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Microbial profiling of street foods in Dehradun: Analysing safety, spoilage and gastrointestinal survivability

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Abstract

The purpose of this study was to assess the overall microbial status, including food-borne pathogens and spoilage bacteria**.** Foodborne illness and microbial food deterioration are the two biggest issues facing the food business when it comes to food shelf life. The primary and significant cause of fruit deterioration is bacteria. The bacterial isolates were identified using microscopic examination, culturing on selective media and biochemical testing. The identified species included *Campylobacter jejuni, Bacillus cereus, Clostridium perferinges* and *Klebshiella pneumoniae.* Poor personal hygiene can contribute to the spread of harmful bacteria from the environment and human hands to food, posing a risk to human health. This study was conducted to assess the microbiological quality of various food items in Dehradun, Uttarakhand, India. To identify microbial contamination, food samples were analyzed using the pour plate method and biochemical tests. These findings revealed a significant presence of microorganisms that can cause food borne illnesses.

Keywords: Foodborne illness, microbial spoilage, personal hygiene, pathogenic bacteria, human health, contamination and Gastrointetinal survivability

Introduction

Foodborne illnesses are a global public health, economic and social burden. According to estimates from the World Health Organization (WHO). There are 31 microorganisms are responsible for 600, 000 foodborne illnesses and 420, 000 fatalities annually [1, 2]. Food spoilage can happen during storage and transportation, whether the products are cereals, tubers, fruits, raw meats, cow milk and vegetables. Contamination may also occur at various stages such as harvesting, handling, transportation or storage, especially if hygiene standards are not properly followed. Spoilage is mainly caused by microorganisms in two ways: first, through the metabolic activities of living microbial cells that break down food components; and second, through the action of enzymes both inside and outside of microbial cells- that can alter the properties of food even in the absence of live cells, leading to spoilage [3]. Food spoilage can result from physical, chemical or microbial deterioration. This often leads to the production of metabolites that cause undesirable flavours or changes in texture, making the food unacceptable for consumption [4]. Microorganisms can contaminate food at any stage of processing. Human handling an always carries the risk of introducing pathogens, as well as contamination from air, dust, water and ingredients. From production to consumption, food comes into contact with many people, and humans are a common source of harmful microorganism that can cause foodborne illnesses, especially in ready-to-eat fruits and some street foods. In fruits and vegetables, microorganisms may come from various sources such as soil, water, air, animals and insects. Street food is often made in open environments, which increases the risk of contamination, especially when its near open drains, as is common in many developing countries like India. These drains can carry dirty water containing harmful bacteria from human waste, including those that causes diarrhoea. Additionally, the water used for cooking and cleaning is often not filtered, making it easy for diseases like cholera and typhoid to spread. Many street vendors many not wash their utensils properly or they might use contaminated water for cleaning, further raising the risk of infection. On top of that, raw ingredients are frequently left uncovered, attracting flies and insects that can also spread bacteria and compromise food safety. Some of the food items like fruit juices, momo chutney and golgappa water should be avoided, as they are typically prepared in open environments and stored before being served, which can lead to contamination by harmful pathogens. Additionally, the serving utensils such as glasses are often not properly cleaned ray be washed with contaminated water, further increasing the risk of infection.

Enteric pathogens are often present in fruits and vegetables when contaminated water or animal and human waste is used for fertilization or irrigation [3]. A large number of these microbes lead to different kinds of product deterioration. When a food's inherent flavour, texture and nutritional

content are lost, it spoils and becomes unsafe for human consumption [5]. Envionmetal issues have led to the evolution of food-borne bacterial diseases and increased human susceptibility to illneses [6]. As a result of eating food contaminated by microorganisms, foodborne illness are typically linked to acute, mild and self-limiting gastroenteritis with symptoms like nausea, vomiting and diarrhoea. A number of chronic consequences can arise from foodborne infection involving illnesses that impact the immune, musculokeletal, cardiovascular and respiratory systems [7]. Street vendors and small restaurants lack refrigeration, and food items left out at room temperature for extended periods of time might attract harmful microorganisms that can cause food poisoning which is a very serious risk. The amount of microganisms are present in the foods are harmful and beneficial also. Food poisoning is caused by the bacteria, viruses, parasite protozoa etc. These microorganisms can be spread from one food to another by using the same cutting board, knife or other utensils repeatedly without cleaning them between the uses. Fully cooked food can also become re-contaminated if it comes into contact with raw food or drippings from raw food that contain harmful pathogens. Many of the bacteria present in contaminated food are very difficult to control and in some cases, they can multiply to levels that may pose serious health risks, including death [8]. Meat can carry bacteria an antibiotic resistance genes that may be transmitted to humans, potentially causing infections that are difficult to treat, including those resistant to beta-lactam antibiotics. Even if the meat is initially free from contamination, it can become contaminated during processes such as barbecuing. This includes bacteria like *Staphylococcus aureus* carrying methicillin-resistant genes (MRSA), which can reach consumers due to poor hygiene practices during food preparation [9].

Developing nations have been burdened by the gram-negative bacterium *Salmonella typhi*, which causes typhoid fever. Typhoid fever is thought to be responsible for 21.7 million illnesses and 216, 000 fatalities worldwide, according to a WHO assessment from 2000. A number of factors can lead to street food becoming contaminated with *S.typhi*, including utensils that facilitate cross contamination, dirty vending locations, tap water used for food preparation, waste and garbage dumped nearby that draws rodents and insects that could spread food borne pathogens, flies that occasionally land on food and finally, vendors handling food with their bare hands [10]. *Klebshiella pneumonia* is a significant foodborne pathogen that can cause pneumonia, septicaemia, liver abscesses and diarrhea in human. This bacteria is commonly found in humans as well as in animal feces. Improper sewage disposal can contaminate soil with *K. Pneumoniae*, which has consequently been detected in vegetables, raw meat, raw milk, fish and other food items [11].

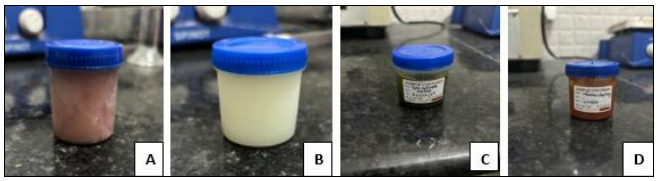
Materials and Methods

To determine the availability of street foods, different street food locations were randomly selected from Dehradun city and the survey was conducted between February to May.

A-Chicken; B-Milk; C- Golgappa water; D-Momo chutney

Fig 1: Location from where samples were collected

Four different kind of popular street food items were collected from street vendors. The samples were Raw chicken, Raw milk, Golgappa water and Momo chutney.



A-Chicken; B-Milk; C- Golgappa water; D-Momo chutney

Fig 2: Different types of street food samples

Microbial Analysis

For the microbiological analysis of food samples, each sample was first mixed thoroughly to ensure uniformity. Serial dilutions (10^1 to 10^6) were then prepared to reduce the microbial load for accurate analysis. The diluted samples were plated using the pour plate method. Once the agar solidified, the Petri dishes were incubated in an inverted position at 37°C for 24 hours. After incubation, the plate showing a countable number of colonies was chosen, and the colonies were counted. Selected isolated colonies were then transferred onto nutrient agar slants for preservation and further identification**.**

Identification and Biochemical analysis of the isolated colonies

The isolated colonies were morphologically characterized by observing their colonial growth, colour, size, shape and pigments. After that different biochemical test were performed. In biochemical test, catalase, coagulase, indole, MR-VP, carbohydrate fermentation test, citrate utilization and urease test were performed.

The biochemical test and gram staining were done in accordance to standard procedure [12].

Gram staining

Gram staining is a differential staining technique used to classify bacteria into two groups: Gram-positive and Gram-negative. The method relies on the structural differences in their cell walls. Gram-positive bacteria have a thick cell wall that strongly retains the crystal violet dye when combined with iodine, so they remain purple even after decolorization steo. In contrast, While Gram-negative bacteria lose the violet stain during decolorization with alcohol and appear colorless until counterstained with safranin, which gives them a pink appearance.

Catalase test

For catalase test, a glass slide was held at an angle, and a few drops of 3% hydrogen peroxide were gently added over

the bacterial culture. The formation of bubbles indicated a positive result, confirming the presence of the enzyme catalase. If no bubbles were observed, the test was considered negative, showing the absence of catalase activity of the bacteria.

Coagulase test

For coagulase test, a loopfull of bacteria was taken and placed over the surface of sterile glass slide. 2-3 drops of freshly collected plasma was placed over bacterial smear. The formation of clums indicates a positive result. If clumping was not observed, the test was considered negative.

IMViC

Indole test

Tryptophan is an essential amino acid that can be broken down by certain bacteria through the action of the enzyme tryptophanase. This enzymatic process produces metabolic by products such as indole, pyruvic acid, and ammonia. To detect the presence of indole, Kovac's reagent is added to the culture. If indole is present, then it forms a cherry red color at the surface. The appearance of this red color indicates a positive indole test. If no red color is seen, it means tryptophan was not broken down, indicating a negative result.

Methyl Red test

Every intestinal microbe produces organic acids and ferments glucose. In the pH range of 4, the methyl red indicator used in this MR test will become red, indicating a Positive result. The indicator becomes yellow and the test is negative at a pH of 6, which still shows the presence of acid but a lesser quantity of hydrogen ions.

Voges Proskauer test

The Voges-Proskauer (VP) test is used to determine whether certain microorganisms can produce neutral end products, like acetyl methyl carbinol, during the breakdown of glucose. The test uses Barritt's reagent, which is a combination of alcoholic alpha-naphthol ($C_{10}H_7OH$) 5% and potassium hydroxide (KOH) 40%. For detection, the acetyl methyl carbinol must be oxidized into a compound called diacetyl. This reaction takes place in the presence of alpha-naphthol as a catalyst and a guanidine group found in the peptone of the MR-VP medium. When this reaction occurs, it produces a pink-colored complex, giving the medium a rose hue indicating a positive result. If no pink colour is observed then it indicate a negative result.

Citrate Utilization test

Some microbes can use citrate as a carbon source for energy when lactose or fermentable glucose are not available. This capability relies on the presence of citrate permease enzyme, which makes it easier for citrate to move across cells. The medium turns alkaline during this process, and the carbon dioxide produced, reacts with sodium and water to produce sodium carbonate, an alkaline by product. The bromothymol blue indicator that is introduced into the medium turns from green to prussian blue when carbonate is present. The presence of growth on the slants' surface, turn bluish in colour, indicates a citrate-positive culture after incubation. No growth will be visible in the slant indicate negative, and the medium will stay green.

Carbohydrate Fermentation Test

Carbohydrate fermentation tests are used to determine that whether microorganisms can break down sugars like glucose, sucrose, or lactose under anaerobic conditions or not. During this test, an inverted Durham tube is placed inside the test tube to capture any gas produced during fermentation process. The fermentation medium contains nutrient broth, a specific carbohydrate, and a pH indicator called phenol red. At a neutral pH of 7, phenol red appears red, but if the microorganism produces organic acids, the pH drops to 6.8 or lower, turning the medium yellow. Gas production is indicated by the presence of a bubble inside the Durham tube.

Urease test

The urease test is a biochemical test used to identify microorganisms that can break down urea, often seen in those associated with urinary tract infections. The test medium either a broth or agar contains urea and phenol red, a pH indicator. Microorganisms that produce the enzyme urease can break down urea in the presence of water, releasing ammonia and carbon dioxide. The ammonia reacts with water and carbon dioxide to form ammonium carbonate, which increases the pH of the medium. As the environment becomes alkaline, the phenol red indicator changes from its original orange-yellow colour to a bright pink, indicating a positive urease result. If no colour change is observed then the test shows negative result.

Antibiotic Susceptibility test (Kirby-Bauer Disk diffusion method)

The disk diffusion sensitivity test, also known as the Kirby-Bauer method, is a straightforward and widely used technique to determine the effectiveness of antibiotics against specific bacteria. In this method, antibiotic-impregnated paper disks are placed on the surface of a solidified agar plate that has been evenly inoculated with a standardized bacterial suspension using a sterile cotton swab. The medium used for this test is Mueller-Hinton agar. The antibiotic disks are carefully placed on the inoculated surface using sterile forceps, ensuring full contact with the agar. The plates are then incubated at 35–37°C for 18–24 hours. After incubation, the results are interpreted by observing zones of inhibition around the antibiotic disks, which indicate the bacteria's susceptibility or resistant to the antibiotics [13].

Microbial Spoilage test

Microbial spoilage test is used to detect and assess the presence of microorganisms responsible for the spoilage of food products. This test helps identify spoilage-causing bacteria, yeasts, and molds that affect the quality, safety, and shelf life of food. By using proper incubation conditions, and microbial enumeration techniques, we can isolate and quantify these organisms. The test is essential in food safety and quality control as it aids in determining the microbial load and potential risk associated with consumption. Understanding microbial spoilage also allows food producers to improve preservation methods,

packaging, and storage conditions to minimize spoilage and extend product longevity. For Microbial Spoilage test Sterile Tomatoes are taken and Aseptically the isolates bacterial colonies are injected into it for obsewrving their spoilage potential.

Beta-Hemolysis test

The principle of beta-hemolysis test is based on the ability of certain bacteria to produce hemolysin, which are exotoxins that completely lyse red blood cells (RBCs) in blood agar. This results in a clear, transparent zones around the colonies, indicating complete hemolysis, if green colour colonies are formed then it called as Partial hemolysis while no colour change of the media and the colonies were observed then it is no hemolysis.

Bile Salt tolerance test

The bile salt tolerance test is used to evaluate the ability of microorganisms especially enteric bacteria to survive and grow in the presence of bile salts. Bile salts are naturally present in the human intestine and can have an inhibitory effect on microbial growth. Microorganisms that are tolerant to bile salts are more likely to survive and function effectively in the gastrointestinal tract and cause infection. The test assesses the organism's resistance by measuring its growth in a medium containing bile salts, compared to a control medium without bile. In the bile salt tolerance test, a bacterial culture is inoculated into two tubes one containing nutrient broth with bile salts (usually 2%) and the other with plain nutrient broth as a control. Both tubes are incubated at 37°C for 18–24 hours. After incubation, bacterial growth is observed by checking the turbidity or measuring optical density. If the organism shows visible growth in the bile salt-containing medium, it indicates bile salt tolerance, suggesting the microorganism can potentially survive in the intestinal environment.

Biofilm formation test

The purpose of the biofilm formation test using crystal violet staining is to determine whether a bacterial strain can adhere to a surface and produce a biofilm (a sticky, protective layer made of bacterial cells and extracellular substances). This ability is important because biofilm forming bacteria are often linked to persistent and long term infections and show increased resistance to antibiotics and immune responses. This test is also valuable in food safety, water treatment, and industrial systems, where biofilms can cause contamination, clogging, or damage. By using crystal violet stain and visualize the attached bacterial layers on the surface of the test tube, we can assess how strongly a bacterium can form biofilms.

Results and Discussion

All the street food sample were aseptically collected from the Dehradun Prem Nagar and Suddhuwala area and the collected samples were Chicken, Milk, Golgappa water and Momo chutney.

Gram staining

The gram staining of all the 4 samples reveals that in Chicken, Gram negative rod shaped bacteria, in Milk-Gram Positive rod shaped bactria, in Momo chutney- Gram positive rod shaped bacteria and in Golgappa water two bacterias were isolated, wherein one was gram positive rod shaped bacterias and another was Gram negative bacteria were present. This technique was previously used to identify the two large groups of bacteria Gram +ve and Gram –ve bacteria [14].

Table 1: Colony morphology of the bacterial isolates

Sl. No.	Character	A	B	C	D
1	Size	1-2 mm	2-3 mm	1-2 mm	1-2 mm
2	Shape	Circular	Circular	Circular	Cirular
3	Texture	Smooth	Smooth	Smooth	Smooth
4	Margin	Regular	Regular	Regular	Irregular
5	Elevation	Convex	Convex	Flat	Convex
6	Gram's Character	-ve rod	-ve rod	-ve rod	+ve rod

A-Raw chicken; B- Raw milk; C-Golgappa water; D-Momo chutney

Biochemical test

There were several bicemical test performed including, Coagulase, Catalse, Indole, MR-VP, Cabohydrate fermentation test, Urease test and Citrate utilization test. All the isolated bacterias were citrate positive, Coagulase negative, Calatase positive, Indole negative. The biochemical test reveals that the bacteria that were isolated from Chicken, Milk, Momo chutney and Golgappa water belongs to the family of *Campylobacteriaceae, Bacillaceae, Enterobacteriaceae* and *Clostridiaceae*. It showed that *Campylobacter jejuni, Bacillus cereus, K. Pneumoniae,* and *Bacillus spp*. may be present in the isolated samples. The presence of these species suggested that the water and container is used for preparing and storing of these sample were contaminated. The food samples obtained from the vendors were more contaminated as the samples were exposed to filthy filled with flies and wastes. Same types of bacteria was previously reported in previous researchs and reports [15].

Table 2: Biochemical test result

Sl.no.	Name of test	A	B	C	D
1	Catalse	+ve	+ve	+ve	+ve
2	Coagulase	-ve	-ve	-ve	-ve
3	Indole	-ve	-ve	-ve	-ve
4	MR	-ve	-ve	-ve	-ve
5	VP	-ve	-ve	-ve	-ve
6	Citrate	+ve	+ve	+ve	+ve
7	Carbohydrate	Gas, Acid	Gas, Acid	Gas, Acid	Gas, Acid
8	Urease	-ve	-ve	-ve	-ve

A-Raw chicken; B- Raw milk; C-Golgappa water; D-Momo chutney

Bile Salt Tolerance test

The result of the bile salt tolerance test reveals that all the bacteria grow properly in the presence of 2% bile salt. Evaluation of bile salt tolerance of bacterial isolates were recorded on the (Table 3) and (Figure 3). The test reveals that the most resistant strain of 2% bile salt concentration was sample A and C that belongs to *C. jejuni* and *K. pneumoniae*, while sample B and D were sensitive to 2% bile salt concentration. It seems that sample A and C bacterias were grown properly in the presence of bile salt while other strains couldn't survive at 2% bile

concentration. From the above study it is found that the bacterial isolates from sample A and C can easily survive in the gastrointestinal tract where the concentration of bile is between 0.2-3% (wt/vol). Some previous studies or investigation gives the evidence that some bacterial have the ability to tolerate the bile salt [16].

Table 3: Bile Salt tolerance test

Sl. No.	Samples	Value of control (650nm)	Value of test (650nm)
1	A	0.8784	0.6256
2	B	0.7930	0.5281
3	C	0.9233	0.8474
4	D	0.7790	0.5474

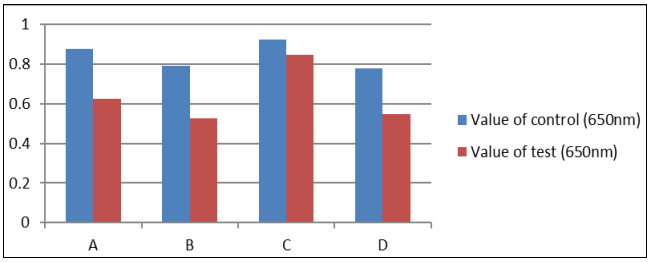


Fig 3: Graphical representation of Bile salt tolerance test

Antibiotic Senstivity test

The antibiotic sensitivity test is used to determine that whether the bacteria were growing in the presence of the particular antibiotic or they are senstive to that. Evaluation of antibiotic susceptibility test of different bacteria were recorded in the (Table 4) and (Figure 4). In this study it was found that some bacterial isolates were sensitive and some wee resistant to particular antibiotics.

Campylobacter jejuni isolated from Chicken, was sensitive to Amicacin, Imipenem, Gentamycin and Ciprofloxacin while it is resistant to Tetracycline.

Bacillus cereus isolated from Milk, was sensitive to Amicacin, Imipenem, Gentamycin and Tetracycline but was resistant to Ciprofloxacin.

K. pneumoniae isolated from Golgappa water was sensitive to Amicacin, Imipenem, Ciprofloxacin and Tetracycline but was resistant to Gentamycin.

Bacillus spp. isolated from Momo chutney was sensitive to all the five antibiotics, including Amicacin, Imipenem, Gentamycin, Ciprofloxacin and Tetracycline.

The antibiotic susceptible profile of some common foofborne pathogens are previously recorded in several studies and reports [17, 20].

Table 4: Antibiotic Susceptibility test

Name of Bacteria	Amicacin	Imipenem	Gentamycin	Ciprofloxacin	Tetracycline
Campylobacter jejuni	18 ± 0.3mm	23± 0.2 mm	22 ± 0.27 mm	29 ± 0.1 mm	NA
Bacillus cereus	18 ± 0.32mm	20 ± 0.4mm	29 ± 0.18 mm	NA	16 ± 0.4 mm
K. pneumoniae	17 ± 0.5 mm	29 ± 0.2mm	NA	22 ± 0.3 mm	18 ± 0.3 mm
Clostridium perfringens	18 ± 0.4 mm	NA	18 ± 0.37 mm	19 ± 0.4 mm	NA

Fig 4: Zone of inhibition

Beta Hemolysis Test

Hemolysis refers to the breakdown of red blood cells, observed on blood agar plates and is categorized into three types: alpha, beta and gamma hemolysis.

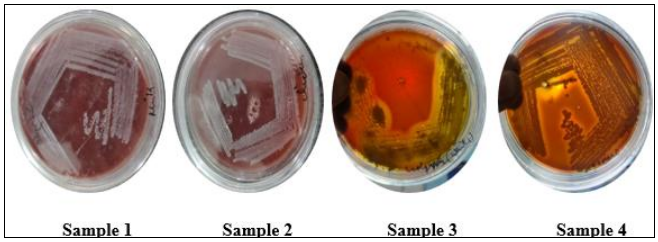
Alpha hemolysis appears as a greenish or brownish discoloration around the colonies due to partial lysis of red blood cells. Beta Hemolysis characterized by a clear, colourless zone surrounding the colonies, indicating complete lysis of red blood cells and Gamma Hemolysis appears no changes in the blood agar surrounding the colonies, indicates the absence of hemolytic activity.

In this study the hemolysis test was conducted on five different samples revealed varried patterns of red blood cell lysis, indicating the possible presence of different bacterial species. Evaluation of Beta hemolysis test of different bacteria were recorded in the (Table 5 and Figure 5). The Bacterial isolate of sample 3(Golgappa water) and Sample 4 (Momo chutney) exhibited beta hemolysis, characterized by a clear zone around the colonies, suggesting the presence of strongly hemolytic and potentially pathogenic bacteria but the bacterial isolates of Sample 1 (Chicken), Sample 2 (Milk) shown Gamma hemolysis means no hemolysis where a lack of hemolysin production and a possible presence of non-pathogenic bacteria. Several studies gives an evidence that some bacteria isolated from street food have the ability to lyse the red blood cell [18].

Table 5: Result interpretation of Beta Hemolysis test

Sl.no.	Sample name	Hemolysis		
		Alpha	Beta	Gamma
1	Sample 1	-	-	+
2	Sample 2	-	-	+
3	Sample 3	-	+	-
5	Sample 4	-	+	-

+ (hemolysis, clear zone around the colonies); - (no hemolysis, no clear zone observed)



sample 1- chicken; sample 2- milk; sample 3- golgappa water; sample 4- momo chutney

Fig 5: Beta-Hemolysis test on blood agar

Microbial Spoilage test

This test is performed to check that the bacteria causing deterioration, spoilage or contamination of food products**.** By performing this test, food manufacturers can detect early signs of spoilage, identify the specific organisms responsible for the spoilage and take some preventive measures in storage, processing or packaging. Evaluation of microbial spoilage test of different bacteria were recorded in the (Figure 6-7).

The results of the microbial spoilage test indicate that all the isolated bacterial strains were capable of causing spoilage in various food items such as tomato. The isolates obtained from golgappa water and momo chutney demonstrated a rapid spoilage effect, spoiling and contaminating the food samples within 24 hours. In contrast, the remaining isolates exhibited a slower spoilage rate, taking between 48 to 60 hours. This variation in spoilage time suggests differences in the metabolic activity and virulence of the microbial strains. Early detection and control of such spoilage-causing microbes are crucial for maintaining food safety, extending shelf life, and minimizing food waste.

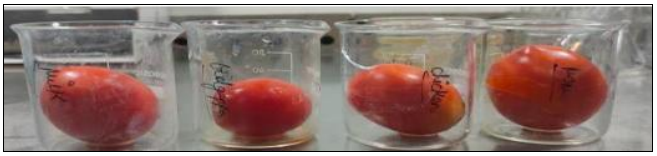
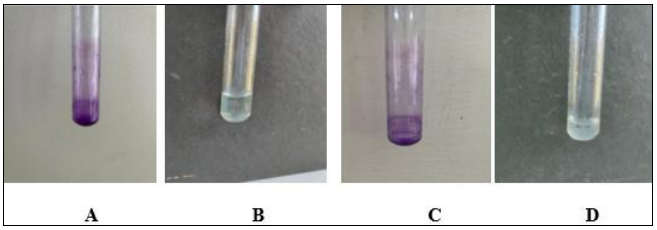


Fig 6: Tomato Control

Fig 7: Test sample of Tamoto

Biofilm formation test

The biofilm formation ability of the bacterial isolates was assessed using a standard crystal violet staining assay. According to the observations recorded in Table 6 and Fig 8, From the tested samples A and C demonstrated positive biofilm formation and B and D) were negative. This indicates that, the isolates A and E have capability to adhere and form structured biofilm layers on the test surfaces. Overall, the findings suggest that two bacterial isolates have biofilm-forming potential among the tested isolates, which may influence their pathogenicity or resistance traits, as biofilm formation is often linked to increased tolerance to antibiotics and host defenses. Some previous studies gives a clear evidence of foodborne pathogenic bacteria which can form biofilm [19].



A- chicken; B- milk; C- golgappa; D- momo chutney.

Fig 8: Biofilm formation by bacteria

Table 6: Observation of biofilm formation by bacterial isolates

Sl.no.	Sample name	Biofilm
1	A	Formed
2	B	Not formed
3	C	Formed
4	D	Not formed

Formed: Crystal violet stain adhere to the surface of the test tube
Not formed: Crystal violet stain does not adhere to the surface of the test tube

Conclusion

This study highlights the microbiological risks associated with commonly consumed street foods, particularly chicken and golgappa water, which were found to be the most contaminated. The presence of both Gram-positive and Gram-negative bacteria, including potentially pathogenic species like *Campylobacter jejuni, Bacillus cereus, K. pneumoniae*, and *Bacillus spp*., suggests significant hygiene lapses during preparation and storage. The isolates showed a varied resistance to antibiotics and differing abilities to tolerate bile salt, indicating potential survival in the human gastrointestinal tract. While samples A (*Campylobacter jejuni)* and C (*K. pneumoniae*,) showed strong biofilm-forming abilities, enhancing their potential for persistence and pathogenicity. The microbial spoilage and hemolysis tests further confirmed the food safety concerns, with some isolates demonstrating rapid spoilage and strong hemolytic activity. Overall, the findings emphasize the urgent need for improved hygiene practices among street food vendors to safeguard public health.

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