Analysis of Packed Food for the Existence of Human Enteric Pathogens

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***Abstract*- The growing popularity of packaged foods, ranging from snacks and biscuits to chocolate and cupcakes, caters to the convenience needs of individuals on the move, whether at school, work, or on vacation. Nonetheless, ensuring food safety remains paramount, given the potential health risks stemming from mishandling, including bacterial, fungal, viral, or parasitic contamination, which can lead to food poisoning and severe illnesses. Bacterial contamination, in particular, stands as a significant global health concern, with the practices of food handlers playing a pivotal role in prevention. It's important to note that various factors such as climate, geography, and development levels influence the repercussions of food contamination. While increased attention to food safety has yielded reductions in reported cases in certain regions, the overall toll remains alarmingly high, with an annual cost reaching nearly $152 billion in the USA alone and thousands of deaths recorded globally. Therefore, the identification and isolation of microbial contaminants in food samples emerge as crucial steps in implementing effective preventive measures and upholding public health standards. This research initiative aims to contribute to the mitigation of foodborne illnesses by evaluating the microbial load as well as existence of enteropathogens present in local branded packed food items available in Washim, Akola and Hingoli cities. The study sheds light on widespread contamination with foodborne pathogens like *E. coli, Salmonella spp., and Shigella spp.,* often surpassing FDA guidelines. These findings underscore potential compromises in food quality and hygiene practices among food handlers, emphasizing the urgent need for stricter enforcement of food safety regulations, continuous laboratory monitoring, and proactive awareness campaigns promoting sound food hygiene practices.**

Key words: **packed food, food poisoning, microbial load, enteropathogens food safety.**

I. INTRODUCTION

Packaged food has witnessed a surge in popularity within our society, offering an excess of options such as snacks, biscuits, chocolate, nuts, and cupcakes. These convenient food items are quick, healthy, and easy to handle, making them ideal for individuals on the go, whether at school, in an office, or while on vacation. However, ensuring food safety is paramount when packing your lunch, as mishandling can lead to serious health risks posed by bacteria, fungi, viruses, or parasites. Contaminated food can result in food poisoning, often manifesting as diarrhea, which can be fatal and lead to numerous deaths. Bacteria in the gut, stemming from tainted food, are a significant global health concern and the primary cause of stomach illnesses in people. The repercussions of food contamination vary depending on factors such as climate, geography, and the level of development in a given area. Food handlers, responsible for preparing, transporting, and serving food, play a crucial role in preventing the spread of harmful bacteria. Encouraging good personal hygiene practices, such as proper hand washing, is essential to mitigate the risk of spreading microbes[1].

According to Teshale worku 2015, In places like Jimma town, southwest Ethiopia, where many individuals frequent hotels, restaurants, and cafeterias, foodborne illnesses are prevalent. Pathogens like *Salmonella*, *E. coli, and Shigella* have been observed in packaged food, leading to illnesses such as diarrhea, shigellosis, and typhoid. Despite advancements in food safety regulations and education, foodborne illnesses continue to pose significant challenges globally. Still, increased attention to food safety has led to a decline in reported cases of certain foodborne illnesses in some regions.[2]

However, foodborne illnesses remain costly, with significant economic and public health implications. In the USA alone, it's estimated that these illnesses cost nearly $152 billion annually, affecting millions of individuals and leading to thousands of deaths worldwide. Identifying and isolating microbial contaminants in food samples is crucial for implementing preventive measures against foodborne illnesses.By understanding how infectious agents enter and spread through the food chain, we can better safeguard public health and minimize the risks associated with

contaminated food[3].Therefore, this research aims to identify and isolate microbial contaminants in various local branded packed food samples from the three city areas viz. Washim, Akola and Hingoli to plan effective preventive measures against foodborne illnesses.

II. MATERIAL AND METHODS

Collection of Sample:

Three different types of packaged food samples viz. chocolate, biscuits, and snacks of different local brands were purchased from markets of three cities viz. Washim, Akola and Hingoli and labeled as LBW, LBA and LBH respectively. These samples were directly transported to the Microbiology Research Laboratory, Department of Microbiology, R. A. College, Washim for further analysis.

Preparation of Sample :

The samples were serially diluted and enriched in nutrient broth. The enriched broth were spread on nutrient agar plates as well as Salmonella-Shigella agar and EMB agar plates. The plates were incubated at 37^{o}C for 24 hrs.

Isolation & Identification of Enteric Pathogens:

Following incubation, the Salmonella-Shigella agar and EMB agar plates were examined for the presence of typical colonies. The appearance of colonies on these plates indicates the presence of pathogenic bacteria in the collected packaged food samples. The colonies were further purified and identified by conventional methods.

Antibiotic sensitivity testing:

The isolates were further subjected for antibiotic susceptibility test by Kirby- Bauer disc diffusion technique. The antibiotics used were Azithromycin, Amoxicillin, Ciprofloxacin, Cefixime, and Levofloxacin. The zone of inhibition was measured using a Himedia antibiotic zone scale and compared with a standard interpretation chart (CLSI, 2008).[4]

III. RESULT AND DISCUSSION

The study aimed to assess the microbial load of three local branded packed foods available in Washim, Akola, Hingoli viz. LBW, LBA and LBH, focusing on three distinct food items. The findings are summarized as follows:

The bacterial load present in the food samples was determined using the standard plate count method, as illustrated in Table 1 and Figures 1. From the table it was observed that the Biscuits samples of LBW and LBA shows high bacterial load 115 and 139 CFU/ml as compared to the samples of LBH 98CFU/ml.

Upon studying microbial load in chocolate, it was observed that the chocolate samples collected from LBA and LBH shows highest microbial load 178 and 145CFU/ml as compared to LBW 120CFU/ml.

The snacks samples collected from LBW and LBH shows microbial load 170and 160CFU/ml. and the snacks samples of LBA also shows 122CFU/ml.

Maximum bacterial contamination was observed in the packed food samples collected from Akola city followed by Washim and Hingoli (fig 2). Hence, from the above observations it is concluded that the local branded pack food items are favorable for the growth and proliferation of microbes[5,6]. The collected packed food items were further investigated for the presence of human enteric pathogen.

Table 1: Determination of bacterial load present in food sample.

Sr.no.	Packed Food items	No of bacteria CFU/ml			Mean CFU/ml
		LBW	LBA	LBH	
1	Biscuit	115	139	98	117
2	Chocolate	120	178	145	147
3	Snacks	170	122	160	150
Mean CFU/ml		135	146	134	

LBW: Local brand Washim LBA: Local brand Akola **LBH** : Local brand Hingoli

Figure 1: Mean bacterial load present in food samples viz. Biscuit, Chocolate and Snacks

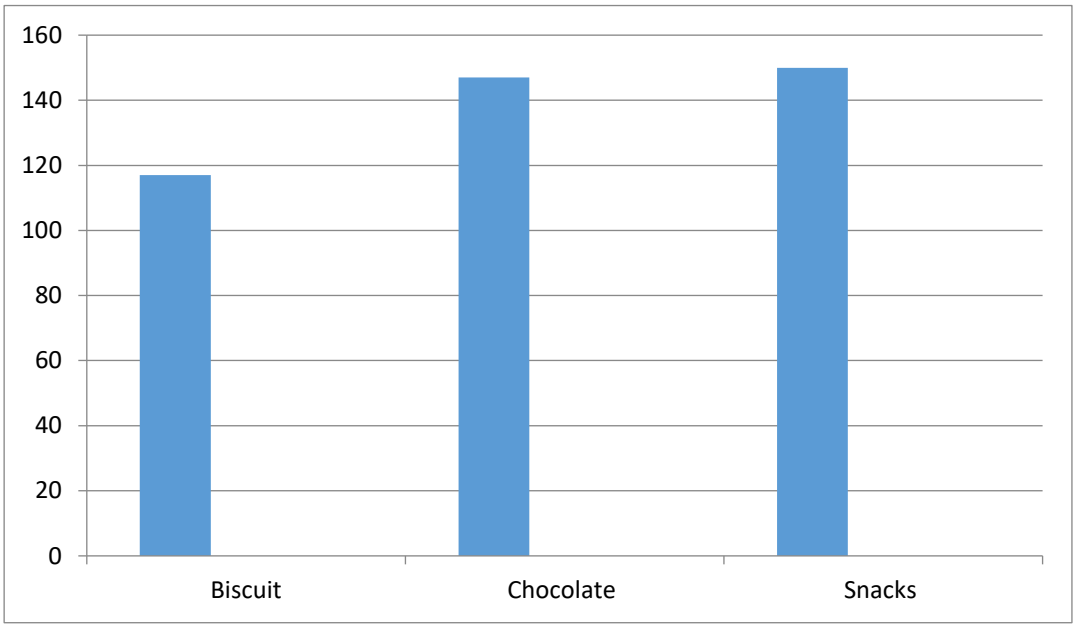


Fig 2: Mean bacterial load in different packed food samples collected from Washim, Akola and Hingoli cities

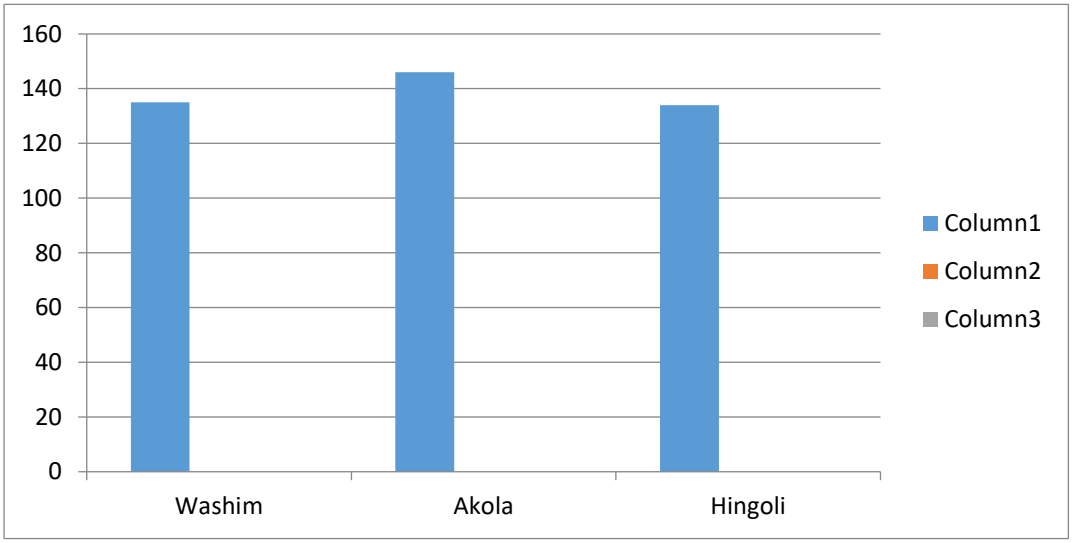


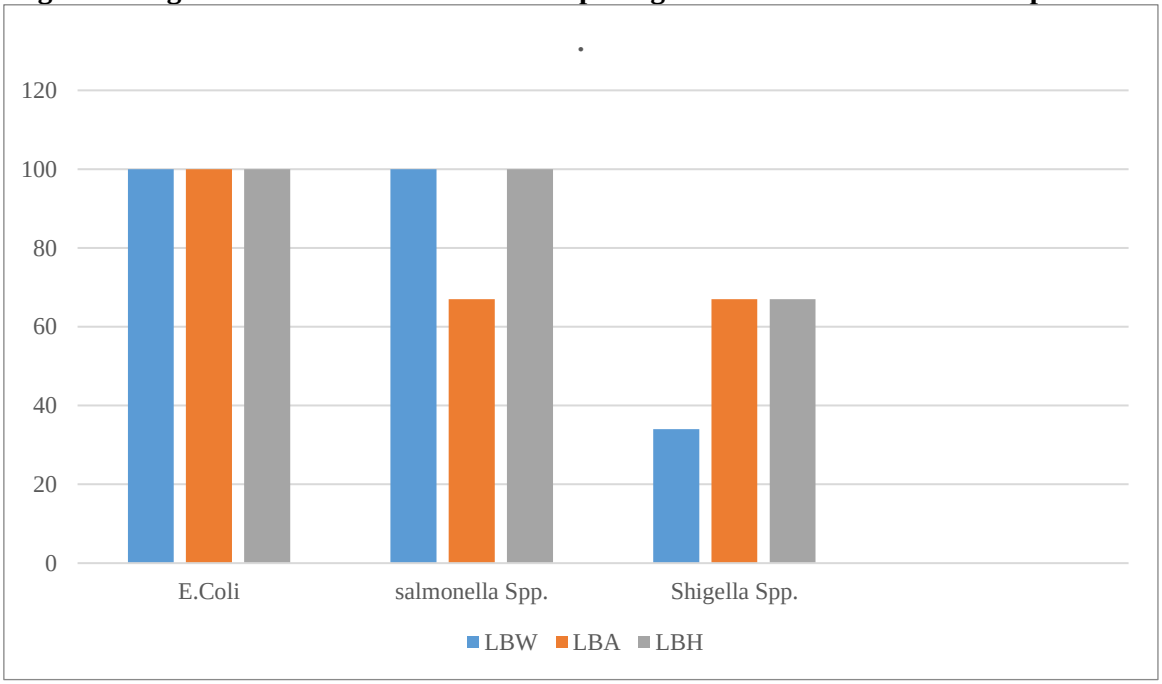
Table 2 and fig 3show the findings on existence of human enteric pathogen in selected Local branded pack food. From the table, it is found that E.coli exists in all the samples tested with 100% existence frequency. Salmonella species was found to be 100% in samples from Washim and Hingoli. However, 67% in packed food samples collected from Akola city. Similarly, Shigella species was exist as 67% in Akola and Hingoli city samples followed by 34% in Washim city packed food samples. Hence, enteric pathogens exist in packed food samples of local brands which pose risk to public health [7,8].

Table 2: findings on existence of human enteric pathogen in selected Local branded pack food.

Sr no	**Packfood Item**	***E.coli***			***Salmonella spp.***			***Shigella spp.***		
		LBW	**LBA**	**LBH**	**LBW**	**LBA**	**LBH**	**LBW**	**LBA**	**LBH**
1	Biscuits	+	+	+	+	-	+	+	-	-
2	Chocolates	+	+	+	+	+	+	-	+	+
3	Snacks	+	+	+	+	+	+	-	+	+
Existence frequency (%)		100	100	100	100	67	100	34	67	67

LBW: Local brand Washim **LBA:** Local brand Akola **LBH** : Local brand Hingoli

Fig 3: findings on existence of human enteric pathogen in selected Local branded pack food

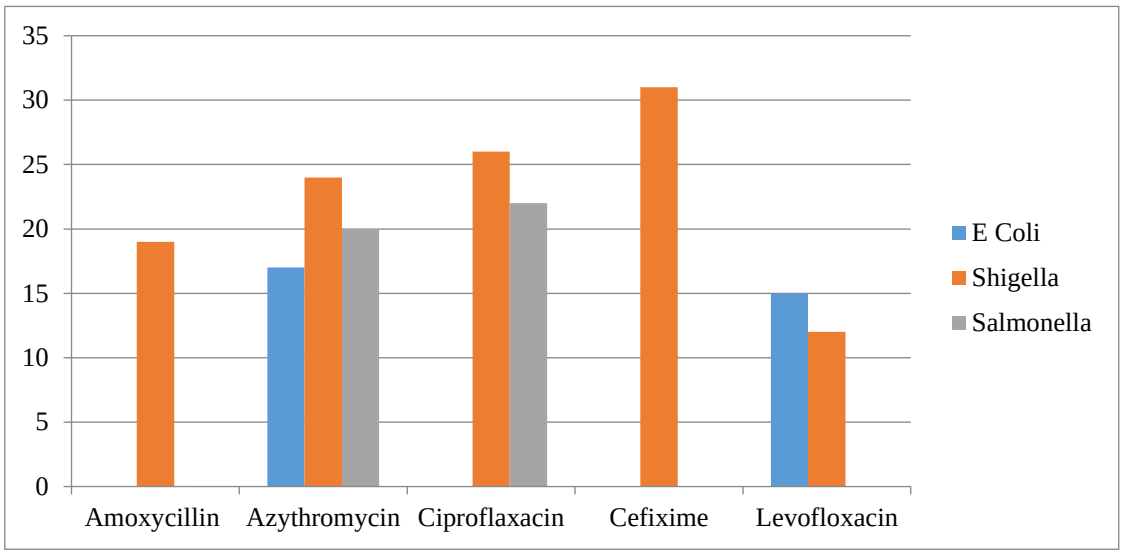


The antibiotic sensitivity/resistance pattern of the isolated foodborne pathogens was determined, as presented in Table 3 and fig 4. It was observed that all the isolates except *Shigella species* displayed resistance against more than one antibiotic, indicating that they are multiple drug-resistant strains. The presence of enteric pathogens suggests fecal contamination in the analyzed food samples, posing a significant health risk to the public consuming such food in the selected city area. Regular monitoring of the microbiological quality of food is crucial because outbreaks caused by contaminated food would be challenging to treat due to the presence of multidrug-resistant pathogens associated with food products.

Table 3 Antibiotic sensitivity/resistance pattern of the isolated enteric pathogens

Sr.no	Organisms	Antibiotics	Zone of inhibition in mm	S/R status
1	*E.coli*	Amoxicillin 500 Ciprofloxacin Azithromycin Cefixime Levofloxacin	No zone No zone 17mm No zone 15mm	Resistance Resistance Sensitive Sensitive Sensitive
2	*Shiglla*	Amoxicillin 500 Ciprofloxacin Azithromycin Cefixime Levofloxacin	19mm 26mm 24mm 31mm 12mm	Sensitive Sensitive Sensitive Sensitive Sensitive
3	*Salmonella*	Amoxicillin 500 Ciprofloxacin Azithromycin Cefixime Levofloxacin	NO zone 22mm 20mm No zone NO zone	Resistance Sensitive Sensitive Resistance Resistance

Fig.4 Antibiotic sensitivity/resistance pattern of the isolated enteric pathogens



IV. CONCLUSION

The findings of present research study showed that local branded packed food possess high bacterial contamination. The presence of food borne pathogens viz. *E. coli, Salmonella spp., and Shigella spp*. Depicts that the food standards are not maintained in the processing of packed food materials. The multiple drug resistance in food borne pathogens is an important threat to public health. Hence, regular laboratory testing should be conducted to detect the presence of new harmful agents, ensuring ongoing food safety. Adherence to food safety regulations and implementation of food regulatory laws are essential to mitigate contamination issues and prevent foodborne diseases.

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