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Food safety and quality assessment of street foods in Jharsuguda District of Odisha

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Abstract

Street foods consumption is highly popular in India due to its affordability and taste, yet it often raises concerns about food safety and hygiene. This study assessed the microbiological, chemical, and physical quality of selected street foods and beverages collected from vendors in Jharsuguda district, Odisha. Laboratory analyses were conducted in the State Food Testing Laboratory and Kalyani Food Testing Laboratory, Bhubaneswar. The study evaluated food samples for starch, sugar, artificial sweeteners, extraneous matter, added colouring, rancidity, and microbial contamination. The findings revealed the presence of artificial colouring agents, starch, and added sugar in several food items, while reheated oils showed high acid values, indicating poor quality. Ghupchup water exhibited a high microbial load, though *E. coli* was not detected. The results highlight a lack of food safety knowledge and hygiene practices among vendors, underlining the urgent need for training and government intervention to safeguard public health.

Keywords: Street foods, food microbiology, hygiene, artificial colors, food safety

Introduction

Street food vending is a major informal sector activity in India, providing affordable and accessible meals to millions. However, street foods often suffer from poor hygiene standards, which can lead to contamination with harmful microorganisms and chemicals. The World Health Organization (WHO, 2010) [9] states that food vendors require adequate knowledge and training in safe food handling. Improper practices, such as poor hand hygiene, use of contaminated water, and reheating of oils, contribute significantly to foodborne outbreaks (Sharif *et al.*, 2013) [5]. This study focuses on the microbiological and chemical analysis of popular street foods sold in Jharsuguda district, Odisha. It also examines vendor practices, hygiene awareness, and the implications of consuming contaminated food. The findings provide insights into food safety issues in the region and suggest remedial measures.

Objectives of the Study

- To identify microbial contamination, adulteration, and chemical additives present in street foods and beverages
- To assess the hygiene and food-handling practices followed by street food vendors
- To recommend appropriate interventions for improving street food safety in the study area

Methodology

Study Area and Design

The study was conducted in Jharsuguda district, Odisha, focusing on the quality and safety of commonly consumed

street foods and beverages. A cross-sectional survey-based sampling method was adopted to collect representative food and water samples from local vendors.

Sample Collection

Food samples were collected in clean, sterilized containers, properly labeled, and immediately transported to the laboratory under hygienic conditions to avoid contamination. The selected items represented high-consumption food groups:

- **Cooked Food Items:** Chowmin, Manchurian, Food Gravy
- **Condiments:** Cooking Oil, Tomato Ketchup, Chilli Sauce
- **Beverages:** Cold Drinks, Tropicana Fruit Juice
- **Water Samples:** Ghupchup (Panipuri) Water, Supply Water

Laboratory Analysis

All samples were analyzed at the State Food Testing Laboratory and Kalyani Food Testing Laboratory, Bhubaneswar, following the Food Safety and Standards Authority of India (FSSAI) manual of methods and AOAC International guidelines.

1. Food Samples (Cooked foods, Sauces, Beverages)

- Starch test for detection of adulterated starch.
- Sugar test for assessing added sugar concentration.
- Artificial sweetener analysis for saccharin, dulcin, and cyclamate.

- Extraneous matter examination to detect physical contaminants.
- Added coloring matter test for identifying non-permitted synthetic dyes.

2. Cooking Oil

- Butyro-refractometer reading (40 °C) to check purity.
- Saponification value, iodine value, and acid value to determine chemical composition and stability.
- Tests for argemone oil and mineral oil to detect harmful adulterants.

- Rancidity test to assess oxidative spoilage.
- Added coloring matter test for non-permitted dyes.
- Bellier test (turbidity temperature, acetic acid method) for detecting oil adulteration.

3. Water Samples (Panipuri and Supply Water)

- Microbiological analysis: *Escherichia coli*, total coli form, total plate count, yeast, and moulds.
- Chemical analysis: Organic and inorganic matter content.

Results and Discussion

Table 1: Chemical and Physical Quality Analysis

Food Samples	Findings
Chowmin	Positive for starch and artificial colouring
Manchurian	Positive for starch and artificial colouring
Food Gravy	Positive for starch and artificial colouring
Tomato Ketchup	Positive for sugar and starch
Chilli Sauce	Positive for sugar and starch
Cooking Oil	Acid value >6.0; poor quality; Bellier test 27 °C; rancidity/argemone negative
Cold Drinks	10.2% sugar by volume; carbon dioxide positive
Tropicana Juice	Additional sugar detected; formol number positive

The chemical and physical quality analysis of the selected food samples revealed significant concerns regarding adulteration, poor nutritional quality, and deviation from established food safety standards. The samples of chowmein, manchurian, and food gravy were all found positive for starch and artificial coloring, suggesting that these fast food items are commonly adulterated to enhance their texture, bulk, and visual appeal. The use of synthetic colors in particular is problematic, as many dyes are non-permitted and may cause allergic reactions, hyperactivity in children, and even long-term health hazards.

Such findings align with the observations of Sahu, who reported that street foods and fast foods often contain starch and prohibited colorants for cost reduction and consumer attraction. Similarly, the samples of tomato ketchup and chilli sauce were positive for both sugar and starch, indicating that these widely consumed condiments are diluted with adulterants, thereby reducing their natural nutritive value. This corresponds with the findings of Patel and Desai, who demonstrated that commercial ketchups and sauces frequently contain added starch and sugar to compensate for low tomato content and to extend shelf life. The presence of these substances not only decreases the nutritional quality but also contributes to excessive sugar intake among consumers, which has been linked to metabolic disorders. The cooking oil sample presented particularly concerning results: the acid value was found to be greater than 6.0, which is significantly above the acceptable limit of 3.0 as per FSSAI standards. A high acid value reflects hydrolytic rancidity and indicates that the oil is of poor quality, possibly due to repeated heating or improper storage. While rancidity and argemone tests were negative, confirming the absence of immediate toxic contaminants, the poor quality revealed by the acid value suggests potential long-term health risks if consumed regularly.

These findings are consistent with those of Mishra, who documented that many food vendors use reused and low-quality oils with high acid values, increasing the risk of

gastrointestinal problems, oxidative stress, and cardiovascular disease. The analysis of cold drinks revealed a sugar concentration of 10.2% by volume, in addition to the presence of carbon dioxide. This result highlights the excessively high sugar content in soft drinks, which contributes substantially to daily sugar intake and increases the risk of obesity, type-2 diabetes, and dental caries. Singh and Gupta (2017) ^[7, 3] reported similar findings in their study, observing that most commercially available soft drinks contained between 8 and 12% sugar, placing the current result well within that range and supporting the view that cold drinks are a major dietary source of added sugars. The Tropicana juice sample, marketed as a natural fruit beverage, was found to contain additional sugar and a positive formol number, which indicates adulteration and possible use of preservatives. This undermines the credibility of “100% natural” claims and highlights misleading practices in the packaged juice industry. Kumar observed parallel results in their study, showing that many branded fruit juices contained added sugar and chemicals despite marketing campaigns emphasizing purity and health benefits. The detection of additional sugar not only misrepresents the product but also contributes to the same health issues associated with soft drinks, including excessive calorie intake and metabolic complications. Taken together, the results of this study reveal a widespread practice of adulteration and substandard quality across multiple categories of foods and beverages, ranging from street foods to packaged products.

Comparisons with other research reinforce that these findings are not isolated, but rather part of a broader pattern of food adulteration prevalent in many regions of India and beyond. Such practices not only compromise consumer trust but also pose serious public health risks, as they increase the intake of sugars, synthetic additives, and degraded oils. The consistency of these findings with earlier studies underscores the urgent need for stronger monitoring, stricter enforcement of FSSAI standards, and increased consumer awareness. Educating the public about the risks of

adulterated food and promoting safe food practices could reduce the demand for such products, while regular inspections and penalties for violators could discourage producers and vendors from resorting to adulteration. The present analysis highlights that although some samples

did not contain immediately toxic adulterants, most exhibited quality deviations that make them unsafe for long-term consumption, echoing the concerns raised in prior research and reinforcing the call for comprehensive food safety interventions.

Table 2: Microbiological Analysis of Water Samples

Sample	Total Plate Count (cfu/ml)	Yeast & Moulds (cfu/ml)	<i>E. coli</i>	Other Findings
Panipuri Water	910,000	10	Not detected	High microbial load due to handling
Supply Water	Not detected	Not detected	Not detected	No organic/inorganic matter detected

The microbiological analysis of water samples revealed a striking difference between the panipuri water and the supply water, highlighting the importance of hygiene and safe handling in maintaining potable water quality. The panipuri water, collected from street-vended food preparation, exhibited a total plate count (TPC) of 910,000 cfu/ml, which indicates an extremely high microbial load and places the water far outside the safe limits recommended for human consumption. Although yeast and moulds were present only in low numbers (10 cfu/ml) and *E. coli* was not detected, the presence of such a large microbial population reflects poor handling, exposure to environmental contamination, and unhygienic storage conditions. This observation is consistent with earlier studies such as those by Tambekar *et al.* (2009) [8], who examined panipuri water sold by vendors in Maharashtra and found TPC levels ranging from 10^5 to 10^7 cfu/ml, similar to the present results. Their findings linked the high microbial contamination directly to inadequate personal hygiene among vendors, lack of clean water for preparation, and repeated exposure of food to dust and open air. Similarly, Barro *et al.* (2006) [11] studied water used by street food vendors in African urban centers and reported heavy bacterial contamination, often caused by the use of non-potable sources and improper storage containers, mirroring the present observation in panipuri water. The absence of *E. coli* in the current sample is somewhat reassuring, as it suggests that fecal contamination may not be a major issue in this particular case.

However, other studies, including Singh *et al.* (2010) [7], documented that *E. coli* was frequently present in street food water samples, often serving as an indicator of fecal pollution and poor sanitation practices in densely populated areas. Therefore, while the lack of *E. coli* detection in this sample reduces the immediate risk of enteric infections like dysentery and diarrhea, the very high TPC still reflects significant microbial contamination that can cause food borne illnesses such as gastroenteritis. In contrast, the

supply water showed no detectable microbial contamination: TPC, yeast and mould counts, and *E. coli* were all absent, and there was no evidence of organic or inorganic matter. This indicates that the supply water was well within safe limits for potable water, aligning with World Health Organization (WHO) and Bureau of Indian Standards (BIS) guidelines, which recommend zero tolerance for *E. coli* and negligible microbial loads in drinking water.

These findings also agree with those of Gupta *et al.* (2015) [3], who reported that municipal water samples in urban areas, when properly treated and supplied through regulated pipelines, generally meet microbiological safety standards. The clear contrast between the safe supply water and the highly contaminated panipuri water underscores the role of post-supply handling in determining microbial quality. Even if the source water is safe, contamination can occur during preparation and storage at the vendor level, especially when containers are uncovered, utensils are unclean, and water is exposed to the external environment. This pattern has been emphasized in multiple studies across India and other countries, where street-vended foods and beverages were often found unfit for consumption due to microbial loads far exceeding permissible limits. The consistency of these findings across diverse regions highlights that microbial contamination in street-vended water is not an isolated incident but a widespread public health concern.

The present analysis demonstrates that while supply water was microbiologically safe, the panipuri water was highly contaminated due to poor hygiene and handling practices. These results echo the concerns raised by previous research, which collectively point to the urgent need for stricter monitoring of street food vendors, enforcement of hygiene regulations, and awareness campaigns to educate both vendors and consumers. Ensuring safe handling of water at the point of use is critical, because even clean supply water can quickly become unsafe when exposed to unsanitary conditions.

Table 3: Findings on the basis of parameters and observations

Parameters	Observations
Artificial colouring	Present in chowmin, manchurian, food gravy
Added sugar	Detected in ketchup, chilli sauce, Tropicana juice, cold drinks
Starch	Positive in chowmin, manchurian, gravy, ketchup
Cooking oil quality	Poor (acid value >6.0, unsafe for repeated use)
Microbial contamination	Very high in ghupchup water; absent in supply water
<i>E. coli</i>	Not detected in either water sample

The analysis of food and water samples revealed significant issues of adulteration, poor quality, and microbial contamination. Artificial coloring was found in chowmein, manchurian, and food gravy, indicating the use of synthetic

dyes to enhance appearance, a practice also reported by Sahu, who highlighted associated health risks such as allergies and hyperactivity. Added sugar was detected in ketchup, chilli sauce, Tropicana juice, and cold drinks. Cold

drinks contained 10.2% sugar, which aligns with Singh and Gupta (2017) ^[7, 3], who observed 8-12% sugar in popular brands. Tropicana juice, despite claims of being natural, contained extra sugar, consistent with Kumar, who reported misleading nutritional claims in packaged juices.

Starch adulteration was observed in chowmein, manchurian, gravy, and ketchup, added to increase bulk and thickness but reducing nutritional quality, a finding also noted by Patel and Desai. The cooking oil showed an acid value above 6.0, exceeding the FSSAI limit of 3.0, indicating poor quality and unsuitability for repeated use, similar to results by Mishra *et al.* (2018) on reused street-vendor oils.

The microbiological analysis revealed extremely high contamination in panipuri water (910,000 cfu/ml), though *E. coli* was absent. Tambekar *et al.* (2009) ^[8] similarly found unsafe microbial loads in panipuri water. In contrast, supply water showed no microbial contamination, aligning with WHO/BIS standards and findings by Gupta *et al.* (2015) ^[3]. While supply water was safe, most food samples were adulterated or of poor quality, emphasizing the need for stricter monitoring and better hygiene practices.

Conclusion

The results demonstrate widespread use of artificial coloring and starch in fast foods, raising concerns about long-term health effects, such as obesity, diabetes, and cardiovascular disease (Erik E.J.G. Eller, 2011) ^[2]. Artificial colors have

also been linked to behavioral problems like hyperactivity and irritability (Shim, 2017) ^[6]. The high microbial load in panipuri water indicates contamination during handling and storage, posing a risk of food borne illness.

Cooking oil quality was unsatisfactory, as reheating increases toxic compounds and Trans fats, leading to health hazards. Despite being a favorite among adolescents, frequent consumption of contaminated foods places consumers at high health risk. The lack of training among vendors is a significant factor behind unsafe food handling practices. Previous studies (Loukieh *et al.*, 2018) ^[4] highlight that government negligence and a lack of awareness programs exacerbate the problem.

Street food vending plays an important role in the local economy, but poor hygiene and unsafe practices compromise food quality. This study found adulteration, artificial coloring, added sugars, and microbial contamination in street foods of Jharsuguda district. Immediate interventions are needed, including: training programs for food vendors on hygiene and sanitation, strict monitoring of food quality by local authorities and awareness campaigns for consumers on safe food practices. Improving vendor knowledge and enforcing regulatory measures are crucial for ensuring food safety and protecting public health.

Recommendations

Issue Identified	Recommended Intervention
Use of artificial colouring	Enforce regulations on approved food colours; conduct random inspections
High sugar content	Educate vendors on health risks; encourage use of natural sweeteners
Presence of starch adulteration	Routine monitoring and penalties for adulteration
Poor oil quality (acid value)	Promote safe oil handling; ban reheating beyond limits; provide awareness programs
High microbial load in water	Ensure access to potable water; encourage vendors to use boiled/filtered water
Lack of vendor training	Organise regular workshops on hygiene, sanitation, and food safety
Weak consumer awareness	Public campaigns on risks of unsafe street foods; encourage consumers to demand safe food

Policy-Level Recommendations

Government authorities should establish clear policies that strengthen food safety monitoring at the district and state levels. The following key policy measures are recommended:

- Creating a dedicated task force to inspect street food vendors regularly.
- Developing licensing systems tied to basic hygiene training.
- Providing infrastructure support, such as a clean water supply and waste disposal facilities for vendors.
- Launching mass awareness campaigns to educate both vendors and consumers on food safety.
- Partnering with local health departments and municipal bodies for routine microbiological testing of street foods.

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