Evaluation of contamination for extraneous materials in "sun meat" sold in the "houses of the north" in the municipality of Diadema (SP, Brazil)

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DOI: 10.5073/jka.2010.425.167.078

Abstract

The "sun meat" is a handmade product, combining surface techniques of salting and dehydration, commonly used by people from the North and Northeast regions of Brazil. The sun meat cooking process lacks in sophisticated technology and official standards of procedure and quality. Thus, production, sale and distribution under unsatisfactory sanitary conditions are risky to the consumers' health. This paper is aimed at evaluating the sanitary conditions of "sun meat" sold at the "houses of the north" for the presence of extraneous materials. Analysis of 44 samples of "sun meat" from 22 "houses of the north" located in "Diadema District" (SP, Brazil) had been carried out. The product conditions of exposure and sale in the "houses of the north" were evaluated and provided additional information to assess the degree of food safety of this product. In 44 samples were found various types of extraneous materials such as whole insects and debris, larvae, exuvia, mites, rodent hairs, bird feather pieces, fungi, and sharp objects. Mechanical vectors were observed at 11 locations of the sale area. The results indicated that 90.9% of the "sun meat" has unsatisfactory sanitary conditions, caused by the presence of physical hazards of contamination. These results, associated with conditions found in the "houses of the north", indicated that these products can put the health of consumers at risk.

Keywords: Sun meat, Sanitary Conditions, Food security.

1. Introduction

The sun meat is obtained from the combination of salting techniques and partial dehydration of the meat, being widely consumed by people from some regions of Brazil, mainly North and Northeast (Costa et al., 1999). The sun meat can be confused with jerked beef, an industrial product (Lira et al., 1998). Due to bad refrigeration conditions this food came up in the Northeast region as an alternative to preserve bovine meat in excess. Inhabitants had a very low buying power and could not acquire refrigerators (Souza, 2005). However, excellent weather all along the year with huge amounts of marine salt existing in those geographical areas allowed the product to be conserved by salting and dehydration processes. This handmade technique became popular, but the sun meat production presented unsatisfactory hygienical-sanitary condition resulting in a product with short on shelf life (Costa et al., 2001). In the beginning, the sun meat was destined in supplying protein needs to the local, neighbor and regional populations (Nobrega et al., 1983). Today, this characteristic of regionally consumed food and ingredient required in some recipes has been changed to a product that increased its consumption area being now appreciated in the whole national territory (SIC, 2007).

Although linked to the Brazilian culture history and rooted in the food habits of the population, mainly the northeastern one, the sun meat sanitary issues have been object of few researches. It should be regarded a highly popular product since it does not require sophisticated technology to be made, nor official standards of specification and quality requirements. These facts allowed the product to be homemade, but under inadequate sanitary conditions. Together with the absence of regulations concerning production, its sale has been facilitated by little conservation requirements, with no need of packing, nor storage under refrigeration. Almost the whole production of sun meat comes from small stores specifically dedicated to this business, or from retailers whose clients appreciate this product.

Despite the conditions mentioned above, literature about sun meat storage and sanitary quality issues, though scarce, shows the product can contain extraneous substances harmful to the health. A study

carried out by Santos and Rodrigues (1991) to appraise the degree of contamination of sun meat sold in the city of São Paulo, came to the conclusion that, even in the presence of crystal sodium chloride, eggs and larvae of insects had developed.

The evaluation of the sun meat quality is relevant mainly when it concerns meat distributed for consumption that scarcely comply with minimum standards of sanitary quality, becoming an agent of dissemination of pathogens, putting the consumer health at risk. Being so, this work was aimed at: i/ macro and microscopically evaluating this product, focusing on the presence of extraneous materials, harmful or not to health; ii/ comparing macro and microscopical evaluation results with parameters read in the Brazilian legislation that rules similar products; iii/ observing procedures taken by the Houses of the North and the sun meat pieces displayed for consumer sale as to its aspects favorable to physical contamination of the product and; iv/ joining the observed stores conditions to the results obtained in this analysis.

2. Materials and methods

2.1. Material

Forty-four samples of sun meat were analyzed, weighing between 150 and 400 g each, bought in the retailer market, specifically in the Houses of North located in the city of Diadema, state of São Paulo. Samples had been acquired at random, in 22 stores, in duplicate. Each unit sample of sun meat was picked up between July and November, 2008 and were examined by the Laboratory of Alimentary Microscopy of the Institute Adolfo Lutz of São Paulo.

2.2. Analysis methods

The macro and microscopical research of extraneous materials followed the recommendations of both Food and Drug Administration and *Codex Alimentarius* and has been carried out based on the methodology used by Santos and Rodrigues (1991). Each unit sample was macroscopically examined through direct observation by naked eye in order to identify the presence of extraneous materials at the surface of the product. Thus, the entire sample was spread over a plastic tray for a thorough visual inspection. Next, they were cut with the aid of instruments in order to check existing extraneous materials in the internal parts of the product. All the extraneous materials found were kept apart and had been placed in a Petri dish for identification by the stereoscopic microscope.

After macroscopic analysis, with extraneous materials found or not by naked eye, the analytical units had been washed with filtered water and this content was filtered to hold other materials not identified macroscopically. This filter paper had been sent for examination by the stereoscopic microscope at a magnification 10 to 30 times. The isolated extraneous materials which were identified as whole insect and/or fragments were kept in 70% alcohol and sent, for further entomologic classification, to the Entomology Laboratory of Oscar Freire Institute of São Paulo University. The same procedure was adopted for identification of materials such as animal hair that had been previously fixed on a glass slide to help identification.

2.3. Comments on products and stores

During the sun meat purchasing activity at sun meat stores or sale shops, an inspection of the sanitary condition of 2 sun meat stores was also carried out.

3. Results and discussion

The extraneous isolated materials found in samples by macroscopic and microscopic methods was recorded and gathered as shown in Table 1. Table 2 and 3 refer to the results obtained from local observations at sun meat stores, which focused on the display of sun meat and vector presence. The general analysis of Table 1 informed that identified and isolated materials had been found in all stores. Most materials were classified as harmful to health, according to the Resolution RDC 175/2003. In the examined samples extraneous materials, harmful to health or not, had been identified as: whole insect or insect fragments, larva, rodent hair, exuvia, mite, bird feather or fragment, hair of unidentified animal, fungi and other materials such as plastic fragment, string, wood piece, carbonized substance, and bone fragment. These materials can point out that good procedures of manufacturing, storage and distribution normally required to control food contamination had not been taken (Brazil, 1997; Atui et al., 1999)

Table 1 Results of macro and microscopic analysis of sun meat showing number and percentage of unacceptable samples (2 samples/store a, b) from Houses of the North, stores listed by number and extraneous materials found, Diadema, SP, Brazil. 2008.

	Extraneous Material Types										
	Harmful to health as per Resolution RDC 175/2003					Not mentioned in Resolution RDC 175/2003					
Store number	Whole insects	Fragments of insects	Larvae	Rodent hair	Other extraneuous materials	Exuvia	Mites	Unidentified Animals Hair	Birds Feather	Filamentosos Fungi	Other extraneous materials
1	-	-	-	1[b]	1[a]	-	-	1[a]	-	-	-
2	-	1[a]	-	-	-	-	-	-	-	1[a]	-
3	-	1[b]	-	-	-	-	-	-	1[b]	-	-
4	-	1[a] ;1[b]	-	1[a]	-	1[b]	-	-	-	-	-
5	1[b]	1[a] ;1[b]	-	-	-	-	-	1[a]	-	-	1[b]
6	1[b]	1[b]	-	-	-	-	-	-	-	-	-
7	-	1[a]	-	-	1[b]***	-	-	-	-	-	1[a]
8	-	1[a]	1[a]	-	-	-	1[a];1[b]****	1[b]	-	1[a]	-
9	1[b]	1[a];1[b]	-	1[a]	-	-	-	1[a]	1[b]	-	-
10	-	1[b]	-	-	-	-	-	1[a]	-	-	-
11	-	-	-	-	-	-	-	1[a];1[b]	-	-	-
12	1[a]	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	1[b]	-	-	-	-	-	-
14	-	1[a];1[b]	1[a];1[b]	-	-	-	-	-	-	-	-
15	1[a]	1[a];1[b]	-	-	-	-	-	1[b]	-	-	-
16	-	1[a];1[b]	-	-	-	-	-	1[a]	-	1[b]	1[b]
17	-	1[a];1[b]	-	-	1[a];1[b]	-	-	1[a]	1[a]	1[a]	-
18	-	-	-	-	-	-	-	1[a]	-	-	-
19	-	1[b]	1[a]	-	1[a];1[b]	-	-	1[b]	-	-	-
20	-	-	-	-	1[b]	-	-	-	-	1[b]	-
21	-	1[a];1[b]	-	-	-	-	-	-	-	-	1[b]
22	-	1[a];1[b]	-	-	-	-	-	-	-	1[a]	-
Partial Total = 32 samples (a+b)						Partial total = 23 samples (a + b)					
T 44	5	25	4	3	8	1	2	12	3	6	4
% 100.0	11.4	56.8	9.1	6.8	18.2	2.3	4.5	27	6.8	13.6	9.1

T = Absolute Totals; % = Relative Totals. *fragments of plastic, bones and wood; ** string and carbonized material; *** Greasy cyst in sample; ****Live and dead mites in sample; - Absence of extraneous materials

Extraneous materials not regarded as health harmful by the Resolution RDC 175/2003 was identified in 23 samples, while extraneous substances mentioned by this Resolution as health harmful were found in 32 samples. Samples from stores 8 and 17 presented the largest quantity and diversity of extraneous material.

Other inert materials such as plastic, wood and bone fragments, found in 18.2% of the samples are considered as physical hazards and harmful to human health. The insects (complete individual or fragment), as well as larvae and rodent hairs can carry infectious agents to the food, causing harm to the human being health (Brazilian National Health Vigilance Agency (ANVISA), 2003). The presence of whole insects was observed in 11.4% of the samples and insect fragments were isolated in 56.8% of the samples. Insect larvae were found in 9.1% of the samples. Santos and Rodrigues (1991) examined jerked beef and "feijoada" ingredients and found 28.8% of samples containing whole live and dead insects, or their fragments, besides larvae and mites. The presence of such materials can be connected with the display of sun meat during the processes of salting and drying and in the sale points sanitation. In general, species found belonged to the order Diptera, mostly being domestic flies. The Resolution RDC 175/03 regards this product as improper for consumption (ANVISA, 2003).

Mites have been identified in 4.5% of the examined samples. According to Gorham (1987), the presence of mites in food is caused by inadequate storage. Consequently, the consumption of products affected by those agents represents a serious threat to human health, and may cause intestinal disorders with or without fever and pain. Fungi were isolated in 13.6% of the samples. According to Baglioni et al. (1999), some species of fungi are heat-resistant and are part of the deterioration process of the food by causing chemical degradation and changes in the components as well as the production of metabolites, acting in the nutritional parameters and sensory characteristics of the product (only in high r.h. conditions and activity of water over 0.75 in the food product). Bird feather or feather fragments, were seen in 6.8% of

the samples and suggested a factor of physical and microbiological contamination, since pathogens like bacteria, and ectoparasites as mites can be transported by birds. (Costa et al., 2002; Tucci et al., 2005). Rodent hairs were found in 6.8% of the samples, evidencing the presence of some or large number of rodents in the sun meat store, and a possible contact of the meat with the animal or its excrement. Rodent hairs are eliminated via its excrement and their presence is a serious hazard for consumer health. The rodents are important carriers of *Salmonella* spp (Veiga et al., 1978; Carter et al., 1991; Acha et al., 2003), spreading this pathogenic bacteria in its environment together with its excrement. The presence of unidentified animal hair was observed in 27.3% of the samples and exuvia in 2.3% of the samples. Although they are not regarded as extraneous material harmful to health, their presence in food sold to consumers was found repugnant.

Concerning the set of extraneous isolated substances and following the Resolution RDC 175/03, the samples of insects or products derived from its metabolism, not recognized as mechanical vectors such as *Dyctioptera* and *Diptera* orders species or other bio-contaminants like mites, fungi, and other extraneous materials were considered satisfactory. Only the stores 11 and 18 did not present extraneous materials that are health harmful. Then, out of 22 stores among 20 (90.9%) presented, at least, one sun meat was not fit for consumption due to the presence of extraneous materials which were health harmful.

Regarding the display of sun meat in the Houses of North (Table 2) it has been observed that 90.9% of the stores kept the sun meat over a surface similar to a sale counter, and 54.5% located near the entrance door, facilitating the storage of several types of dirtiness contamination existing in and around the stores, such as car smoke, dust in the air left by cars while passing the public street. Samples from stores 16 and 22, hung near the entrance door, were subjected to weather changes, facilitating the adherence of very small burnt parts, contamination and growth of fungi.

Table 2 Results of observations of Houses of the North, sun meat supplier, regarding product display, Diadema, SP, Brazil, 2008

	Types of display of Sun Meat					
Store Number	**Hanging on**		**Over surface (counter)**		**Near the door**	
1	X		X		X	
2	X		X		X	
3	-		X		X	
4	X		X		X	
5	-		X		-	
6	-		X		-	
7	-		X		-	
8	-		X		-	
9	-		X		-	
10	-		X		-	
11	-		X		-	
12	X		X		-	
13	-		X		-	
14	-		X		X	
15	-		X		X	
16	X		X		X	
17	-		X		X	
18	-		X		X	
19	-		X		X	
20	X		-		X	
21**	-		-		-	
22	-		X		X	
	X	-	X	-	X	-
T	6	16	20	2	12	10
%	27.3	72.3	90.9	9.1	54.5	45.4

Notes: Yes = X ; No = -; T = Absolute Totals; % Relative Totals; * Multiple answers;
** Product displayed in plastic box covered with film paper

The study of vector animals and/or urban pests existing in the stores is shown in Table 3. There were mechanical vectors in 50% of the stores. Most belonged to the order Diptera (mainly domestic flies) flying over the sale area or over products displayed. When comparing Table 3 and Table 1, only the samples from stores 1 and 11 did not show isolated whole insects or fragments during the macro and microscopic evaluations. In all other places where flies were present, insects were always found in the analyzed samples. The issue regarding mechanical vectors is that these animals have potential to disseminate pathogens. According to Thyssen et al. (2004), one of the reasons why the Diptera presents this potential is because it is in very close contact with man and his environment.

In store 17, there were live birds in cages hanging over the sun meat displayed over a surface. Table 1 shows that one sample from this store presented bird feathers, signaling physical contamination of the product for consumer sale that most likely came from the birds kept in the store.

Table 3 shows that 32 analyzed samples were improper for consumption because containing extraneous materials harmful to health. The conclusion reached is that the absence of both packing and good manufacturing practices connected with integrated control of plagues facilitated this situation.

Table 3 Results of observations of Houses of the North, meat suppliers, concerning vectors presence and urban pests, Diadema, SP, Brazil, 2008.

	Vectors and Pests		
Store Number	**Presence**	**Observed animal(s)**	**Where**
1	X	Pigeons and flies	Entrance Door
2	-	-	-
3	-	-	-
4	X	Domestic Fly	Inside the store
5	X	Domestic Fly	Inside the store
6	X	Domestic Fly	Inside the store
7	X	Domestic Fly	Inside the store
8	-	-	-
9	-	-	-
10	-	-	-
11	X	Domestic Fly	Inside the store
12	X	Domestic Fly	Inside the store
13	-	-	-
14	-	-	-
15	-	-	-
16	X	Domestic Fly	Over products
17*	X	Birds in Cage	Over products
18	-	-	-
19	-	-	-
20	-	-	-
21	X	Domestic Fly	Inside the store
22	X	Domestic Fly	Over products
	X -		
T	11 11		
%	50.0% 50.0%		

Notes: Yes = X ; No = -;T = Absolute Total; % = Relative total;
*Store that sold live birds and sun meat sharing the same physical area or close

The results shown in this research allowed the conclusion that the sun meat sold in 20 among 22 (90.9%). Houses of the North were improper for consumption. Materials found in samples together with sale procedures taken by the Houses of North indicate that these products can put the consumer health at risk.

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