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RISK ASSESSMENT OF HEAT TREATED STREET VENDED EDIBLE OFFALS

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SUMMARY

Thirty sixth samples of heat treated meat organs and edible viscera were collected from street vendors in Cairo and Giza. Six samples from each heart, liver, rice sausage, meat sausage, tripes and lung were collected and tested bacteriologically.

The least mean aerobic plate count was found in tripe samples while the highest one was detected in liver and meat sausage.

The highest Enterobacteriaceae count was in the lung samples while the lowest one was in the tripe ones.

E. coli could be isolated from liver, rice sausage, tripe and lung.

Aerobic spore-formers were found in all samples. The lowest mean count was $8 \times 10^2/g \pm 2 \times 10^2$ in heart samples, while the highest one was $10^5/g \pm 3 \times 10^4$ in meat sausage.

No S. aureus or salmonella or shigella could be detected.

Unacceptable samples of heart, liver, rice sausage, meat sausage, tripe and lung were found in the following percentages: 16.7, 100, 83.3, 100, 50 and 83.3% respectively.

Suggestive measures for improving street vended foods are mentioned.

INTRODUCTION

Urbanization and population growth, especially in developing countries, are expected to continue into the next century and street-vended edible offals, which are largely but not exclusively an urban phenomenon, will expand accordingly.

While street-vended foods are appreciated for their unique flavour as well as their convenience, they are also often essential for maintaining the nutritional status of the population. It also assures food security for low-income urban popualtions. It is recognized that street-food vendors are often poor, uneducated and lack appreciation for safe food handling. Consequently street foods are perceived to be a major public health risk.

The WHO survey of street-vended foods reported in 1996 that 74% of countries reported street-vended foods to be a significant part of the urban food supply.

Street vending is recognized as a potential risk to health due to chemical, and microbiological contamination of foods (Ceha Newsletter East Mediterranean Newsletter WHO, 1996). They are important source of cheap, nutritious food, particularly for the urban poor.

Many street vendors are stationary; they may have a stall, even tables and chairs. Ambulant vendors may use pushcarts, bicycles or other vehicles for carrying their wares. Others carry them about by hand, on their back, heads or on shoulder poles.

Street foods include a large variety of items with different degrees of potential for causing disease. Foods are fried or cooked and consumed on the spot. Street vendors have come under suspicion for selling contaminated foods that have led to diarrheal diseases.

In 1977, Tjoa et al. isolated high numbers of *E.coli* from street- vended foods. Enterotoxigenic bacteria were also isolated from foods obtained from street vendors in Ethiopia (Jiwa et al., 1981).

El Sherbeeny et al. (1985) examined ready-to- eat meat organs and edible viscera for assessment of their microbiological profiles. They failed detection of salmonella from any samples. On the other hand shigella was isolated from one sample while four of 15 samples tested for *S. aureus* were positive and 58% of them had counts of at least 10^3/g. *B. cereus* was isolated from 37% of samples. They found that the aerobic colony count/g of them was 1.3×10^5.

To-date in collaboration with number of countries in Africa, Latin America and Asia, activities have been carried out with FAO assistance in reviewing different aspects of street foods as they pertain to their composition, availability and safety.

This paper focuses on the microbiological profiles of street-vended heat treated edible offals sold by vendors in streets for immediate consumption or consumption at a later time without further processing or preparation.

MATERIAL AND METHODS

Thirty sixth samples of heat treated meat organs and edible viscera were collected from street vendors in Cairo and Giza. Six samples from each heart, liver, rice sausage, meat sausage, tripes and lung were collected and transported to the laboratory on the day of collection. Sample units were

usually stored over night in a refrigerator (5°C) before testing bacteriologically for the following:

A- Bacterial count

1- Aerobic colony count using plate count agar (Oxoid Nr. CM 325)

2- Enterobacteriaceae count using crystal violet bile glucose agar (Merck 10275).

3- *Staphylococcus aureus* count using Baird-Parker agar (Oxoid Nr. CM 275).

4- Aerobic spore-formers count using PEMBA-agar (Oxoid Nr. CM 617, SR 99).

Procedures for diluting and counting followed those stated by ICMSF (1978).

B- Isolation and Identification of the following pathogens:

1- **Salmonella and Shigella:** Portions from the sample units were weighed and 25g were used for assessing the presence of salmonellae and shigella according to technique recommended by ICMSF (1978) using Rappaport-Vassiliadis (Oxoid CM 699) as enrichment broth and XLD (Merck 5287) and Rambach agar (Merck 1.07500, 001) as selective media for salmonella and XLD Agar as selective media for shigella.

2- *E. coli*: The technique recommended by Ibrahim et al. (1995) was applied using fluorocult lauryl sulfate broth (Merck 12588) and long wave UV lamp (4 w/366nm Merck, 13203).

3- **Aerobic-spore formers:** The technique recommended by Elmossalami (1994) for isolation and detection was used.

RESULTS AND DISCUSSION

It is evident from the achieved results that the least mean aerobic plate count was found in the tripe samples, while the highest one was detected in the liver and meat sausage samples (Table 1, Fig.1).

Concerning Enterobacteriaceae count, the highest one was in the lung samples while the lowest one was in the tripe ones. *E. coli* could be isolated from liver, rice sausagae, tripe and lung samples in the following percentages 50%, 66.7%, 83.3% and 100% respectively. Serotypes of isolated *E.coli* were tabulated in table (2).

Regarding aerobic spore-formers count the lowest mean count was in heart samples while the highest one was observed in meat sausage ones. No. *S. aureus* or *salmonella* or *shigella* could be detected (Table 3).

As regard the detected isolates, the following species of aerobic sporeformers could be identified: *B.subtilis, B. licheniformis, B. cereus, B. pumilus* and *B. coagulans.*

Elmossalami (1994) stated that *B. cereus* species have a cytopathic effect, that appeared as vacuolic degeneration and lysis of cells. The other Bacillus species; *B. pumilus, B. licheniformis* and *B. subtilis* caused rounding of cells but no lysis while other strains did not induce morphological changes.

In 1984, Rheinbaben and Hadlock stated that aerobic spore-formers could be found in 6-98% of examined meat products by different authors.

Table (1): Statistical Analysis of Aerobes and Enterobacteriaceae counts in heat treated edible offals.

	Heart		Liver		Rice sausage		Meat sausage		Tripe		Lung	
	A	E	A	E	A	E	A	E	A	E	A	E
Min.	10^3	10^2	$2x10^7$	$<2x10^2$	$2x10^2$	$<2x10^2$	$4x10^6$	$<2x10^2$	$3x10^3$	$2x10^2$	10^5	$2x10^3$
Max.	10^9	$6x10^6$	$4x10^9$	$6x10^6$	$4x10^9$	$4x10^5$	$3x10^9$	$2x10^7$	$4x10^8$	10^5	$2x10^9$	$2x10^7$
Mean	$2x10^8$	10^6	10^9	10^6	$9x10^8$	$7x10^4$	10^9	$4x10^6$	$7x10^7$	$2x10^4$	$7x10^8$	$4x10^6$
SE±	$6x10^7$	$3x10^5$	$3x10^8$	$4x10^5$	$2x10^8$	$2x10^4$	$2x10^8$	10^6	$2x10^7$	$6x10^3$	10^8	10^6

A= Aerobes count, E= Enterobacteriaceae count, SE= Standard error.

Table (2): Serotypes of isolated *E. coli*

Samples	n	Serotype
Heart	-	-
liver	3	O_{114} : K.
Rice sausage	4	not identified
Meat sausage	-	-
Tripe	6	not identified
Lung	5	O_{26}:K_{60}, O_{119}:K_{69}

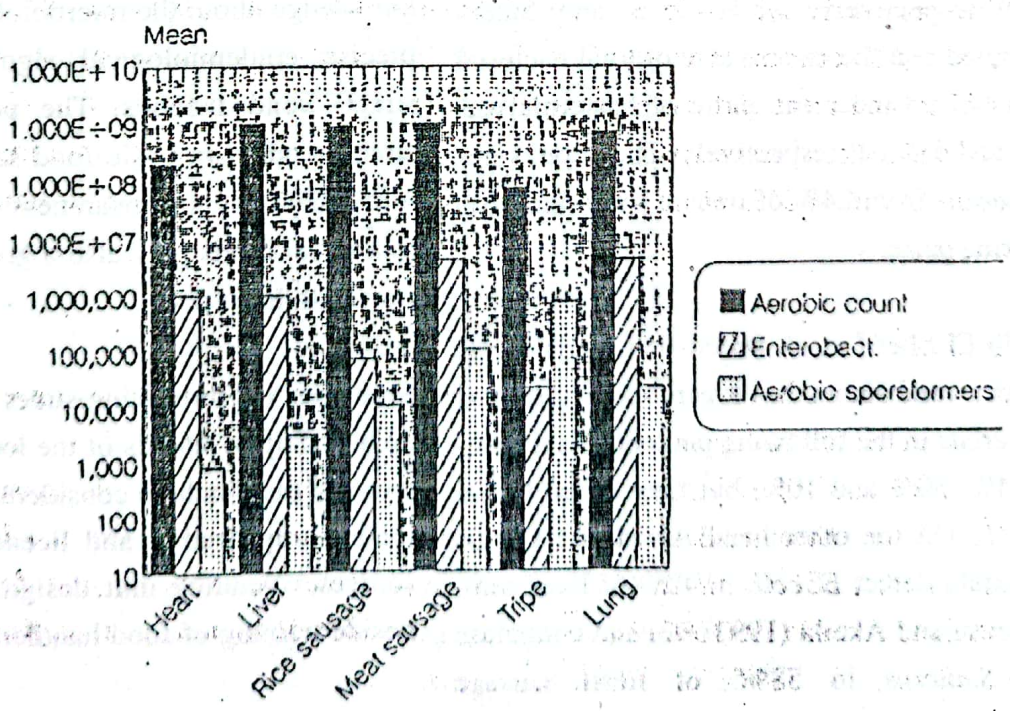
Konuma et al. (1988) detected *B. cereus* in 23, 7% of heat treated hamburger while Hafez et al. (1990) found it in 50% of heat treated Kofta.

Lotfi et al. (1988) detected *B. cereus* in 48% of heat treated Luncheon meat.

Deficient hygienic conditions observed at the vending facilities and lack of proper knowledge on food handling and hygiene by both the vendors and the consumers, contribute to make street foods a potential risk for the transmission of food borne diseases, requiring a prompt action of both health authorities and the community.

These foods are sold from carts or small outside stands or while sitting on the street. Street vendors provide persons with a cheap, ready-to-eat food or meal. Such foods are sometimes prepared from raw foods of doubtful quality and are exposed to contamination from numerous sources (e.g improper handling, utensils, vectors, dust and water) during preparation, storage and display.

Fig. (1): Mean counts of street vended-heat treated edible offals



These foods are often kept at ambient temperatures that permit bacterial growth.

In this respect, Hafez et al. (1994) examined raw edible offals including heart, liver, rumen and intestine. They stated that the average count of Enterobacteriaceae and *S. aureus* were $2x10^3$ and $5x10^2$; $4x10^4$ and $4x10^3$; $7x10^5$ and $2x14^4$; and $2x10^6$ and $4x10^4$ per gram respectivily, while Shahat (1995) stated that the edible offals of sheep lung, liver, kidney are significantly contaminated. He detected *E. coli* (type I), *Pr. mirabilis* and *Pr. vulgaris*. Almeida et al. (1997) could also isolate microorganisms from street-vended foods in the following percentages: *S. aureus* (8.42%), *B.cereus* (7.89%),*salmonella* (0.95%), *E. coli* O157:H7 in one sample out of 2433 samples, and faecal coliforms (9.4%).

Eldaly et al. (1987) found that cooked spiced minced meat has average counts of aerobes, Enterobacteriaceae, *E. coli* of $7x10^3$, $2x10^2$ and $0.29x10^2$ respectively, while Edris and Salem (1990) stated that the mean value of total bacterial count of treated meat and paste of basterma was $4.8x10^2$ and $5.4x10^7$ respectively. They could isolate *S. aureus* from 24% of treated meat and 36% of basterma paste.

In (1991) El Sherif et al. stated that ready-to eat beefburger sandwiches have aerobes, *S. aureus* and *B. cereus* in the following percentages respectively 84%, 30% and 10%, but they failed to detect *E.coli*. On the other hand Awad and Gergis (1993) could detect *E. coli*. in 42% of liver samples. Mousa and Akeila (1993) isolated coagulase positive *S.aureus* in 58% of fresh sausage samples.

In (1998) Mosupye et al. found that the mean aerobic plate count for ready-to-eat meat samples was 3.1 log cfu/g and *E. coli* count 2.0 log cfu/g out of 51 samples. *B. cereus* was found in 21.5%, *E. coli* in 5.9% while *S. aureus* failed detection.

Comparing to literature reports, the safety and quality of the street foods (heart, liver, rice sausage, meat sausage, tripe and lung) were found to be unacceptable in the following percentages 16.7, 100, 83.3, 100, 50 and 83.3% respectively.

Therefore, street vended foods pose significant public health problems due to the lack of basic infrastructure and sources such as potable water supplies, difficulty in controlling the large numbers of street food vending operations because of their diversity, mobility and temperary nature. The insufficient resources for inspection and laboratory analysis beside general lack of factual knowledge about the microbiological status or the precise epidemiological significance of many street- vended foods. The poor knowledge of street vendors in basic food safety measures and inadequate public awareness of hazards by certain street foods play also a great role in the public health hazard.

Strategies for improving street food safety should be based upon studies of the local street food system and may include consideration of policy, regulation, registration and licences, infrastructure, sources, vending unit design and construction, beside training of food handlers and education of

Table (3): Statistical Analysis of Aerobic spore-former and S. aureus counts in heat treated edible offals.

	Heart		Liver		Rice sausage		Meat sausage		Tripe		Lung	
	ASF	S	ASF	S	ASF	S	ASF	S	ASF	S	ASF	S
Min.	10^2	$<10^2$	10^2	$<10^2$	$<10^2$	10^2	10^3	$<10^2$	10^2	$<10^2$	$3x10^2$	$<10^2$
Max.	$3x10^3$	$<10^2$	10^4	$<10^2$	$5x10^4$	$<10^2$	$5x10^5$	$<10^2$	$5x10^4$	$<10^2$	10^5	$<10^2$
Mean	$8x10^2$	$<10^2$	$3x10^3$	$<10^2$	10^4	$<10^2$	10^5	$<10^2$	$2x10^4$	10^2	$2x10^4$	$<10^2$
SE±	$2x10^2$	-	$6x10^2$	-	$3x10^3$	-	$3x10^4$	-	$3x10^3$	-	$6x10^3$	-

ASF= Aerobic spore-formers, S=S. aureus, SE= Standard error.

Table (4): Aerobic spore-formers isolated from the examined heat treated edible offals

Samples	Isolates
Heart	B. subtilis, B. licheniformis
liver	B. subtilis, B. licheniformis, B. pumilus
Rice sausage	B. cereus, B. licheniformis, B. coagulans
Meat sausage	B.subtilis, B. pumilus
Tripe	B. cereus, B. pumilus
Lung	B. licheniformis, B. punilus

consumers. For minimizing the risks from street-vended foods, the essential safety requirements for street-vended foods published by Food Safety Unit, Division of Food and Nutrition, WHO (1996) should be followed.

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