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Study and microbial evaluation of homemade meat meals sold in the markets of the city of Al Bayda – Libya

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Abstract

Background: Home-cooked meals were frequently linked to foodborne diseases. Microbial contamination of meals depends on many factors: handling and preparing of foods, the environment and quality of raw materials, and also habits of cooks. People who sell such meals for customers with lower income in the street are at risk from foodborne diseases and a need for periodical control to protect them. Deleterious microorganisms present in food may produce toxins and other harmful substances; some may spoil foods and cause off-odors and off-flavors.

Objective: the aim of this study is to evaluate microbial contamination in home-made meat and meals sold in the markets of the city of Al-Bayda – Libya

Methods: This study evaluated 40 samples of home-prepared meat in the city of Al-Bayda (20 red meat meals and 20 poultry meat samples). All samples were tested for the total number of viable bacteria, *E. coli*, *Staphylococcus aureus*, *Enterococcus*, psychoactive and Anaerobic bacteria, mold count, and yeast count

Results: The study showed that the average number of home meals red meat and processed poultry were 14.63×10^6 , 19.19×10^5 , 10.35×10^5 , 16.04×10^5 , 104×3.8 , and 7.39×10^5 CFU/g, respectively. The percentage of *Staphylococcus aureus* is 46.4% and 40% in processed red meat and poultry meals, respectively.

Conclusion: The research showed that aerobic Bacteria did not grow in all the meals that were tested, and these results demonstrated the importance of this, which gave a serious indication that all home-prepared meat is dangerous to human health.

Keywords: Aerobic Bacteria, Al Bayda, *E. coli*, meat, *Saccharomyces cerevisiae*, , supermarkets , *Staphylococcus aureus*, Foodborne Diseases

INTRODUCTION

Meats provide a variety of micronutrients essential for human nutrition and health, as well as protein and vital amino acids. Meat's extreme perishability necessitates the development of novel technologies, such as chilling techniques and procedures, to improve its quality and safety. To guarantee food safety, it is equally crucial to develop innovative detection techniques [1].

Fresh meat has enough free amino acids, lactic acid, and vitamins to promote the growth of even the most sensitive bacteria. It also includes some fermentable carbohydrates, making it a great growth substrate for most foodborne germs [2]. These germs and fungi are formed on several factors that have a significant role in the bacteria present in fresh meats: temperature, oxygen availability in the environment directly above the meat's surface and its surface tissues, and pH value [3].

It is commonly known that rotting meat contains enterococci. Though enterococci are thought to be pathogenic, current research shows that the pathogenicity of food and meat enterococci, particularly Enterococci, is significantly lower than that of clinical strains[4], when it comes to meat fermentation, enterococci are superior to other microorganisms because they may create enterocytes, which have antibacterial properties against pathogens and microbes that cause meat deterioration. This is especially true for many enterococci isolated from sausages [5].

Poultry meat is less costly than red meat. The physical, chemical, and biological

factors of chicken flesh determine its safety and quality[6].

Due to their high perishability, raw meat and poultry can degrade in various ways based on how they are handled and stored. Historical records show that early civilizations adopted smoking, drying, and salting methods to preserve meat because of its high potential for spoiling. Controlling spoilage in meat and poultry is crucial now more than ever because of the globalization of the food supply and the increase in demand from picky customers [7]. Homes with outdated technology and functional facilities These procedures will cause needless anguish [8]. It causes meat to deteriorate, lose quality, and be lost altogether. Thus, it is crucial to avoid contamination during the cutting, processing, and manufacturing stages of meat following slaughter [9]. It is necessary to prevent the sale of meat products that are manufactured at home without licenses or data bearing the date of the expiration date of the product or the place of manufacture, as well as the ingredients, because this will cause many health risks, especially food poisoning [1].

Materials and methods

We conducted this research by collecting and testing about 40 meals of home-prepared meat (20 meals of red meat and 20 meals of poultry meat). From some local markets in the city of Al-Bayda during the year 2022 AD, all samples were transferred to the central laboratory at Omar Al-Mukhtar University and kept in sterile containers. Decimal dilutions in sterilized nutrient peptone water were prepared at 0.1% (w/v) of this homogenate. Each sample was examined

for:

1. Total number of live bacteria

One milliliter of aliquots of each dilution is transported sterilely to the laboratory and mixed with approximately (15) ml of nutrient agar diluted to 40-45°C. The petri dish is inverted when it cools in sterile conditions and incubates at 37°C for 48 hours in intense conditions. Sterilization by following appropriate procedures. Plates containing between 25 and 250 colonies (diffusion plate technique). Microbes were expressed as colony forming units (CFU) per gram [10].

2. The total number of E. coli

Twenty-five grams of the examined sample was homogenized in 225 ml of sterile peptone water and inoculated at 37 °C for 24 hours. 1 ml of the original dilution was transferred to 9 ml MacConkey broth tubes and incubated at 37°C for 24 h.

Separate lines of positive MacConkey broth tubes were plated on Eosin Methylene Blue (EMB) agar, which was incubated at 37°C for 24 h. Suspected colonies were metallic green in color. Suspected colonies were purified and inoculated into tilted nutrient agar tubes for further identification Green [11].

3. Number of staphylococci.

Using Mannitol Salt Agar to test pathogens, cluster coronas are picked up [10]. Colonies are subjected to a coagulation test [12]. Rabbit plasma (0.3 ml) was placed in a well-sterilized container, then a sterile test tube containing 0.1 ml of 12-hour brain staphylococcal heart infusion broth. The tube is rotated to mix the contents in the tube and then incubated in the incubator

at 37°C. A positive test with plasma coagulation can occur within 2 to 4 hours or later [13].

4. Psychological counting:

For the total number of viable bacteria, plate in cubes at 8 °C for ten days.

5. Number of enterococci:

Maconici agar, lactose fermentation [11] was used.

6. Aerobic bacterial count

Carefully placed into each sterile Petri dish with the proper labels, one milliliter of the previously made dilutions was combined with around 15 milliliters of thawed and pre-cooled ($45 \pm 1^\circ\text{C}$) standard plate count agar. The inoculation plates were solidified, then turned over and incubated for 48 hours at 35°C. After counting and choosing plates with between 25 and 250 colonies, the number of aerobic plates was determined by multiplying the colony count by the reciprocal of the dilution. After counting and expressing the number of aerobic plates as Cfu/g of samples [12].

7. Number of mold and yeast:

Using Sabouraud agar (SDA), medium supplemented with 100 mg of each of chloramphenicol and chlortetracycline, yeast and mold counts were carried out.

Approximately 15 ml of sterile Sabouraud dextrose agar that had been thawed and pre-cooled at 45°C was added to one milliliter of the previously made dilutions, which had been aseptically placed onto sterile Petri plates. The mixture was then well mixed horizontally. The control plates were incubated upside-down following solidification. Keep it at 25°C for five

days. Separate counts of yeast and mold colonies were made, and the results were reported as the number of mold and yeast/g.

RESULT

Food prepared at home, especially meat, is considered unsafe because it has not been processed under sterile conditions, and its source is unknown. If prepared food shows signs of spoilage, it may end up spoiling, swelling, leaking, developing an unpleasant odor, or becoming moldy. Home-cooked meat meals contain some toxins if not processed properly. Correctly and under sterile conditions and

appropriate sanitary procedures. Table 1 shows. The average total number of viable bacteria was 14.63×10^6 CFU/g. Table (2) The average of homemade poultry meals is 26.30 Tables (1) and (2). Table 3 showed that 46.4% and 40% of the samples were positive for the coagulation enzyme test. Table (1) shows the arithmetic mean of the number of enterococci, 21.030. The main number of anaerobic bacteria in red meat meals as well as homemade poultry meals that were prepared without following sanitary conditions in homes, is 1.852×10^3 and 3.8×10^4 cfu/g, respectively.

Table 1. Results for processed red meat samples are expressed as colony-forming units per gram

N=20	Total plate count	E.Coli	Staph. aureus	Enterococcus	Psychrotrophic	Anaerobic Bacterial Count	Mold Yeast
Mean	14.63×10^6	3.50×10^4	9.20×10^5	21.030×10^5	12.26×10^5	1.852×10^3	2.92×10^5
S.d	$\pm 1.94 \times 10^7$	$\pm 0.40 \times 10^3$	$\pm 1.53 \times 10^5$	$\pm 6.79 \times 10^5$	$\pm 1.71 \times 10^4$	$\pm 0.48 \times 10^3$	$\pm 0.56 \times 10^4$
Rang	$0-37 \times 10^7$	$0-9 \times 10^3$	$0-60 \times 10^5$	$0-169 \times 10^5$	$0-31 \times 10^4$	$0-6 \times 10^3$	$0-15 \times 10^4$

Table 2. Results for home-processed poultry meat samples are expressed as colony-forming units per gram

N=20	Total plate count	E.Coli	Staph. aureus	Enterococcus	Psychrotrophic	Anaerobic Bacterial Count	Mold Yeast
Mean	26.30×10^7	7.80×10^7	19.19×10^5	10.35×10^5	16.04×10^5	3.8×10^4	7.39×10^5
S.d	$\pm 3.42 \times 10^7$	$\pm 2.14 \times 10^3$	$\pm 2.40 \times 10^5$	$\pm 1.63 \times 10^5$	$\pm 1.400 \times 10^4$	$\pm 0.88 \times 10^3$	$\pm 1.36 \times 10^4$
Rang	$0-3.43 \times 10^7$	$0-37 \times 10^3$	$0-2.36 \times 10^5$	$0-25 \times 10^5$	$0-4.25 \times 10^4$	$0-22 \times 10^3$	$0-15 \times 10^4$

Table 3. Coagulase test for Staphylococcus aureus

Samples	No. of staph	No. Strain positive for the enzyme	%
Homemade red meat n=20	20	14	46.4
Homemade poultry meat n=20	20	11	40

DISCUSSION

A study was carried out to investigate the microbial quality of eight homemade meat meals sold in Al-Bayda Market, Libya. The purpose of the present work was to form a foundation for any further studies based on the assessment of microbial quality and safety of these meals and to provide experiment-based data. One of the main research areas deals with food products' safety, and microbial contamination is known to be a major problem. Bacteria and, for example, fungi, yeasts, and molds can spoil the appearance of a food product and cause foodborne infections when entering the human body. The methods that are applicable for the detection of microbes possess the advantage of measuring live cell counts and other biological material related to the health of a food product. The average of homemade poultry meals is 26.30 Tables (1) and (2). It is not heat treated at the appropriate time, temperature, or both during heat processing of home-processed meat meals[13]. Many anaerobic bacteria and conditions are necessary to produce toxins that are sometimes dangerous to the consumer in an oxygen-free, low-acidity environment. Improperly processed meat meals in low-acid homes, such as red meat and poultry meals prepared at home, can This environment provides [14] so the study showed that the average mold and yeast counts in home-cooked red meat and poultry meals were 2.9×10^5 and 7.39×10^5 CFU/g, respectively. [15]. Home-prepared meat meals have been found to contain fewer molds. However, the environmental processing and handling of these industries may introduce many

pathogenic microorganisms, including dangerous pathogens, into the processing of these products, which must also be considered. There was no growth of aerobic bacteria in home-processed red meat and poultry meals.

CONCLUSION

Meat products that are prepared at home are considered dangerous and can cause intestinal diseases and poisoning due to the lack of appropriate conditions that prevent contamination of meat, especially since it is a quickly perishable food material, especially if the medium is not sterile, and such materials must be prepared in places or factories designated for them. Under health and supervisory supervision by the responsible authorities. Analysis and evaluation of the microbiological quality of the popular meat meals before consumption is indispensable. Microorganisms do not always provide external sensory signs and cannot be detected by the senses of human organs or consumers. The results occasionally reveal that a food product or consumption trend is detrimental to health and unfit for dietary routines. Satisfactory results were obtained for the meat meals, except that only a few samples were highly contaminated with microorganisms.

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Conflict of interest

None

Author contributions

Both authors contributed equally in this research.

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