating awareness of unusual odours associated with adulteration. The refrigeration test was used by 55.8 per cent of respondents, especially for detecting adulteration in oils like mustard oil. Other methods such as colour observation (46.7%) and the cotton wick test (40%) were used by fewer respondents, showing moderate familiarity with these techniques. In the case of red pepper, the water test was the most commonly used method, reported by 73.3 per cent of respondents, as it helps identify brick powder and artificial colours. This was followed by rubbing on the palm (63.3%), which can reveal excess colour. The smell test was practised by about half of the respondents (50.8%), while the paper test was the least used method (36.7%). For jaggery, the water dissolution test was the most popular detection method (65.8%), as it helps identify insoluble impurities such as soil or chalk. Visual inspection (59.2%) and taste testing (53.3%) were also commonly reported. The touch test, used by 43.3 per cent of respondents, was comparatively less common but still indicates awareness of texture changes due to adulteration. In the case of milk, a high level of awareness was observed. The water test was used by 75.8 per cent of respondents, making it the most common method. This was closely followed by the boiling test (70%), which helps detect dilution and synthetic milk. Taste and smell tests were also widely practised (64.2%). However, the iodine test, which is used to detect starch, was reported by only 32.5 per cent of respondents, suggesting limited knowledge or practice of chemical-based household tests.

Table 3. Common Adulterated Food Items

Food items	Adulterants	Frequency	Percentage
4*Cereals	Stones and sand	78	65
	Husk or chaff	62	51.7
	Chalk powder	45	37.5
	Insect-damaged or mouldy grains	54	45
4*Pulses	Kesari dal (Lathyrus sativus)	40	33.3
	Artificial colours	58	48.3
	Stones and dirt	70	58.3
	Weevil-infested or damaged pulses	52	43.3
4*Edible Oil	Argemone oil (especially in mustard oil)	46	38.3
	Mineral oil	34	28.3
	Cheap vegetable oils mixed with pure oils	72	60
	Artificial colouring agents	29	24.2
4*Red Pepper	Brick powder	68	56.7
	Red oxide or artificial red dyes	59	49.2
	Sawdust	41	34.2
	Talc or chalk powder	36	30
4*Jaggery	Flour	55	45.8
	Soil	48	40.0
	Arrowroot	32	26.7
	Artificial colour (yellow dye)	39	32.5
4*Milk	Water	92	76.7
	Chemicals	57	47.5
	Soya milk	28	23.3
	Starch	44	36.7

Table 4. Detection of Food Adulteration by Respondents

Food products	Means of detection by respondents	Frequency	Percentage
43cmCereals	Handpicking method	85	70.8
	Water test	62	51.7
	Visual inspection	78	65
	Sun-drying method	45	37.5
43cmPulses	Water soaking test	74	61.7
	Visual examination	82	68.3
	Rubbing between fingers	59	49.2
	Taste test (after cooking)	41	34.2
43cmEdible Oil	Refrigeration test	67	55.8
	Smell test	73	60.8
	Cotton wick test	48	40
	Colour observation	56	46.7
43cmRed Pepper	Water test	88	73.3
	Rubbing on palm	76	63.3
	Smell test	61	50.8
	Paper test	44	36.7
43cmJaggery	Water dissolution test	79	65.8
	Visual inspection	71	59.2
	Taste test	64	53.3
	Touch test	52	43.3
43cmMilk	Water test	91	75.8
	Boiling test	84	70
	Taste and smell test	77	64.2
	Iodine test (traditional household practice)	39	32.5

5. DISCUSSION

Food adulteration is a matter of concern in today's era as it not only decreases the quality of the food products but also causes a number of ill effects on health [6].

The present study also found that respondents knew food adulteration, especially regarding its definition, health effects, and commonly adulterated foods. In the present study respondents were well aware of vari-

ous forms of food adulteration prevalent in commonly consumed food items. The high frequencies reported for multiple adulterants reflect widespread consumer exposure and concern regarding food quality in the study area whereas [7] reported that three fifths of rural women from Rahi block of Raebareli district of Uttar Pradesh were unaware of food adulteration. [8, 9] reported that nearly 50% of the food consumed every day is adulterated. Respondents were largely dependent on traditional, low-cost, and easily applicable methods to detect food adulteration [8, 10]. While awareness of visual and physical detection techniques is relatively high, the use of more specific chemical tests remains limited. This highlights the need for consumer education and awareness programmes to promote simple scientific detection methods and strengthen food safety practices at the household level. However, gaps remain in awareness about regulatory authorities and reliable methods of detection, emphasising the need for targeted awareness programmes and consumer education initiatives.

6. Conclusion

The study concludes that most participants had a good understanding of food adulteration, recognising commonly adulterated items such as milk, cereals, pulses, red pepper, jaggery, and edible oils, and identifying harmful substances like water, chemicals, and artificial colours. Respondents were aware of traditional detection methods, including handpicking, water tests, visual inspection, and boiling tests for milk. However, knowledge about regulatory authorities and food safety laws was comparatively lower. Overall, while general awareness of food adulteration and its health risks is satisfactory, there is a need for increased public education and awareness programs to strengthen preventive practices and ensure food safety.

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