Effect of packing on extension of self life of retail meat

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Abstract: The packing of meat in retail markets plays important role in controlling of microbial load. Trails for extension of shelf-life of meat was studied during chilling. The comparative between the different types of packing as well as compared with fresh and chilled meat have low available data. Therefore, this study was carried out to assessment the effect of packing (Aerobically and anaerobically) on chilled meat as compared with fresh ones in retail market.

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Introduction

The packing of meat in retail markets plays important role in controlling of microbial load. Trails for extension of shelf-life of meat was studied during chilling **(White et al, 1988; Nortje et al, 1990;Cliver and Riemann, 2002 and Ashton et al, 2006)** as well as the effect of packing in aerobic **(Byun et al, 2003)** and anaerobic **(Plaatjies et al, 2004)** was done for reduction the microbial load on retail meat.

The acceptable limits of microbial load in meat cuts was stated by **(ICMSF, 1986, Grau and vanderlinde, 1990 park et al, 1994 and E.O.S.Q.C, 2001-2004)** as well as the offensive odour and change in colour were appeared when the count reached 10^7CFU/g **(Jay, 1986; Shelef et al, 1997; Moje, 1999 and Byun et al, 2003).**

The comparative between the different types of packing as well as compared with fresh and chilled meat have low available data.

Therefore, this study was carried out to assessment the effect of packing (Aerobically and anaerobically) on chilled meat as compared with fresh ones in retail market.

Material & Methods

1- Experimental samples:

Seven kilograms of fresh beef were obtained from recent slaughtered animal after arrival of the meat to butcher's shop. The collected meat was taken from hindquarter after preparation (without visible fat). The collected meat was rapidly transferred as possible to laboratory in ice box with minimum delay.

2- Experimental design:

The techniques recommended by Gill et al. (2002) was applied as follows:

The collected meat was divided into two parts:

- The first part was sliced to samples; each weighed 100 g and 7 x7 x 0.5 cm in dimensions; then, kept at room temperature (about 25-30ºC) and daily examined (3 samples each time) till spoilage.
- The second part was divided into samples as previously mentioned, then kept into three groups at chilled temp (5ºC), the first group was preserved without packing (aerobic) and the secand group aerobically was packed in polyethylene bags and finally, third group, was anaerobically (vacuumed) packed. The samples were examined with 48 hours intervals (3 samples in each time).

3- Preparation of samples.

The techniques recommended by **AOAC (2000)** was applied as follows:

4- Techniques:

i) Aerobic plate count at 35ºC (mesophiles).

ii) Aerobic plate count at 25ºC (Psychrotrophs).

iii) Enumeration of coliforms (MPN).

iv) Isolation and identification of *E. coli*.

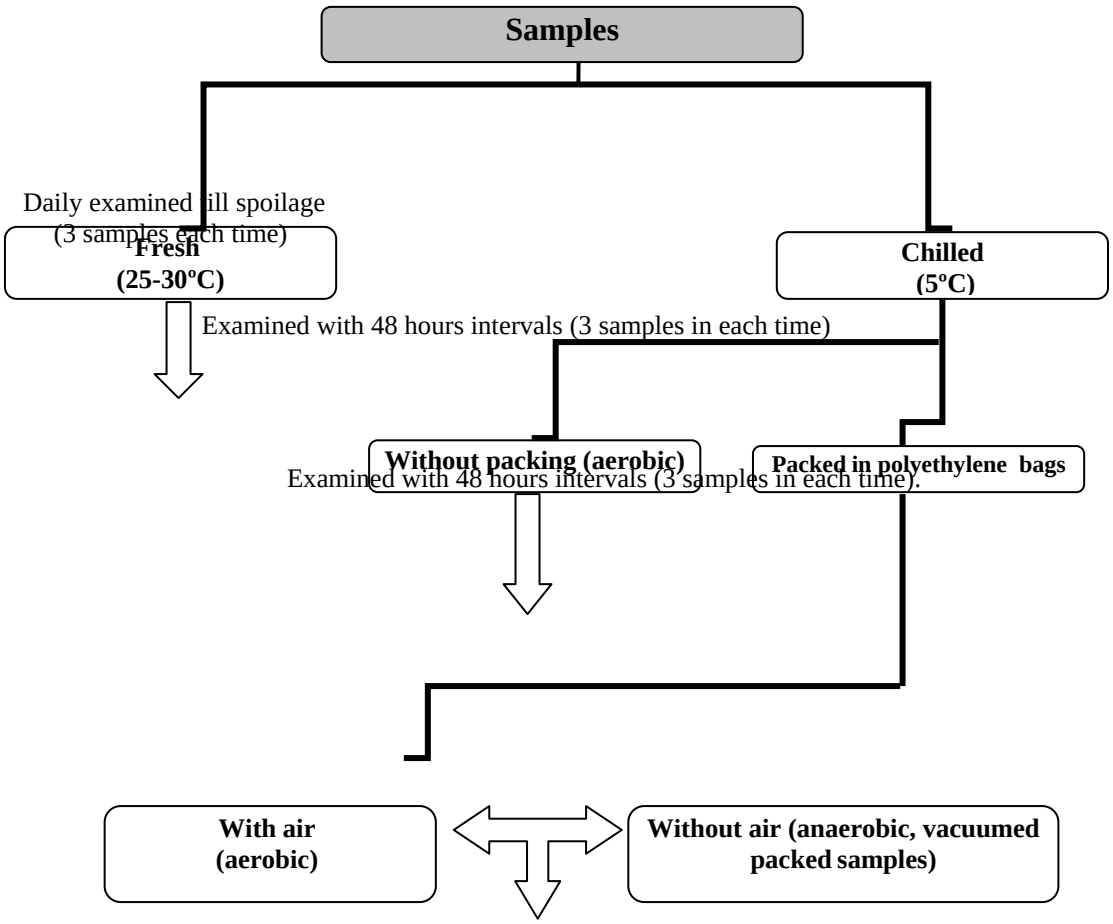
v) Isolation and Identification of Salmonellae.

vi) Determination of *Staphylococcus* count.

vii) Isolation and identification of *Staphylococcus aureus.*

viii) Isolation and identification *of Listeria monocytogenes*.

Experimental design (Gill et al., 2002):



Results

Table (1) Statistical analysis of bacteriological status of examined fresh meat samples.

Time	No. of samples	APC *	Psychrotrophic *	Coliforms bacteria (MPN) *	Fecal coliform bacteria (MPN) *	*Staphylococcus aureus* count *
1st day	3	$8\times10^{5}\pm5x10^{5}$ a	$2\times10^{4}\pm2\times10^{3}$ a	$6.7\times10\pm1.7\times10$ a	$2.8\times10\pm0.7\times10$ a	$5\times10^{2}\pm2\times10^{2}$ a
2nd day	3	$2\times10^{6}\pm9\times10^{5}$ a	$2\times10^{4}\pm1\times10^{4}$ a	$6.3\times10\pm1.5\times10$ a	$3.5\times10\pm4\times10$ a	$2\times10^{3}\pm6\times10^{2}$ b
3rd day	3	$3\times10^{7}\pm1\times10^{7}$ a	$3\times10^{5}\pm1\times10^{5}$ a	$5\times10^{2}\pm2\times10^{2}$ a b	$1\times10^{2}\pm1.9\times10$ a b	$6\times10^{3}\pm1\times10^{3}$ c e
4th day	3	$2\times10^{8}\pm1\times10^{8}$ a	$3\times10^{5}\pm1\times10^{5}$ a	$8\times10^{2}\pm2\times10^{2}$ b	$2\times10^{2}\pm1\times10^{2}$ c b	$9\times10^{3}\pm5\times10^{2}$ e
5th day	3	$9\times10^{8}\pm3\times10^{7}$ b	$9\times10^{5}\pm2\times10^{5}$ b	$1\times10^{3}\pm4\times10^{2}$ b	$1\times10^{3}\pm3\times10^{2}$ e	$2\times10^{4}\pm4\times10^{3}$ f

Mean in the same column with different alphabetical letters (a, b, c, d and f) are significant differences at ($P<0.05$).

* Mean and Standard error of three trials.

MPN = Most Probable number

Table (2) Statistical analysis of bacteriological status of examined chilled meat without packing samples during storage period.

Time	No. of samples	APC *	Psychrotrophic *	Coliforms bacteria (MPN) *	Fecal coliform bacteria (MPN) *	*Staphylococcus aureus* count *
1st day	3	$6\times10^{4}\pm2\times10^{4}$ a	$2\times10^{2}\pm5.7\times10$ a	$2.1\times10\pm0.7\times10$ a	$0.4\times10\pm0.1\times10$ a	$10^{2}\pm3\times10$ a
3rd day	3	$7\times10^{5}\pm1\times10^{5}$ a	$7\times10^{3}\pm8\times10^{2}$ a	$2\times10\pm0.9\times10$ a	$0.4\times10\pm0.09\times10$ a	$3\times10^{2}\pm8\times10$ a
5th day	3	$2\times10^{6}\pm1\times10^{6}$ a	$2\times10^{4}\pm5\times10^{3}$ a	$2.8\times10\pm0.7\times10$ a	$0.8\times10\pm0.1\times10$ a	$5\times10^{2}\pm1\times10^{2}$ a
7th day	3	$6\times10^{6}\pm1\times10^{6}$ a	$3\times10^{4}\pm1\times10^{4}$ a	$5.7\times10\pm1.8\times10$ a	$2.8\times10\pm0.8\times10$ a	$8\times10^{2}\pm1\times10^{2}$ a
9th day	3	$2\times10^{7}\pm9\times10^{6}$ a	$3\times10^{5}\pm5\times10^{4}$ a	$4\times10^{2}\pm3\times10^{2}$ a	$1\times10^{2}\pm1\times10^{2}$ a	$1\times10^{3}\pm3\times10^{2}$ c
11th day	3	$4\times10^{8}\pm1\times10^{7}$ b	$8\times10^{6}\pm1\times10^{6}$ b	$2\times10^{2}\pm1\times10^{2}$ a	$5.3\times10\pm2\times10$ a	$3\times10^{4}\pm2\times10^{4}$ b

Mean in the same column with different alphabetical letters (a, b and c) are significantly differences at ($P<0.05$).

* Mean and Standard error of three trials.

MPN = Most Probable number

period.

Time	No. of samples	APC *	Psychrotrophic *	Coliforms bacteria (MPN) *	Fecal coliform bacteria (MPN) *	*Staphylococcus aureus* count *
1st day	3	$5\times10^{3}\pm8\times10^{2\ a}$	$2\times10^{2}\pm8.8\pm\times10^{a}$	$0.4\times10\pm0.1\times10^{a}$	$0.3\times10\pm0.01\times10^{a}$	$10^{2}\pm4\times10^{a}$
3rd day	3	$3\times10^{4}\pm1\times10^{4\ a}$	$1\times10^{3}\pm8\times10^{2\ a}$	$0.8\times10\pm0.1\times10^{a}$	$0.3\times10\pm0.01\times10^{a}$	$2\times10^{2}\pm8.8\times10^{a}$
5th day	3	$1\times10^{5}\pm6\times10^{4\ a}$	$2\times10^{4}\pm1\times10^{4\ a}$	$1.7\times10\pm0.3\times10^{a\ c}$	$0.8\times10\pm0.3\times10^{a\ e}$	$2\times10^{2}\pm3.3\times10^{a}$
7th day	3	$3\times10^{6}\pm1\times10^{6\ a}$	$4\times10^{3}\pm1\times10^{3\ a}$	$3.1\times10\pm0.6\times10^{b\ c}$	$1.4\times10\pm0.4\times10^{b\ e}$	$6\times10^{2}\pm8.8\times10^{a}$
9th day	3	$7\times10^{6}\pm6\times10^{5\ a}$	$7\times10^{4}\pm5\times10^{3\ a}$	$5.7\times10\pm0.9\times10^{e}$	$2.7\times10\pm0.4\times10^{c}$	$4\times10^{3}\pm2\times10^{2\ b}$
11th day	3	$8\times10^{7}\pm5\times10^{6\ b}$	$4\times10^{5}\pm1\times10^{5\ b}$	$1\times10^{3}\pm3\times10^{2\ f}$	$1\times10^{3}\pm4\times10^{2\ f}$	$8\times10^{4}\pm3\times10^{2\ c}$

Mean in the same column with different alphabetical letters (a, b, c and e) are significantly differences at ($P<0.05$).
* Mean and Standard error of three trials.
MPN = Most Probable number

Table (4) Statistical analysis of bacteriological status of examined anaerobic packaged meat samples during storage period.

Time	No. of samples	APC *	Psychrotrophic *	Coliforms bacteria (MPN) *	Fecal coliform bacteria (MPN) *	*Staphylococcus aureus* count *
1st day	3	$1\times10^{3}\pm4\times10^{2}$ a	$10^{2}\pm2.5\times10^{a}$	$0.32\times10\pm0.2\times10^{a}$	$0.3\times10\pm0.01\times10^{a}$	$10^{2}\pm4\times10^{a}$
3rd day	3	$5\times10^{3}\pm8\times10^{2}$ a	$1\times10^{2}\pm3.3\times10^{a}$	$0.74\times10\pm0.09\times10$ a	$0.3\times10\pm0.01\times10^{a}$	$10^{2}\pm3.5\times10^{a}$
5th day	3	$3\times10^{4}\pm1\times10^{4}$ b	$3\times10^{2}\pm5.7\times10^{a}$	$1\times10\pm0.09\times10^{a}$	$0.\ 5\times10\pm0.\ 2\times10^{a}$	$10^{2}\pm4\times10^{a}$
7th day	3	$3\times10^{5}\pm2\times10^{5}$ c	$6\times10^{2}\pm5.7\times10^{a}$	1.2×10±0.2×10 a	$0.07\times10\pm0.01\times10$ a	$2\times10^{3}\pm1\times10^{3\ a}$
9th day	3	$3\times10^{6}\pm1\times10^{6}$ d	$5\times10^{3}\pm1\times10^{3\ a}$	$2.2\times10\pm0.1\times10^{a}$	$1\times10\pm0.09\times10^{a}$	$5\times10^{4}\pm3\times10^{4\ b}$
11th day	3	$7\times10^{7}\pm2\times10^{7}$ f	$1\times10^{6}\pm8\times10^{5\ b}$	$4\times10^{2}\pm3\times10^{2\ f}$	$4\times10^{2}\pm3\times10^{2\ b}$	$3\times10^{4}\pm2\times10^{4\ c}$

Mean in the same column with different alphabetical letters (a, b, c, d and f) are significantly differences at ($P<0.05$).
* Mean and Standard error of three trials.
MPN = Most Probable number

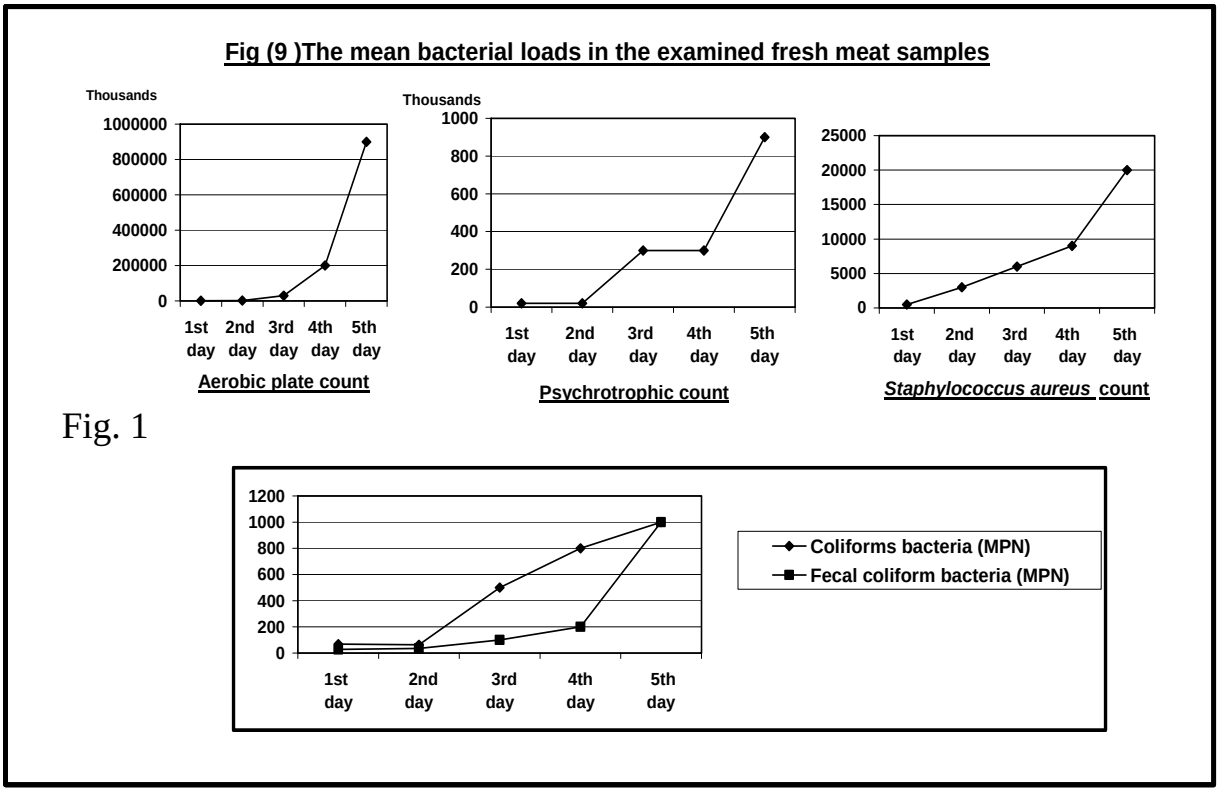


Fig (9)The mean bacterial loads in the examined fresh meat samples
Thousands
1000000
800000
600000
400000
200000
0
1st day
2nd day
3rd day
4th day
5th day
Aerobic plate count
Thousands
1000
800
600
400
200
0
Psychrotrophic count
25000
20000
15000
10000
5000
0
Staphylococcus aureus count
1200
1000
800
600
400
200
0
Coliforms bacteria (MPN)
Fecal coliform bacteria (MPN)

Fig. 1

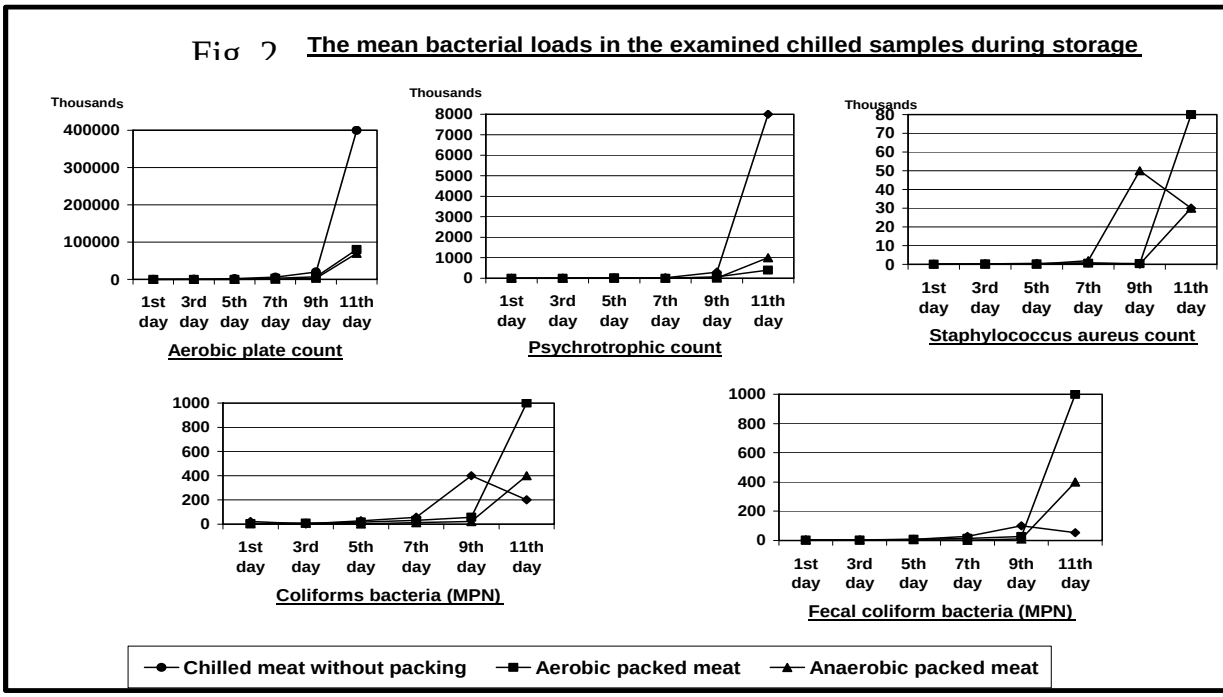


Fig. 2 The mean bacterial loads in the examined chilled samples during storage
Thousands
400000
300000
200000
100000
0
1st day
3rd day
5th day
7th day
9th day
11th day
Aerobic plate count
Thousands
8000
7000
6000
5000
4000
3000
2000
1000
0
Psychrotrophic count
Thousands
80
70
60
50
40
30
20
10
0
Staphylococcus aureus count
1000
800
600
400
200
0
Coliforms bacteria (MPN)
Fecal coliform bacteria (MPN)
Chilled meat without packing
Aerobic packed meat
Anaerobic packed meat

DISCUSSION

- From the results achieved in Table (1) fig. (1), it was evident that the mean value of aerobic plate count of fresh meat at 1st day was $8 \times 10^5 \pm 5 \times 10^5$ organisms/g while it was reached to $9 \times 10^8 \pm 10^7$ organisms/g at 5th day. Aerobic plate count was significantly increased at ($p<0.05$) at the 5th day, constituting $9 \times 10^8 \pm 10^7$ organisms/g. Concerning psychrotropic count, it was $2 \times 10^4 \pm 2 \times 10^3$ organisms/g as well as it was reached to $9 \times 10^5 \pm 2 \times 10^5$ organisms/g at 5th day. There is a significant increase in psychrotrophic count at 5th day ($9 \times 10^5 \pm 2 \times 10^5$ organisms/g.).
- Most probable number of coliforms was $6.7 \times 10 \pm 1.7 \times 10$ organisms/g at the first day while it was reached to $10^3 \pm 4 \times 10^2$ organisms/g at the 5th day. It was significant at ($P < 0.05$) at 4th and 5th days, each constituting, $8 \times 10^2 \pm 2 \times 10$ and $10^3 \pm 4 \times 10^2$ organisms/g, respectively. Dealing with most probable number of fecal coliforms, it was $2.8 \times 10 + 0.7 \times 10$ organisms/g at 1st day while it was reached to $10^3 \pm 3 \times 10^2$ organisms/g at 5th day. A significant increase in fecal coliforms (MPN) at 5th day, constituting $10^3 \pm 3 \times 10^2$ organisms/g. *Staphylococcus aureus* count was $5 \times 10^2 \pm 2 \times 10^2$ organisms/g at 1st day while it was reached to $2 \times 10^4 \pm 4 \times 10^3$ organisms/g at 5th day. There are a significant differences between *Staphylococcus aureus* counts starting from 2nd day till the 5th day, each constituting $2 \times 10^3 \pm 6 \times 10^2$ and $2 \times 10^4 \pm 4 \times 10^3$ organisms/g, respectively.
- The total bacterial counts for microbial species is freshly cut meat surfaces are likely to vary. It may be attributed to these organisms are mainly derived from exterior and the gut of animal but also from knives, other utensils; butchery tables. Therefore, variations in counts often reflect the hygienic conditions under which that meat produce. This agrees with that reported by **Nottingham (1982).** Aerobic storage of meat allowed total aerobic counts to reach high levels. The growth of initial bacterial counts in fresh meat may enhanced by the time of storage due to highly enrichment of meat with nutrient elements required for multiplication of microorganisms. The shelf-life of the meat will depend upon the rate of spoilage. Spoilage microorganisms may represent only a very small part of the initial flora they will consistently become predominant in raw meat under storage conditions **(Forsythe and Hayes, 1998 & Skandmis and Nychas, 2002).** In this respect, **Ingram (1971)** stated that some 10^8 bacterial cells per gram may be necessary to induce measurable spoilage in food over a number of days of storage. On the other hand, **Gardner (1965)** stated that sliced meats hold at 15 or 10ºC develop off-odors after to five days storage and surface slime is evident at about seven days.
- The present data in table (2) fig.(2), it is revealed that the aerobic plate count of meat at 1st day was $6 \times 10^4 \pm 2 \times 104$ organism/g. Such count was gradually increased during storage at chilling (5ºC) to reach $4 \times 10^8 \pm 10^7$ organisms/g at 11th day. Psychrotrophic count of meat/gm at 1st day of chilled storage was $2 \times 10^2 \pm 5.7 \times 10$ as well as it was highly increased to reach $8 \times 106 + 106$ organisms/g after 11th day chilled storage. There is a significant differences at ($P<0.05$) in counts of each of aerobic plate and psychrotrophic at 11th day of storage. Most probable numbers of each of coliforms and fecal coliforms were $2.1 \times 10 \pm 0.7 \times 10$ and $0.4 \times 10 \pm 0.1 \times 10$ organisms/g, respectively at the 1st day. After 11th day of chilled storage, such counts were reached to $2 \times 10^2 \pm 10^2$ and $5.3 \times 10 \pm 2 \times 10$ organisms/g; respectively. No significant variations in both most probable numbers of each of coliforms and fecal coliforms during chilled storage at $P<0.05$.
- The Staphulococcus aureus count was $10^2 \pm 3 \times 10$ organisms/g at 1st day of chilled storage while it was reached to $3 \times 10^4 \pm 2 \times 10^4$ organisms/gm after 11th day storage. There is a significant differences between the Staphylococcus counts during chilled storage at $P< 0.05$.

The obtained results were in accordance with that achieved by **Ayres (1960) and Forsythe and Hayes (1998).**

- The general viable count should be less than 10^7 organisms/g in chilled meat **(ICMSF, 1986).**
- The bacterial growth is usually inhibited at chilling room temperature, the meat continues to lose water by evaporation, and the air, becoming humid, creates a condition which is suitable for the growth of mould. This held the view reported by **Gracey and Collins (1992)** and **(Patterson and Gibbs, 1978).**
- The gradual variations in microbial counts during chill storage may be attributed to the storage in chilled temperatures at 5ºC or below a definite lag phase is apparent. The length of this phase depends on storage temperature and extends for 24 hours at 5º C before the onset of the first signs of spoilage is extended and off-odor and slime production take 8 and 12 days, respectively, to develop at 5ºC and 16ºC. This substitutes the hypothesis mentioned by **Forsythe and Hayes (1998).**
- On contrary, **Gould (1995)** stated that, in chill-stored proteinaceous foods such as meat, this generally results in the inhibition of Gram-negative e.g. Enterobacteriaceae whilst the Gram-positive

bacteria become the dominant organisms. On the other hand, **Farber (1991)** stated that the oxygen stimulate the growth of aerobic bacteria and can inhibit the growth of strictly anaerobic bacteria, although there is a very wide variation in the bacterial counts according to sensitivity to oxygen.

- From table (3) fig. (2), it was achieved that the aerobic plate count of aerobically packed meat at 1st day was $5 \times 10^3 \pm 8 \times 10^2$ organisms/g. It was reached to $3 \times 10^6 \pm 10^6$ organisms/g at7th day. Finally, it became $8 \times 10^7 \pm 5 \times 10^6$ organisms/g at the end of the experiment (11th day). Dealing with psychrotrophic count in aerobic packed meat, it was $2 \times 10^2 \pm 8.8 \times 10$.organisms/g at first day of storage. At the end of the experiment, it was reached $4 \times 10^5 \pm 10^5$ organisms/g at 11th day. There are significant variations in either of aerobic plate count and psychrotrophic count at 11th day of storage of aerobically packed meat at $P< 0.05$.
- Most Probable number of coliforms and fecal coliforms of aerobically packed meat were $4 \times 10 \pm 10$ and $0.3 \times 10 \pm 0.1 \times 10$.organisms/g, respectively at the 1st day of storage as well as they were reached to $10^3 \pm 3 \times 10^2$ organisms/g at 11th day of storage. A significant variation was observed between the Most Probable number of both coliforms and fecal coliforms during storage at ($P <0.05$). Concerning *Staphylococcus aureus*, it was $10^2 \pm 8.8 \times 10$ organisms/g, it was gradually increased; reaching $8 \times 10^4 \pm 3 \times 10^2$ organisms /g at the end of the experiment (11th day). There is a significant differences in count stating from 9th and 11th day of storage at $P <0.05$.The growth of microorganisms on vacuum-packed fresh meats may be attributed to initial bacterial contamination. Subsequent growth is slow so that by the time the final total count of 10^7 per gram will reached. The gradual changes in the spoilage flora are observed. This held with that reported by **Egan and Roberts (1987).**
- Packing of meat may be an effective method for meat shelf-life extension. The bacterial counts including the spoilage-related microbial groups had changes depending on the packing condition. When the beef was packed in air, all microbial groups showed viable counts higher than those of the other packing conditions. This in-agreement with that reported by **Skandamis and Nychas (2005); Ercolini et al. (2006) and Koutsoumanis et al. (2006).** Microbial spoilage on aerobically packed meats can be detected as off odor when surface counts reach 10^7 organisms/gm **(Jay, 1986).**
- From the present data reported here in (table 4) and fig.(2), it is evident that the aerobic plate count and psychrotrophic count of anaerobically packed meat (vacuum packed) at 1st day of storage were $10^3 \pm 4 \times 10^2$ and $10^2 \pm 25 \times 10$ organisms/g, respectively. Such counts reach $7 \times 10^7 \pm 2 \times 10^7$ and $10^6 \pm 8 \times 10^5$ organisms/g after 11th day of storage. There is a significant variations between aerobic plate counts during storage period at $P<0.05$ while this variation was significantly only on 11th day storage in psychotropic count.
- Either of Most Probable number of coliforms and fecal coliforms of anaerobic packed meat at 1st day were $0.32 \times 10 \pm 0.2 \times 10$ and $0.3 \times 10 \pm 0.1 \times 10$ orgamisms/g, respectively while it reached to $4 \times 10 \pm 3 \times 10$ and $4 \times 10^2 \pm 3 \times 10^2$ organisms/g, respectively; at the end of the experiment (at 11th day). There is only significant variation in counts during storage at 11th day in both of coliforms and fecal coliforms at $P< 0.05$.
- Concerning Staphylococcus aureus, the count was $10^2 \pm 4 \times 10$ organisms/g as well as it was not change till the 5th day. It reached to $3 \times 10^4 \pm 2 \times 10^4$ organisms/g at 11th day of storage. A significant variations ($P <0.05$) was observed in the day and continued till the end of experiment (11th day).
- The change of spoilage-related microbial flora during storage of beef under different packing condition. The large variation of gas composition during packing due to microbiological growth, which, in the contrary, is inhibited by using anaerobic condition (under vacuum). This was confirmed by suggestion reported by **Kennedy et al. (2004).**
- Vacuum packages prevent the growth of high spoilage potential aerobic microorganisms. Reaching potential spoilage numbers under anaerobic storage conditions does not necessarily coincide with the onset of spoilage. On contrary, **Sadler and Swan (1997)** stated that the storage life was shorter in vacuum-packing because a small amount of oxygen can enter the pack, allowing more rapid bacterial growth, and because there is no inhibitory carbon dioxide atmosphere.
- Vacuum packing of fresh meats provides sufficient shelf-life of primal cuts for long-term storage and intercontinental transport. Vacuum package beef held in films with oxygen permeability had a storage life of 11 weeks at 0ºC. The extension of the shelf- life of vacuum packed meat as compared with aerobic packed may be attributed to change of microflora from aerobic to anaerobic organisms in the vacuum packaged meat. This substitutes the hypothesis reported by **Pierson et al. (1970); Seideman et al. (1976) & Lee and Yoon (2001).**
- On the present data, it could be concluded that, the anaerobically packing of retail meat in markets was the preferred method for extension of shelf

life of meat as compared with aerobic packing. The suggestive measures showed that the vacuum pack of fresh meat provides sufficient shelf life of cuts at 1-5ºC for long term storage then aerobic pack of chilled beef which prefer to butchers. Finally cold storage under different packing condition for freshness of meat would benefit both consumers and meat industry**.**

- Application of HACCP (Hazard Analysis Critical Control Points) system in retail meat production and industries.

SUMMARY

This experiment was carried to assessment the effect of packing (aerobically and anaerobically) on chilled meat as compared with fresh ones. Aerobic plate count was significantly increased at $p<0.05$ at the 5th day, constituting $9 \times 10^8 \pm 10^7$ organisms/g. There is a significant increase in psychrotrophic count at 5th day $9 \times 10^5 \pm 2 \times 10^5$ organisms/g. Most probable number of coliforms was significant at $P < 0.05$ at 4th and 5th days, each constituting $8 \times 10^2 \pm 2 \times 10$ and $10^3 \pm 4 \times 10^2$ organisms/g, respectively. A significant increase in fecal coliform (MPN) at 5th day, constituting $10^3 \pm 3 \times 10^2$ organisms/g. Staphylococcus aureus count starting from 2nd day till the 5th day, each constituting $2 \times 10^3 \pm 6 \times 10^2$ and $2 \times 10^4 \pm 4 \times 10^3$ organisms/g, respectively.There is a significant differences at $P<0.05$ in count of each of aerobic plate and psychrotrophic at 11th day of storage. No significant variation in both most probable numbers of coliforms and fecal coliform during chilled storage at $P<0.05$.There is a significant differences between the Staphylococcus counts during chilled storage at $P< 0.05$. There are significant variations in either of aerobic plate count and psychrotrophic count at 11th day of storage of aerobically packed meat at $P< 0.05$. A significant variation was observed between the Most Probable number of both colifrm and fecal coliforms during storage at $P <0.05$. There is a significant difference in Staphylococcus *aureus* count stating from 9th and 11th day of storage at $P <0.05$. Significant variations between aerobic plate counts during storage period at $P <0.05$ while this variation was significantly only on 11th day storage in psychotropic count. There is only significant variation in count during storage at 11th day in both of coliforms and fecal coliforms at $P< 0.05$. A significant variation ($P <0.05$) was observed in Staphylococcus *aureus* between the days and continued till the end of experiment (11th day). Suggestive for measure extension shelf-life time of marketed retail meat in butcher's shops was discussed.

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الملخص العربي

أجريت هذه الدراسة لمعرفة مدى تأثير والتغليف (هوائى ولا هوائى) على المبردة مقارنة باللحوم الطازجة وذلك فى 4 تجارب:

1) **التجربة الأولى** : حفظ عينات اللحوم الطازجة فى درجة حرارة الحجرة 25–30 ^{5}م التى تمثل محل الجزارة حتى الفساد وكانت من يوم الذبح حتى اليوم الخامس والفحص الميكروبيولوجي لهذه العينات.
2) **التجربة الثانية** : حفظ عينات اللحوم الطازجة والغير معبأة فى درجة حرارة 1–5 ^{5}م حتى الفساد فيحدد الزمن والحالة الميكروبيولوجية لصلاحية اللحوم فى التبريد بدون تغليف حتى اليوم الحادي عشر.
3) **التجربة الثالثة** : حفظ عينات اللحوم المعبأة هوائياً فى درجة حرارة 1–5 ^{5}م حتى الفساد فى اليوم الحادي عشر.
4) **التجربة الرابعة** : حفظ عينات اللحوم المعبأة لاهوائياً فى درجة حرارة 1–5 ^{5}م حتى اليوم الحادي عشر الذى حدث به الفساد وتم الفحص الميكروبيولوجي ومنها ومنها الوصول إلى طريقة الحفظ الأمثل وتحديد درجة الحرارة المثالية لحفظ جودة اللحوم لأطول فترة ممكنة.

وأظهرت النتائج الآتية :

التجربة الأولى : متوسط العد الميكروبات الهوائية فى اليوم الأول كان العد 8×10 ^{5} ± 8× 10 ^{5} وزادت 3× 10 ^{7} ± 10 ^{7} ووصلت إلى الفساد فى اليوم الخامس وكانت 9×10 ^{8} ±10 ^{7} ميكروب/جرام ومتوسط الميكروبات المحبة للبرودة بدأت فى الزيادة من اليوم الثاني حتى اليوم الخامس ووصلت والميكروب القولوني زاد فى اليوم من اليوم الثاني إلى اليوم الخامس 10 ^{3} ± 3×10 ^{2} ميكروب/جرام.

والميكروب المكور الذهبي بدأت فى الزيادة من اليوم الثاني حتى الفساد فى اليوم الخامس من 5×10 ^{2}± 2×10 ^{2} و 2×10 ^{4} ± 4×10 ^{3} ميكروب/جرام.

وهذه الطريقة للحفظ غير مجدية حيث أنها تفسد اللحوم بسرعة ويرجع هذا إلى تلوث الأسطح الملامسة للحوم.

التجربة الثانية : متوسط العد الميكروبات الهوائية للحوم المبردة الغير مغلفة بدأت فى الزيادة والميل إلى الفساد من اليوم السابع وبلغت أقصاه فى اليوم الحادي عشر 4×10 ^{8} ± 10 ^{7}ميكروب/جرام. الميكروبات المحبة للبرودة بدأت فى الزيادة من اليوم التاسع حتى اليوم الحادي عشر 8×10 ^{6} ± 10 ^{6}. الميكروب القولوني يبدأ يتزايد من اليوم السابع حتى أقصاه فى اليوم الحادي عشر. الميكروب العنقود الذهبي بدأ فى الزيادة تدريجياً من اليوم الحادي عشر 4 × 10 ^{4} ± 2 × 10 ^{4}.

التجربة الثالثة : اللحوم المبردة المعبأة هوائياً قد يتضح أن متوسط العد الكلي للميكروبات الهوائية تبدأ فى التزايد التدريجي فى اليوم السابع حتى اليوم التاسع ويرتفع أقصاه فى اليوم الحادي عشر 5×10 ^{3} ± 8× 10 ^{2} ، 3×10 ^{6} ± 10 ^{6} ، 8× 10 ^{7} ± 5× 10 ^{6}ميكروب/جرام على التوالي.

والميكروبات المحبة للبرودة أيضا تبدأ الزيادة من اليوم السابع تدريجيا حتى اليوم التاسع يبلغ أقصاه عن النسبة المقررة فى المواصفات القياسية المصرية وكذلك الميكروب المكور العنقود الذهبي وجدت أنها تبدأ فى الزيادة من اليوم التاسع وتصل إلى الفساد فى اليوم الحادي عشر 8×10 ^{4} ± 3×10 ^{2} ميكروب/جرام. الميكروبات القولونية فقد وجدت أنها تبدأ من اليوم السابع فى الزيادة حتى اليوم التاسع ثم فى اليوم الحادي عشر.

التجربة الرابعة : اللحوم المبردة المعبأة لاهوائيا وجد أن المتوسط العد الكلي للميكروبات الهوائية والمحبة للبرودة تبدأ فى الزيادة تدريجياً حتى اليوم الحادي عشر 7×10 ^{7}± 2×10 ^{7} 10 ^{6} ± 8× 10 ^{5} ميكروب/جرام على التوالي. والميكروبات القولونية وجدت أنها تبدأ فى الزيادة فى اليوم التاسع إلى اليوم الحادي عشر حيث الفساد. وكان متوسط المكور العنقود الذهبي يبدأ فى الزيادة اليوم السابع ويصل إلى 4× 10 ^{4} اليوم الحادي عشر.

ومن هذه النتائج : اتضح ان حفظ اللحوم المبردة المعبأة لاهوائيا تحفظ اللحوم مدة 7–9أيام عند درجة حرارة 1–5م وتساعد على زيادة مدة الصلاحية لها. ثم يليها حفظ اللحوم المبردة المعبأة هوائياً فى زيادة مدة الصلاحية لحفظ اللحوم.

1. ناقشت الباحثة الأهمية الاقتصادية للميكروبات المعزولة وكذلك الأهمية الصحية لها والاقتراحات المناسبة اللازمة لحفظ اللحوم لأطول فترة ممكنة.

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