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MICROFLORA EVOLUTION DURING AGING AND SPOILAGE OF BEEF IN MEXICO CITY'S SUPERMARKETS.

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KEYWORDS

Shelf-life, microbial spoilage, hygienic handling

BACKGROUND

Type and level of meat microbial contamination are important not only on health, but also in the storage life and spoilage reactions occurring. The presence of a given microbial population in meat cuts depends on the way the animal was slaughtered and eviscerated, as well as how the meat was handled and stored in terms of time, temperature, hygienic conditions, etc. (Brown, 1982). An excessive microbial population in the carcass results on a fast deterioration of the meat tissue. This depends on the type of microorganisms as well as on a time-temperature relationship. As the presence of some pathogens does not alter the visual aspects of the meat, it could be a health hazard if refrigerated conditions are not tightly kept.

Due to the high demand of meat in Mexico City, carcasses are cut and distributed to the main supermarket chains without previous aging. It is assumed that aging takes place once the wholesale cuts are refrigerated in the central facilities of these supermarkets. However, as pH has not reached it final value, it is possible that any failure in refrigeration increases the microbial population within few hours of storage. This represents a loss on the wholesomeness of the meat, from the physicochemical point of view, as colour, texture and odour are altered, as well as being a health hazard. Knowing the type and amount of microorganisms present in the meat, it is possible to trace the time-temperature history of the meat (McMeekeing, 1982).

OBJECTIVE

To monitor the type and amount of microorganism present in meat during aging and spoilage of meat sold in some supermarkets in Mexico City, as an indication of the way the meat was handled.

MATERIALS AND METHODS

Meat was obtained from local supermarkets, sectioned in 500 g portions, wrapped in saran film and stored at 4°C for a total study time of 14 days. Samples were taken every 3 days for the following analysis: pH, water holding capacity (WHC) and total nitrogen. The microbial analysis carried out were for the following populations: *Enterobacteriaceae*, psychrophiles, mesophiles, and moulds and yeasts.

RESULTS AND DISCUSSION

An increasing trend in pH values was related to deamination reactions, as reported by Gill (1982). Deamination is related with an increase in desirable flavour when it occurs in small amounts (Guerrero and Taylor, 1994). Water holding capacity increased with storage time. As the meat was not aged in the carcass, changes associated with ripening occurred once it was cut. Increase in WHC could be due to an increase in water adsorption by the proteins as the pH shifted from the isoelectric point, due to various chemical reactions, such as deamination. Samples with some degree of spoilage, as detected by their odour, had an increased in WHC. Total nitrogen content did not vary throughout the study time.

Enterobacteriaea counts were high in all cases (10^5 cfu/g), an index of fecal contamination (Brown and Baird-Parker, 1982). *Enterobacteriaea* and psychorphile counts in

sample 2 were consistently higher as compared to the others. As a result, the highest pH and WHC values were observed. Psychrophiles (mainly *Pseudomonads*) were generally lower, except in sample 2 (10^5 cfu/g). These were the main microorganisms responsible of meat spoilage, probably originated from the water used to spray the carcass after evisceration. Mesophiles counts were moderate at the beginning of the study time (10^2 to 10^4 cfu/g). In general, microbial loads in the inner part of the carcass (thoracic and abdominal cavities) are low in healthy animals, slaughtered under hygienic conditions (10^1-10^2 cfu/g). The source of contamination is mainly the invasion of microorganisms from stomach blood (bacteremia).

The average microbial load after slaughtering and evisceration and cutting was 10^3 to 10^4 cfu/cm^2. Being the meat shelf-life related to initial microbial load, initial counts of 10^1 cfu/cm^2 or g resulted in spoilage after 17 days at 4°C. When the meat had an initial microbial load of 10^5 cfu/cm^2 or g, spoilage started at day 6 of storage at 4°C. However, in some supermarkets the meat remains in display if it does not show signs of loosing its wholesomeness. Mould and yeast populations decreased throughout the study time, probably as a result of proliferation competitive microorganisms such as *Pseudomonds* spp. By the end of the study time, yeast were dominant. Moulds were very rarely are a problem, whereas yeast play an important role in the alteration of sensory characteristics.

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Table 1. Microbial population of beef (log cfu/g).

Storage time (days)	Supermarket				
	1	2	3	4	5
Enterobacteriaceae					
1	3.886	5.136	2.755	3.963	3.843*
4	3.008	5.176	>5.5	4.173	3.518
7	5.033	5.471	>5.5	5.245	3.214
11	>5.5	>5.5	>5.5	>5.5	5.617*
14	>5.5	5.146	>5.5	>5.5	>5.5
Psychrophiles					
1	1.954	5.214	2.792	2.380	1.698
4	3.008	>5.5	4.311	3.740	3.518
7	5.093	>5.5	>5.5	5.017*	5.017*
11	5.021	5.206	>5.5	5.247*	5.247*
14	4.770	>5.5	>5.5	4.827*	4.827*
Mesophiles					
1	4.170	5.230	3.944	3.352	2.875
4	3.770	5.060	4.863	4.274	3.602
7	5.071	5.334	5.459	>5.5	5.380
11	5.086	4.954	>5.5	>5.5	5.161*
14	>5.5	>5.5	>5.5	>5.5	>5.5
Moulds and yeasts					
1	2.903	5.093	2.755	3.064	1.477
4	2.954	4.250	3.732	4.056	3.170
7	4.579	4.365	4.394	5.411	4.357
11	5.113	4.113	5.459	5.123	4.707*
14	5.401	3.903	>5.5	>5.5	5.065*

* predicted values