

Bacteriological quality of different types of natural salted casing El-baz, S.M.; Manal, M. Said; Kawthr, A. Ismail and Randa Gabr

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Received in 12/1/2016

Accepted in 24/2/2016

Abstract

Seventy five natural casing samples were collected and divided into three groups (twenty five samples each of cattle, sheep and pig). All samples were examined for aerobic plate count (APC), *S. aureus* count, Enterobacteriaceae counts, and presence of sulphite-reducing clostridium spores. The obtained results revealed that, the mean values of APC were $8.26 \times 10^4 \pm 4.1 \times 10^4$, $3.78 \times 10^5 \pm 1.4 \times 10^5$ and $1.55 \times 10^5 \pm 1.2 \times 10^5$ of examined cattle, sheep and pig samples, respectively. Moreover, the mean values of *S. aureus* counts, of the aforementioned samples were 70.4 ± 33.5 , 28 ± 14.7 and 0.0 , respectively, while the mean of Enterobacteriaceae counts were 64.4 ± 41.7 , 89 ± 39.8 and 8.44 ± 4.8 for cattle, sheep, and pig, respectively. In this study, the presence of sulphite-reducing clostridium spores failed to be detected in all samples.

Key words: Natural casing, salting, contamination.

1. Introduction

Sausage is known to be the oldest and longest established form of processed meat and the intestines of sheep, hogs and cattle have been used for thousands of years as an edible container for this well-regarded product. The basic technique for the cleaning of casing has also remained unchanged over all this time (Ockerman and Hansen, 2000) and a comparative study (Koolmees *et al.*, 2004) revealed no significant difference in the cleaning efficacy of manual or mechanical cleaned sheep casing. In general, the remaining submucosa layer is known as the natural casing (Bakker *et al.*, 1999) and based on the animal it originates from, is used for a wide variety of sausages (Houben, 2005).

Natural animal casing are used as sausage skins and there is considerable trade in these casing. Casing are usually preserved by salting, curing and / or drying (Fischer and Schweflinghaus, 1988; Ockerman and Hansen, 1988). Overall, adequately salted products are considered microbiologically fully acceptable, although sometimes casing packed in dry

salt may deteriorate in quality (Ockerman and Hansen, 1988; Rust, 1988). This deterioration is possibly caused by microorganisms that persist on salted natural casing (Extremely salt-tolerant or halophytic species). Microorganisms may also produce off-odors (Rust, 1988) or unwanted pigments e.g. 'red dog' or black spots' (Ockerman and Hansen, 1988) when casing are stored at high temperatures.

Casing may be used in the manufacture of either fresh sausages, fermented sausages, or cooked / sterilized sausages. Spores of sulphite-reducing Clostridium species, of which some genera are pathogenic, may survive in heated products as well; develop under certain adverse conditions and cause spoilage or even intoxication. It is therefore, of great interest to be aware of eventual contamination levels of natural casings.

Staphylococcus aureus in particular, consider the main cause of food borne illness throughout the world. Sickness resulted from the ingestion of one or more preformed staphylococcal enterotoxins in contaminated food. The pathogenicity of *Staphylococcus aureus* has

been recognized for many years; it may lead to food borne intoxication among consumer of meat or meat products (**Bolstridge and Rolh, 1985**). Moreover, **Houben (2005)** recommended that determination of sulphite reducing clostridium strains present is carried out and their properties investigated in relation to the manufacture of meat products, since some of the strains may be potentially pathogenic and/or able to spoil products. Therefore, the present study was conducted to evaluate the bacteriological status of different types of natural salted casing according to European Natural Sausage Casing Association. (**ENSCA, 1997**).

2. Material and Methods

2.1 Collection of samples: Seventy five natural salted casing samples collected from differ-

ent producers were subdivided into three groups (Twenty five samples for each group) cattle, sheep and pigs intestine respectively.

2.2. Bacteriological examination

2.2.1 Determination and enumeration of total aerobic bacterial count according to the technique recommended by **ISO 4833 (2003)**.

2.2.2 Detection and enumeration of *S. aureus* according to **FDA (2001)**

2.2.3 Enterobacteriaceae count according to **ISO (21528 – 2/2004)**

2.2.4 Detection and enumeration of Sulphite-reducing clostridia spores according to **ISO 6461/1 (1986)**.

2.3 Statistical analyses: the **SAS / STAT (2000)** were used. Descriptive statistics including average and standard error were done.

European National sausage Castings Association (ENSCA) (Fisher and Krol,1997) microbiological recommendations.

Count	Accepted limit (cfu/g)	Maximum limit (cfu/g)
Aerobic Plate Count (APC)	$<10^5$	5×10^6
<i>S. aureus</i>	$<10^2$	10^3
Enterobacteriaceae	$<10^2$	10^4
Sulphite-reducing Clostridia Spores	$<10^2$	10^3

Results and Discussion

Since no microbiological criteria were described for natural casing in existing legislation, ENSCA agreed on certain microbiological recommendation for salted natural casing in 1996. These recommendations were incorporated into the HACCP manual for the processing of natural sausage casing (**Fisher and Krol, 1997**) as mentioned below.

From the recorded results in **Table (1) and Fig. (1)**, it is evident that the mean values of APC of examined cattle, sheep and pig casing samples were $8.26 \times 10^4 \pm 4.1 \times 10^4$, $3.78 \times 10^5 \pm 1.4 \times 10^5$ and $1.55 \times 10^5 \pm 1.2 \times 10^5$ respectively. Nearly similar results were reported by **Sayed *et al.* (2012)**, **El-Mossalami *et al.* (2008)** and **Ockerman and Hansen (2000)**. They reported that examined natural sausage

casing samples contained APC ranged from 10^4 to 10^7 cfu/g, they also added that Aerobic bacterial count gives an idea about the hygienic measures applied during processing and also helps in the determination of keeping quality. So it is the most reliable method for detection of sanitary level of proper processing, storage and marketing of food products. Generally, adequately salted casing are considered microbiologically fully acceptable.

On contrast **Oluwafemi and simisaye (2006)** recorded APC counts of examined sausage were ranged from $2.06 - 2.8 \times 10^6$ cfu/g.

Table (1). Statistical analysis of mean values of different bacterial counts in examined cattle, sheep and pig sausage casing samples (n= 25 of each).

Count (Mean±SE)	Cattle	Sheep	Pig
(APC)	$8.26 \times 10^4 \pm 4.1 \times 10^4$	$3.78 \times 10^5 \pm 1.2 \times 10^5$	$1.55 \times 10^5 \pm 1.2 \times 10^5$
(<i>S. aureus</i>)	70.4±33.5	28±14.7	0.00
(Enterobacteriaceae)	64.4±41.7	89±39.8	8.44±4.8

NB: Mean is calculated for both positive and negative samples, at which negative samples (contained $<10^2$ cfu/g).

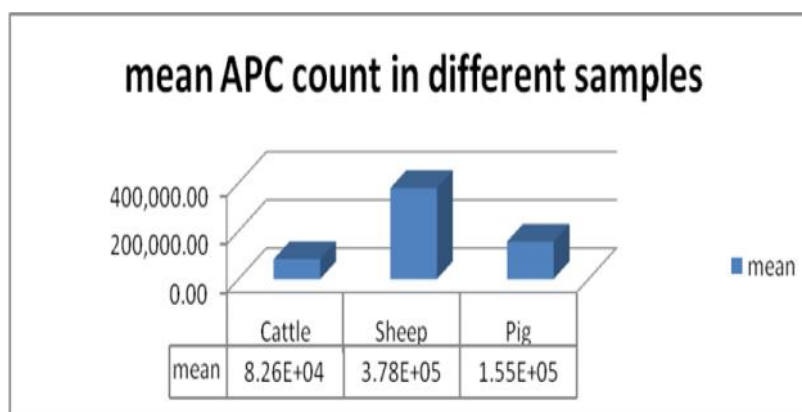
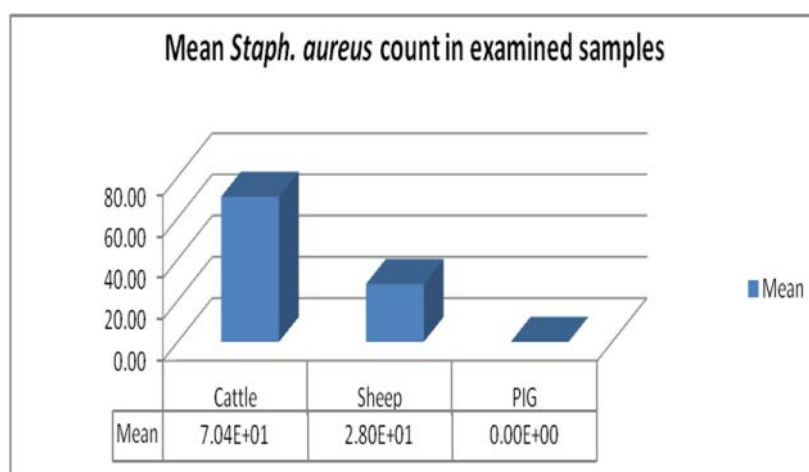
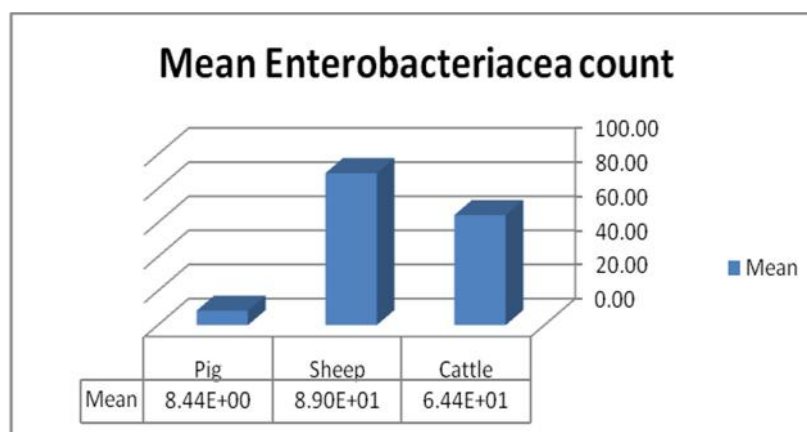
**Fig. (1):** Mean APC count of examined cattle, sheep and goat**Fig. (2):** Mean *S. aureus* count in examined samples**Fig. (3):** Mean Enterobacteriaceae count in examined samples

Table (1) and Fig. (2) also showed the mean value of *S. aureus* of cattle, sheep and pigs casing samples were $1.7 \times 10^4 \pm 0.4$, 2.4 ± 0.1 and 0.0, respectively. Similar result was recorded by **Sayed *et al.* (2012)** who found that, ready to eat rice sausage were contained $1.9 \times 10^4 \pm 10.29$ cfu/g *S. aureus*. While, lower results were reported by **Hassan and Sayed (2008)** and higher results were reported by **Ali and Abd-El-Aziz (2011)** and **Oluwafemi and sennisaye (2006)** who recorded mean *S. aureus* count of examined sausage ranged from $1.1-1.47 \times 10^6$ cfu/g. Moreover, **KuKu (1985)** concluded that the presence of *S. aureus* could be as a result of being a common organism on the skin, hands and hence their presence in sausage may be as a result of contamination due to improper handling, processing, transportation and storage. Its presence in high numbers is a good indication of poor hygienic and temperature control.

The results of Enterobacteriaceae count as shown in table (1) revealed that the mean values were 6.4×10 , 8.9×10 and 8.4 cfu/g for examined cattle, sheep and pig casing samples, respectively. In this respect, **Oluwafemi and Simisaye (2006)** recorded Enterobacteriaceae counts of examined sausage were ranged from $1.57 - 2.17 \times 10^6$ cfu/g. These results were higher than that reported in this study.

The Eu-CRAFT-Project (BRE 2.CT 94. 1495), Commissioned by ENSCA1997, illustrated the microbiological load of sheep and hog casing at different steps of the cleaning process **Ockeman and Hansen (2000)**, with $4.3/\log^{10}$ cfu/g⁻¹ for Enterobacteriaceae after the final cleaning step. Since sheep casings were found to be more contaminated than hog casings.

Sulphite – reducing clostridium in this study failed to be detected by using Differential Reinforced Clostridial Agar (DRCA), which was more effective than Iron Sulphite Agar (ISA). The maximum counts obtained on DRCA and ISA were 17.5 and 2500 cfu g⁻¹, respectively. Casings from china, (3 of 35 hog consignments) and (7 of 22 sheep) showed spore counts above 100 cfu g⁻¹. From the remaining 81 samples, Originating from Netherland, new-Zealand and

UK, none showed a count above 100 cfu g⁻¹ (**Houben 2005**). He added the most important representatives of sulphite-reducing clostridium species were *Cl. perfringens*, *Cl. Bifermentans*, *cl. sporogens* and *cl. Botulinum* (**Dijk and Grootentuis, 1999**). The organisms are ubiquitous in nature, however, many authors reported that presence and fate of sulphite – reducing clostridia in the intestines of living humans and animals (**Tschirdewahn *et al.*, 1991; Songer, 1996; Khan *et al.*, 2001 and Song *et al.*, 2002**). It is likely than some will persist following natural casing cleaning operations. Fresh sausages are not preserved, contain some salt (and spices) and can be kept for a few days and under refrigeration only. Storage of the products is under aerobic conditions and it is highly unlikely that clostridia will ever cause problems with this commodity.

Recommendation

Adequate salting and refrigeration, effective good hygienic practice at all cleaning steps should applied. Application of HACCP in production area is obligatory in many countries to guarantee the food safety. HACCP system include the entire production cycle beginning with the selection of raw materials, storage, production process and distribution.

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الجودة البكتريولوجية للأنواع المختلفة من أغلفة السجق الطبيعية المملحة
سحر محمد ابوطالب الباز – منال مراد سعيد محمد – كوثر احمد اسماعيل – راندا جبر ابوسمرة
 قسم صحة الاغذية – معهد بحوث صحة الحيوان-القلى

المخلص العربي

تم تجميع خمسة وسبعين عينة من اغلفة السجق الطبيعية للأنواع المختلفة من عينات الأبقار و الأغنام والخنزير وتقسيمها الى ثلاث مجموعات (كل مجموعة خمسة وعشرين عينة) . وكانت النتائج التي تم الحصول عليها اظهرت ان متوسط العد البكتيرى الكلى للميكروبات الهوائية فى اغلفة السجق المختلفة كانت $1.0 \times 10^4 \pm 1.0 \times 10^4$ و $1.0 \times 10^3 \pm 1.0 \times 10^3$ و $1.0 \times 10^2 \pm 1.0 \times 10^2$ على التوالي الى جانب هذا كان متوسط العد الكلى للميكروب المكور العنقودى الذهبى للعينات السابق ذكرها كانت على التوالي $3.3, 0 \pm 7.0$ و 0.0 ± 2.8 ، بينما كان متوسط العد الكلى للميكروبات المعويه 1.7 ± 6.4 و $3.9, 8 \pm 8.9$ و 4.8 ± 8.4 فى الانواع سابقة الذكر على التوالي بينما لم يمكن عزل ميكروب الكولستيريديوم المختزل للكبريت وقد تم مناقشة اهمية فحص أغلفة السجق للحيوانات المختلفة لمدى تواجد ميكروب الكولستيريديوم المختزل للكبريت ، وايضا الاهمية الصحية وتأثيرها على صحة الانسان.