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GROWTH PROMOTORS AND THE DURABILITY OF MEAT

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SUMMARY

The microbial contamination of carcasses has been reported to have significant effect on the shelf life of meat. Refrigeration-storage (at 0°C) of meat to prolong its shelf-life recommended by many authors. The flavomycin is antibiotic used as veterinary drug and as feed additive to promote the growth of cattle and buffalo. The aim of this work is to study the effect of flavomycin on the durability of chilled beef and buffalo's meat. Sixteen calves, 8 each of Friesian and buffalo, four animals of each fed on 20 mg/day flavomycin (growth promotor) and other four are untreated (control), sample of each carcass were kept at 0°C±1 and examined every 2 hr 5, 10, 15 and 20 day for bacteriological quality (Aerobic plate C., Enterobacteroceae C., Coliforms C., Pyshrotrophic C. and Staphylococcus aureus C. Analysis of muscle, liver, kidney and intestine for detection the presence of flavomycin residues.

The obtained results proved that the flavomycin has an effect on the initial bacterial count and the bacterial count during the periods of cold storage. The absence of flavomycin in the tissue was also observed this may attributed to the fact that flavomycin is poorly observed from the digestive tract. Therefore, it could be concluded that the flavomycin can be safely used as growth promotor.

Keywords: Growth promotor, shelf-life, Friesian, Buffalo, bacterial count, storage

INTRODUCTION

Meat as sensitive raw material requires special care during production and storage in order to remain its natural properties and nutritive value.

The main microbial problems involved in meat production and storage are represented in the consumer protection from foodborne diseases as well as its spoilage.

Muscular tissues of healthy animals at slaughter are virtually free from microorganisms and that contamination is connected only with human handling (Zender et al., 1958; Ingram 1964; Hasegawa et al., 1970; Ingram and Dainty (1971) and Gilland Netwon (1977).

It has been established that the potential sources of microbial contamination come from hide, hair, hoofs, soil, contents of the gastro-intestinal tract, water used for washing the carcasses, air borne contamination, cloths, knives and finally the personnel (Ayres, 1955; Frazier and Westhoff, 1978 and Thomton, 1977). Because of these varied sources of contamination, the quality and quantity of microorganisms which are likely contaminate carcasses will also be varied.

The microbial contamination of carcasses has been reported to have a significant effect on the shelf life of meat. Moreover, the initial contamination can be directly correlated with the keeping quality of beef meat, Greer and Jeremiah (1980). In connection with this, many investigators have stressed the importance of the rapidly decreasing temperature of meat without freezing as a precise method to inhibit or even stop the subsequent multiplication of initial contaminants, particularly, the mesophilic ones (Ayres, 1955 and Elliott and Michener, (1965). Hence, refrigeration-storage of raw meat to prolong its shelf and acceptable life is now a universally accepted principle in the field of meat storage.

In practice, refrigeration storage of meat carcasses has not stopped the process of psychrotrophic or psychrotrophilic microbial growth which has most often been the cause of surface discoloration, slime formation, undesirable odors, rancidity of fat or even spoilage of refrigerated meat (Ayres, 1960; Elliott and Michener, 1965; Ingram and Dointy, 1971; Elmosalami and

Wassef, 1973; Bala et al., 1977; and Gill and Newton, 1977).

During storage of meat, total number of bacteria may be increased specially psychrotrophic strains. Ayres (1955) stated that chilling of meat inhibits the growth of microorganisms other than psychrophiles.

The keeping quality of meat is not affected only by the initial count of the bacteria, but also by the temperature and relative humidity of the storage room. Storage of edible meat in chilling chambers adjusted at 0°C and relative humidity 88-90% recommended by Roushdy et al. (1982) as meat retain its freshness for a relatively long duration.

Hapke and Grahwit (1987) stated that the application of veterinary drugs is a necessity for prophylactic and therapeutic reasons both in individual animal and in large scale farming. By this the health of the animals is maintained and good performance is ensured. Thus, in many cases the prophylactic application of drug until short time before is unavoidable.

The aim of the present study is to clarify the effect of flavomycin antibiotic as a growth promotor on the durability of chilled beef and buffalo's meat.

The flavomycin is an antibiotic related to the flavophospholipol group, and is used as feed additive. Thus, corresponding to its primary purpose, has an absorption ratio of only 0.25% from the digestive tract. It does not create residue levels in the animal's tissue (Mirna, 1971).

MATERIALS AND METHODS

Sixteen calves, 8 each of Friesian and buffalo. Four animals of each species fed on 20 mg/day flavomycin (growth promotor) during fattening period untill three days before slaughter (450 Kg) and the other 4 are untreated (control). From each carcass the fore shank and hind shank are collected and placed in plastic bags in a refrigerated container for transport to the laboratory with a minimum of delay.

The muscle samples were kept on refrigerator at 0°C ±1 and examined every 2 hr, 5, 10, 15 and 20 days for bacteriological quality as follows:

1. Aerobic plate count (APC):

Samples were prepared and examined according to the technique recommended by ICMSF (1978), where the drop method was used and the plates were incubated at 30°C for 48 hr.

2. Psychrotrophic count:

The technique adopt simulates what has been stated on APC. Standard plate count agar was used according to A.P.H.A. (1976) and incubated at 7°C for 10 days.

3. Enterobacteriaceae count:

The same technique of the drop plate method was applied using violet red bile glucose agar (ICMSF, 1978), with incubation temp. 37°C for 24 h.

4. Staphylococcus aureus count:

(ICMSF, 1978), using Baird parcker medium.

5. Enumeration of coliform (MPN):

The three tube method recommended by ICMSF, (1974) and ISO, (1975) was applied.

In addition samples of liver, kidneys and intestine were collected for detection of flavomycin residue.

Detection of flavomycin residues in different tissues. The technique adopted was that recommended by Levetzow and Weise (1979) using Bacillus subtilise strain.

Statistical analysis were adopted according to Snedecor and Cochran (1968).

RESULTS AND DISCUSSION

The results in Table (1) showed the associative growth pattern of the initial bacterial population in beef meat (control) during cold storage.

The highest mean APC (Aerobic plate count) $3.7 \times 10^6 \pm 1.4 \times 10^6$ was obtained after 20 days at 0°C while the lowest mean APC was $3.0 \times 10^2 \pm 1.3 \times 10^2$ after 2 hours. These findings fall close to the observation reported by Abd Al-Menom (1986).

Dealing with coliforms most probable number (MPN), it showed a gradual increase up to 31.5 after 20 days in beef untreated with flavomycin, 12.1 in beef treated with flavomycin, 19.6 in buffaloes untreated and 12.1 in buffaloes treated (Table 2), these findings agree with

Table 1. The effect of feeding growth promotors on bacteriological quality of chilled beef meat

Time	Treated					Control				
	APC	E.C.	C.C.	Psy.C.	S.aureus C.	APC	E.C.	C.C.	Psy.C.	S.aureus C.
2 hours post-morlom										
Min.	$<2\times10^2$	$<2\times10^2$	<3	$<2\times10^2$	$<10^2$	$<2\times10^2$	$<2\times10^2$	<3	$<2\times10^2$	$<10^2$
Max.	$<2\times10^2$	$<2\times10^2$	<3	$<2\times10^2$	$<10^2$	6×10^2	2×10^2	15	4×10^2	$<10^2$
Moam	0	0	0	0	0	3×10^2	10^2	5.05	1.5×10^2	0
S.E.±	0	0	0	0	0	1.3×10^2	50	3.03	82.9	0
5 days						10^3	$<2\times10^2$	<3	10^3	$<10^2$
Min.	$<2\times10^2$	$<2\times10^2$	<3	8×10^2	$<10^2$	10^4	8×10^2	19	8×10^3	$<10^2$
Max.	3×10^2	$<2\times10^2$	<3	10^3	$<10^2$	8.8×10^3	8.5×10^2	8.6	4.5×10^3	0
Moam	1.1×10^3	0	0	9×10^2	0	3.6×10^3	1.8×10^2	3.8	1.4×10^3	0
S.E.±	5.6	0	0	50	0					
10 days						10^4	10^2	15	10^4	$<10^2$
Min.	10^3	4×10^2	3	2×10^3	$<10^2$	2×10^5	10^3	27	8×10^4	$<10^2$
Max.	6×10^4	10^3	3	6×10^3	$<10^2$	6.2×10^4	10^3	18.25	4.5×10^4	0
Moam	1.6×10^4	7×10^2	3	3×10^2	0	3.9×10^4	0	2.53	1.4×10^4	0
S.E.±	1.3×10^4	0	0	8.7×10^2	0					
15 days	10^4	6×10^2	6	10^4	$<10^2$	8×10^4	2×10^2	15	10^5	$<10^2$
Min.	2×10^5	2×10^3	12	10^5	$<10^2$	6×10^5	2×10^4	35	2×10^5	$<10^2$
Max.	1.2×10^5	1.4×10^3	9.75	6.8×10^4	0	4.7×10^5	7×10^3	21.25	1.7×10^5	0
Moam	4.1×10^4	3×10^2	1.2	1.8×10^4	0	1.1×10^5	3.8×10^3	4.1	2×10^2	0
S.E.±										
20 days	6×10^5	10^3	9.2	8×10^5	$<10^2$	8×10^5	6×10^2	20	8×10^6	$<10^2$
Min.	6×10^6	6×10^3	15	2×10^6	$<10^2$	8×10^6	6×10^4	42	8×10^7	$<10^2$
Max.	1.9×10^6	4.3×10^3	12.1	1.1×10^6	0	3.7×10^6	3.7×10^4	31.5	4.2×10^7	0
Moam	1.2×10^5	1.4×10^3	1	2.8×10^5	0	1.4×10^6	1.2×10^4	4.1	1.5×10^7	0
S.E.±										

APC = Aorobic plate count.
Psy. C = Psychrotropphic count.
E.C. Enterobteriacose
S. unreous = Staphyltococcus aurous count
CC = Coliform count (MPN)

Table 2. The effect of feeding growth promotors on bacteriological quality of chilled beef meat

Time	Treated					Control				
	APC	E.C.	C.C.	Psy.C.	S.aureus C.	APC	E.C.	C.C.	Psy.C.	S.aureus C.
2 hours post-morlom										
Min.	$<2x10^2$	$<2x10^2$	<3	$<2x10^2$	$<10^2$	$<2x10^2$	$<2x10^2$	<3	$<2x10^2$	$<10^2$
Max.	$<2x10^2$	$<2x10^2$	<3	$<2x10^2$	$<10^2$	$4.0x10^2$	$2x10^2$	3	$<2x10^2$	$<10^2$
Moam	0	0	0	0	0	$2.5x10^2$	50.0	0.75	0	0
S.E.±	0	0	0	0	0	82.9	43.3	0.64	0	0
5 days										
Min.	$<2x10^2$	$<2x10^2$	<3	$8.0x10^2$	$<10^2$	$8.0x10^2$	$<2x10^2$	3	$6.0x10^3$	$<10^2$
Max.	$5x10^3$	$<2x10^2$	<3	$2.0x10^3$	$<10^2$	$6.0x10^3$	10^3	15	$2.0x10^3$	$<10^2$
Moam	$1.2x10^3$	0	0	$9.3x10^2$	0	$2.2x10^3$	$4.0x10^2$	5.25	$1.1x10^3$	0
S.E.±	$5.7x10^2$	0	0	52.1	0	$1.1x10^3$	$1.9x10^2$	2.0	$2.9x10^2$	0
10 days										
Min.	$2.0x10^3$	$3 \ x10^2$	3	$4.0x10^3$	$<10^2$	$4.0x10^4$	$6.0x10^2$	3	10^3	$<10^2$
Max.	$8.0x10^4$	$2 \ x10^3$	3	$7.0x10^3$	$<10^2$	$5.0x10^4$	$6.0x10^3$	15	$6.0x10^4$	$<10^2$
Moam	$1.8x10^4$	$7.3x10^2$	3	$3.4x10^2$	0	$5.5x10^4$	$2.4x10^3$	10.5	$3.1x10^4$	0
S.E.±	$1.4x10^4$	$1.3x10^2$	0	$8.9x10^2$	0	$4.3x10^3$	$1.1x10^3$	2.25	$1.5x10^4$	0
15 days										
Min.	$2x10^4$	$9.0x10^2$	8	$3.0x10^4$	$<10^2$	$4.0x10^4$	10^3	9	$2.0x10^5$	$<10^2$
Max.	$4x10^5$	$5.0x10^3$	12	$2.0x10^5$	$<10^2$	$6.0x10^4$	10^4	20	$8.0x10^5$	$<10^2$
Moam	$1.3x10^5$	$1.7x10^3$	9.75	$7.2x10^4$	0	$5.5x10^4$	$5.3x10^3$	14	$6.1x10^5$	0
S.E.±	$4.3x10^4$	$3.2x10^2$	1.20	$2.1x10^4$	0	$4.3x10^3$	$1.9x10^3$	2	$1.7x10^5$	0
20 days										
Min.	$8.0x10^5$	$2.0x10^3$	9.2	$6.0x10^5$	$<10^2$	$2.0x10^5$	$6.0x10^3$	12	10^6	$<10^2$
Max.	$7.0x10^6$	$9.0x10^3$	15.0	$4.0x10^6$	$<10^2$	0^6	10^4	36	$8.0x10^6$	$<10^2$
Moam	$2.1x10^6$	$4.4x10^3$	12.1	$2.4x10^6$	0	$3.7x10^5$	$9.0x10^3$	19.6	$4.3x10^6$	0
S.E.±	$1.3x10^6$	$1.6x10^3$	1.0	$3.1x10^5$	0	$1.4x10^5$	$8.7x10^2$	4.8	$1.4x10^6$	0

APC = Aorobic plate count.
Psy. C = Psychrotropphic count.
E.C. Enterobteriacose
S. unreous = Staphyltococcus auroús count
CC = Coliform count (MPN)

that reported by Shultwz and Olson (1960) and Abd Al-Monem (1986).

From the results reported in Tables (1 and 2) it is evident that the mean psychrotrophic count showed a gradual increase in the cold store. Beef untreated with flavomycin, the lowest count was obtained after 2 hours ($1.5x10^2$) while the highest one after 20 days (4.2×10^7) but in treated beef the lowest and highest psychrotrophic count were 0/gm and 1.1×10^6, respectively. Buffaloes untreated with flavomycin showed the lowest psychrotrophic count 0/gm after 2 h.p.m. while the higher one after 20 days was 4.3×10^6.

Psychrotrophic count in the samples from treated beef with flavomycin were 0/gm and 1.1×10^6 after 2 h.p.m. and 20 days at 0°C. While the count in treated buffaloe's meat samples were 0 and 2.4×10^6. This finding is expected as psychrotrophic organisms found in favourable conditions to survive and multiply, besides removal of competitors that can't withstand such holding temperature. The obtained results were agreed with that reported by Ayres et al. (1950) and Abd Al-Monem (1986).

Hamdy et al. (1986) studied the effect of chilling on staph aureus and reported that there was an initial decrease followed by gradual increase of count. The authors attributed this phenomena to the cold shock, then to the adaptation of the microorganism to low temperature.

The analysis of muscle, liver, kidney and intestine for the presence of flavomycin residues were revealed no any of such antibiotic in them. This may attributed to the fact that flavomycin is poorly absorbed from the digestive tract (Mima, 1971).

Many public health problems may arise from antibiotic resistant strains (Garrod, 1964), allergic reaction and toxicity (Corry et al., 1983).

It could be concluded that the flavomycin can be safely used as a growth promoter. In addition, it was proved that the flavomycin had an effect not only on the initial bacterial counts but also on the bacterial counts during the periods of cold storage.

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منشطات النمو وعلاقتها بصلاحية اللحوم ومدة الحفظ بالتبريد

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اجريت هذه الدراسة فى قسم الانتاج الحيوانى - كلية الزراعة -جامعة القاهرة - وذلك باستخدام ستة عشر عجل - ثمانية منها من الفريزيان والثمانية من الجاموس المصرى. تم تغذية أربعة عجول من كل نوع على ٢٠ ملليجرام فلافوميسيين يوميا (كمنشط للنمو) - والأربعة الأخرى أستخدمت بدون معاملة (للمقارنة) ٠

حفظت العينات من كل ذبيحة على درجة صفر°م ±١ واختبر المحتوى الميكروبى فى هذه العينات كل ٢ ساعة، ٥، ١٠، ١٥، ٢٠ يوم - كما أجرى تحليل كل من العضلات والكبد والكلية والأمعاء للكشف عن خلوها من آثار الفلافوميسيين ٠

وكان الهدف من هذه الدراسة هو دراسة تأثير الفلافوميسيين وعلاقته بإطالة مدة حفظ اللحم تحت درجات التبريد العادية فى لحوم العجول البقرى والجاموس وقد تلخصت أهم النتائج فيمايلى :

١- كان للفلافوسيين تأثير معنوى على العدد الأولى للبكتريا والعدد البكتيرى أثناء فترات التبريد للذبيحة بين أول فترة (ساعتين) ١٠ ٢± ١,٣ × ١٠ ٢ وكان أعلى بعد ٢٠ يوم من الحفظ (١٠×٣,٧ ٦±١٠×١,٤ ٦) بالنسبة للبكتريا الهوائية (Aerobic plate count)

أما بالنسبة لمجموعة القولون coliform كان العدد فىمجموعة الفريزيان المعاملة أقل (١٢,١) عنه فى نفس النوع فى الحيوانات غير المعاملة عند ٢٠ يوم وبنفس الإتجاه - بالنسبة للحوم الجاموس فكانت ١٩,٦ لمجموعة المقارنة بالنسبة للمجموعة المعاملة (١٢,١) ٠

- بينما بالنسبة لمجموعة psychrotrophic كانت الزيادة تدريجية فى التخزين بالتبريد من ساعتين وحتى ٢٠ يوم من التبريد بالنسبة للفريزيان والجاموس ٠

- بالنسبة لمجموعة staph aureus حدث انخفاض مبدئى ثم تبعه زيادة تدريجية فى العدد

٢- بتحليل عينات العضلات والكبد والكلية والأمعاء ثبت غياب الفلافوسيين فىجميع العينات مما يؤكد أن الفلافوسيين يمتص أثناء وجوده فى القناه الهضمية ٠

وبناء عليه أوضحت الدراسة أنه يمكن استخدام الفلافوميسسيين كمنشط للنمو بصورة آمنة ٠ بالإضافة أن الفلافوسيين لم يؤثر فقط على العدد الأولى للبكتريا ولكن أيضا على أعداد البكتريا أثناء فترات الحفظ بالتبريد٠