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PREVALENCE AND RAPID DETECTION OF FOOD ADULTERATION IN BULDHANA DISTRICT RURAL MARKETS: A PUBLIC HEALTH ASSESSMENT

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ABSTRACT

Food adulteration remains a critical public health issue in India, particularly in rural regions where informal food markets dominate, regulatory enforcement is limited, and consumer awareness is low. Rural populations in Buldhana District of Maharashtra are especially vulnerable due to their dependence on locally sourced, unpackaged food commodities. The present study aimed to assess the prevalence of food adulteration in selected rural areas of Buldhana District and to generate evidence to inform public health interventions.

A cross-sectional, field-based study design was employed. Food samples were collected from rural markets and households using a stratified random sampling technique. Commonly consumed staple food categories—including milk, edible oils, spices, and grains—were analyzed. Adulteration was detected using simple physical and chemical tests, along with Food Safety and Standards Authority of India (FSSAI)–approved Detect Adulteration with Rapid Test (DART) kits. Structured questionnaires were also administered to households and food vendors to evaluate awareness levels, purchasing behaviour, and food handling practices related to adulteration.

The findings revealed widespread adulteration across all food categories tested. Milk exhibited the highest adulteration prevalence (35%), followed by spices (25%), edible oils (20%), and grains (15%). Common adulterants detected included detergents, starch, and urea in milk; lead salts and extraneous matter in spices; argemone and mineral oil in edible oils; and physical contaminants in grains. Consumer awareness was notably low, with 70% of respondents unaware of basic adulteration detection methods. Vendor responses highlighted profit-driven practices and weak regulatory enforcement as major contributors to adulteration.

The study concludes that food adulteration in rural Buldhana District poses a significant public health risk. Strengthening food safety surveillance, improving regulatory enforcement, and implementing community-based consumer awareness programs are urgently required to enhance food safety and protect rural populations.

Keywords: *Food adulteration, Buldhana, Milk adulteration, public health.*

INTRODUCTION

Food adulteration is recognized as a major public health challenge in India, with serious implications for food safety, nutritional quality, and overall community health. The problem is particularly pronounced in rural regions, where limited regulatory enforcement, fragmented food supply chains, and low levels of consumer awareness create favourable conditions for the circulation of adulterated food products. In such settings, populations are often exposed to inferior and potentially harmful food items, increasing the risk of both acute and chronic health effects.

Food adulteration can be broadly defined as the intentional addition, substitution, dilution, or removal of food constituents in a manner that compromises quality, safety, or authenticity. These practices are largely driven by economic motivations, as traders and intermediaries attempt to maximize profits by reducing production costs or increasing product volume. India's predominantly unorganized food distribution system further exacerbates this issue, particularly in rural areas where food commodities are commonly sold loose, without labelling, packaging, or traceability. As a result, consumers have limited ability to assess food quality or detect adulteration prior to consumption.

Staple foods that constitute a significant portion of the Indian diet—such as milk, edible oils, spices, cereals, and pulses—are among the most frequently adulterated commodities. Milk is often diluted with water to increase volume and, in more severe cases, adulterants such as detergents, starch, urea, or synthetic milk solids may be added to mimic natural characteristics. These substances can cause gastrointestinal disturbances, metabolic stress, and long-term health complications, particularly among vulnerable populations such as children, pregnant women, and the elderly. Similarly, edible oils may be adulterated with cheaper or non-edible oils such as argemone oil, which is associated with epidemic dropsy and other serious health outcomes. Spices including turmeric and chili powder are commonly adulterated with artificial dyes, lead chromate, or extraneous matter to enhance color and weight, while cereals and pulses may contain inferior grains, stones, husk, or chemical preservatives.

The persistence of food adulteration in rural India is closely linked to broader socio-economic factors, including poverty, illiteracy, lack of infrastructure, and inadequate regulatory oversight. Rural consumers often prioritize affordability over quality due to economic constraints, inadvertently encouraging the availability of cheaper, adulterated food products. At the same time, small-scale vendors and traders frequently operate without formal training in food safety practices and remain outside the scope of routine inspections, allowing adulteration to persist unchecked.

Buldhana district, located in the Vidarbha region of Maharashtra, represents a relevant setting for examining this public health issue. The district's economy is largely agrarian, and food procurement in rural areas primarily depends on weekly village markets, roadside vendors, and small local shops. These informal markets play a vital role in ensuring food access but often function with minimal regulatory supervision, increasing the likelihood of adulterated food entering the local supply chain.

Despite national initiatives such as the Food Safety and Standards Act and awareness campaigns by the Food Safety and Standards Authority of India, the reach and effectiveness of food safety measures in rural settings remain limited. Against this backdrop, the present study aims to assess the prevalence of food adulteration in selected rural markets of Buldhana district. The study focuses on identifying commonly adulterated food items, detecting specific adulterants using simple, rapid, and field-applicable methods, and generating evidence to support public health interventions, improved surveillance, and enhanced consumer awareness at the community level.

REVIEW OF LITERATURE

Food adulteration remains a significant public health concern in India, particularly in rural and semi-urban regions where informal food markets are prevalent. Several studies have documented widespread adulteration of staple foods such as milk, edible oils, spices, and cereals, largely driven by economic incentives and weak regulatory oversight (Mehta, 2010; Patel, 2013; Mishra, 2015). Rural populations are especially vulnerable due to inadequate food safety infrastructure and limited enforcement mechanisms (Kulkarni, 2008; Deshmukh, 2012).

Milk is consistently reported as the most frequently adulterated commodity, with water, starch, detergents, and urea commonly added to increase volume and improve appearance (Choudhary, 2013; Singh et al., 2017). Consumption of such adulterants has been associated with gastrointestinal disturbances and long-term renal and metabolic complications. Edible oils are also widely adulterated, particularly with argemone oil, which poses serious health risks including epidemic dropsy and cardiovascular toxicity (Reddy, 2012; Sharma, 2016).

Spices such as turmeric and chili powder are highly susceptible to adulteration using synthetic dyes, lead salts, and extraneous matter to enhance color and weight (Gupta, 2015; Kumar, 2014). Chronic exposure to these contaminants has been linked to anemia, neurological damage, and increased carcinogenic risk. Adulteration of cereals and grains, often involving physical contaminants, reduces nutritional quality and may cause mechanical injury (Joshi, 2011).

Reports from the Indian Council of Medical Research and the World Health Organization highlight the serious health consequences of prolonged exposure to food adulterants, particularly among vulnerable populations (ICMR, 2018; WHO, 2019). Despite regulatory efforts, consumer awareness of adulteration and simple detection methods remains limited in rural areas (Tripathi, 2009; Jain, 2014). Rapid detection kits recommended by the Food Safety and Standards Authority of India offer cost-effective tools for preliminary screening, though laboratory confirmation remains essential (Agarwal, 2008; FSSAI, 2020). The limited availability of district-specific data underscores the need for localized studies to inform targeted public health interventions.

METHODOLOGY

The present study was conducted as a cross-sectional, field-based investigation to assess the prevalence of food adulteration in rural areas of Buldhana District, Maharashtra. The study focused on commonly consumed food items

sourced from local village markets and examined consumer awareness and vendor practices related to food quality and safety. Simple, cost-effective, and field-applicable detection methods were employed to ensure feasibility in rural settings.

The study was carried out in selected villages of Buldhana District, located in the Vidarbha region of Maharashtra. Villages were chosen based on population size and the presence of active local markets or weekly village markets (haats), which serve as primary food distribution points for rural households. Villages from different blocks of the district were included to ensure geographical representation.

The study population comprised rural households, local food vendors, and food samples collected from village markets. A total of 120 households were selected to assess food consumption patterns and awareness of food adulteration. Additionally, 40 food vendors, including milk sellers, grocery shop owners, oil vendors, and spice sellers, were included to evaluate food sourcing, storage practices, and awareness of food safety regulations. For adulteration analysis, 50 food samples were collected, representing milk, edible oils, grains/cereals, and spices.

A stratified random sampling method was used to select households, while vendors were selected purposively based on the food items sold. Food samples were collected randomly from vendors and, where applicable, from household stocks to reflect actual consumption.

Primary data were collected using structured and pre-tested questionnaires administered through face-to-face interviews. Food samples were collected in clean, labeled containers and analyzed using simple physical, chemical, and observational methods. Milk samples were tested for dilution and chemical adulterants; edible oils were examined for argemone oil; spices were assessed for artificial colours and extraneous matter; and grains were inspected for physical contaminants. FSSAI-approved DART kits were used for rapid field-level detection.

RESULTS

The assessment of commonly consumed food commodities revealed a substantial prevalence of adulteration across all tested categories. Among the analyzed samples, milk showed the highest adulteration rate (35%), followed by spices (25%), edible oils (20%), and grains (15%), indicating widespread compromise of food quality in rural markets of Buldhana District.

Milk samples were frequently adulterated with starch, detergents, and urea, substances commonly added to enhance apparent thickness and shelf life. The observed prevalence of 35% suggests that more than one-third of milk available to rural consumers may pose potential health risks, including gastrointestinal disturbances and long-term renal complications. Given the daily consumption of milk across all age groups, this represents a significant public health concern.

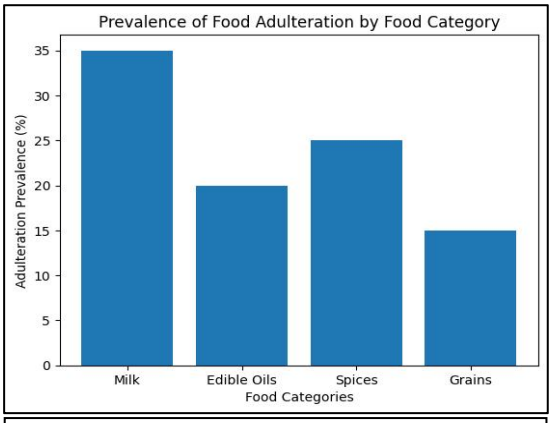
Edible oils demonstrated an adulteration prevalence of 20%, primarily due to the presence of argemone oil and mineral oil. Although lower than milk and spices, this level of contamination is alarming because argemone oil is highly toxic and associated with serious health conditions such as epidemic dropsy and hepatic damage.

Spices exhibited a 25% adulteration rate, with turmeric contaminated by lead salts and chili powder mixed with brick powder. The presence of heavy metals such as lead raises serious concerns due to their cumulative toxicity and association with anaemia, neurological impairment, and increased carcinogenic risk following prolonged exposure.

Grain samples showed a comparatively lower adulteration prevalence of 15%, mainly involving stones, husk, and artificial polishing agents. While these adulterants are less chemically hazardous, they compromise nutritional quality and increase the risk of physical injury and digestive disorders.

Analysis of consumer awareness revealed that 70% of respondents lacked knowledge of basic adulteration detection methods, indicating heightened vulnerability to adulterated food. Vendor responses identified profit-driven motives and weak regulatory enforcement as key factors sustaining adulteration practices.

Food Category	**Adulterants Detected**	**Prevalence (%)**	**Health Risks**
Milk	Starch, detergents, urea	35%	Gastrointestinal disorders, kidney damage.
Edible Oils	Argemone oil, mineral oil	20%	Epidemic dropsy, liver toxicity.
Spices	Turmeric: lead salts Chili powder: brick powder	25%	Anemia, neurological damage, carcinogenic risk.
Grains	Stones, husk, artificial polishing	15%	Physical contamination, reduced nutritional value.
Consumer Awareness	70% unaware of detection methods	-	Increased vulnerability to adulteration.
Vendor Drivers	Profit margins, weak regulation	-	Sustained adulteration practices.



Graph 1. Prevalence of Food Adulteration in Selected Food Categories

Overall, the findings demonstrate a clear gradient in adulteration prevalence, with liquid and powdered foods (milk and spices) showing higher contamination rates than solid foods. As illustrated in Figure 1, milk exhibited the highest level of adulteration, highlighting it as a critical exposure pathway requiring urgent public health intervention.

DISCUSSION

The present findings confirm that food adulteration is widely prevalent in the rural areas of Buldhana District, consistent with trends reported in national and regional studies across India. The high incidence of adulteration in commonly consumed food items underscores the seriousness of the problem in rural markets, where informal supply chains and limited regulatory oversight facilitate the persistence of unsafe practices.

Milk adulteration emerged as an immediate public health concern due to the frequent presence of substances such as starch, detergents, and urea. These adulterants are known to cause acute gastrointestinal disturbances, metabolic stress, and potential renal complications, particularly among children and elderly populations who consume milk regularly. In contrast, the adulteration of spices—especially turmeric—with lead salts represents a more insidious health threat. Chronic exposure to heavy metals is associated with long-term health consequences, including anemia, neurological impairment, and increased carcinogenic risk. The study thus highlights a dual burden of food adulteration, encompassing both acute toxic effects and chronic cumulative health impacts depending on the nature of the adulterant.

Socio-economic factors play a significant role in sustaining adulteration practices in rural settings. Profit-oriented behaviour among small-scale vendors remains a primary driver, as adulteration provides a low-cost method to increase product volume and economic returns. This is further exacerbated by weak enforcement of food safety regulations, infrequent inspections, and inadequate penalties in rural marketplaces. Additionally, low levels of consumer awareness regarding simple adulteration detection methods significantly increase vulnerability, limiting consumers' ability to identify or avoid contaminated food products.

The study also demonstrates the utility of rapid detection kits as effective tools for preliminary screening and community-level awareness. While these kits are valuable for early detection, laboratory-based analytical methods remain essential for confirmatory testing and regulatory enforcement. Incorporating basic food adulteration detection training into rural schools, self-help groups, and community outreach programs could substantially enhance consumer vigilance and promote community participation in food safety monitoring.

CONCLUSION

Food adulteration in rural areas of Buldhana District constitutes a serious public health challenge, with milk, edible oils, and spices identified as the most frequently adulterated food commodities. The high prevalence of adulteration in these staple items significantly increases both immediate and long-term health risks for rural populations.

The findings emphasize the urgent need for targeted consumer awareness initiatives, particularly community-based campaigns conducted in Marathi to ensure effective communication and outreach. Capacity-building programs involving self-help groups, schools, and local organizations can play a crucial role in strengthening early detection and prevention efforts.

Furthermore, strengthening regulatory enforcement mechanisms, including regular inspections and stricter penalties, is essential to deter adulteration practices in rural markets. A comprehensive and integrated approach—combining consumer education, community engagement, rapid detection tools, and effective policy implementation—is critical for mitigating food adulteration and safeguarding public health in the region.

REFERENCES

[1]. Agarwal, R. (2008). Detection kits for food adulteration. Indian Journal of Technology, 16(2), 112–118.
[2]. Banerjee, S. (2011). Food adulteration and consumer protection. Indian Journal of Law and Society, 3(1), 45–52.
[3]. Choudhary, R. (2013). Milk adulteration detection methods. International Dairy Journal, 28(1), 1–6. https://doi.org/10.1016/j.idairyj.2012.10.004

[4]. Deshmukh, S. (2012). Food safety challenges in rural Maharashtra. Journal of Agricultural Extension, 18(2), 89–95.
[5]. Food and Agriculture Organization of the United Nations. (2009). Food safety and adulteration in developing countries. FAO.
[6]. Food Safety and Standards Authority of India. (2020). Manual on food adulteration detection. FSSAI.
[7]. Government of Maharashtra. (2007). Reports on food safety in Vidarbha region. Government Press.
[8]. Gupta, S. (2015). Lead contamination in turmeric: A public health concern. Environmental Monitoring and Assessment, 187(3), Article 178. https://doi.org/10.1007/s10661-015-4415-3
[9]. Hukla, A. (2022). Know your food: A comprehensive review of food adulterants. International Journal of Research and Analytical Reviews, 9(1), 210–218.
[10]. Indian Council of Medical Research. (2018). Health hazards of food adulterants. ICMR.
[11]. Jain, D. (2014). Consumer awareness of food adulteration in Vidarbha. Journal of Rural Development, 33(4), 421–430.
[12]. Joshi, A. (2011). Detection of adulterants in grains. Journal of Food Quality, 34(2), 97–103. https://doi.org/10.1111/j.1745-4557.2011.00363.x
[13]. Kumar, V. (2014). Adulteration in spices: A toxicological perspective. Food Chemistry, 156, 225–231. https://doi.org/10.1016/j.foodchem.2014.01.102
[14]. Kulkarni, S. (2008). Food adulteration in Maharashtra markets. Journal of Social Sciences, 17(3), 201–207.
[15]. Mehta, R. (2010). Food adulteration in India: A review. Indian Journal of Public Administration, 56(2), 345–356.
[16]. Mishra, A. (2015). Food adulteration in rural Maharashtra. Indian Journal of Community Medicine, 40(4), 252–257. https://doi.org/10.4103/0970-0218.164392
[17]. Pantola, P., & Agarwal, P. (2021). Detection of adulteration in spices. International Journal of Applied Research and Innovation, 5(2), 66–72.
[18]. Patel, H. (2013). Food adulteration and public health. Indian Journal of Nutrition, 7(1), 14–19.
[19]. Rao, P. (2007). Food adulteration and its detection. Journal of Analytical Chemistry, 62(6), 567–572. https://doi.org/10.1134/S1061934807060123
[20]. Reddy, K. (2012). Adulteration in edible oils. Food Control, 25(1), 1–6. https://doi.org/10.1016/j.foodcont.2011.10.029
[21]. Sharma, P. (2016). Detection of argemone oil in edible oils. Indian Journal of Public Health, 60(2), 125–129. https://doi.org/10.4103/0019-557X.184548
[22]. Singh, P. (2010). Adulteration in chili powder. Journal of Food Safety, 30(3), 584–591. https://doi.org/10.1111/j.1745-4565.2010.00231.x
[23]. Singh, R., Kumar, S., & Verma, A. (2017). Adulteration in milk and milk products in India. Journal of Food Science and Technology, 54(9), 2674–2683. https://doi.org/10.1007/s13197-017-2734-0
[24]. Tripathi, N. (2009). Consumer perception of food adulteration. Journal of Consumer Studies, 33(4), 412–418.
[25]. World Health Organization. (2019). Food safety in developing countries. WHO.