




Clinical Reports

Use of bovine fetal blood, omasum and ears in a slaughterhouse in São Luís County – Maranhão State

Aproveitamento de sangue fetal, omaso e orelha de bovinos em abatedouro frigorífico no município de São Luís – MA

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ARTICLE INFO

Article history

Received 14 April 2020

Accepted 10 June 2020

Keywords:

Beef industry

Recycling

Waste

Maranhão

ABSTRACT

The aim of the present study is to report the technical procedures applied to fetal blood, omasum and ears deriving from beef cattle slaughter in a slaughterhouse in São Luís County – Maranhão State. A case study, divided into three stages, was conducted for such a purpose: (i) technical visitations to observe and better understand waste generation and its use process; (ii) analysis of slaughterhouse records about waste destination; and, (iii) photographic records for the best analysis of waste-use conditions. Based on the results, the slaughterhouse does not have the appropriate infrastructure to use the assessed waste given its artisanal techniques, which are not in compliance with the sanitary, hygiene and humanitarian legislation in Brazil. The use of waste presenting economic and commercial value is feasible and, yet, a way to go on with the technological process adopted by the assessed slaughterhouse. However, it is of paramount importance adjusting the implemented procedures and techniques in order to achieve production-management update, technological advancements in the industrial structure, and economic gains. Nevertheless, these actions must be in compliance with environmental prevention principles. It is also important emphasizing the need of rigorous inspections by the Official State Inspection and Livestock and Agriculture Defense Service in the assessed slaughterhouse.

RESUMO

Objetivou-se com o estudo relatar os procedimentos técnicos para o aproveitamento de sangue fetal, omaso e orelha oriundos do abate de bovinos em um abatedouro frigorífico no município de São Luís- MA. Para isso, realizou-se um estudo de caso dividido em três etapas: (i) visitas técnicas para a observação e compreensão do processo de geração e aproveitamento dos resíduos; (ii) análise dos registros do abatedouro frigorífico sobre o destino dos resíduos; e, (iii) registros fotográficos para melhor análise das condições de aproveitamento dos resíduos. Diante dos resultados obtidos, pode-se constatar que o abatedouro frigorífico não possui estrutura totalmente adequada para o aproveitamento dos resíduos avaliados com o emprego de técnicas artesanais em desconformidade com legislações brasileiras de cunho sanitário, higiênico e humanitário. O aproveitamento dos resíduos, todos com valor econômico e comercial, é exequível e configura-se como uma forma de continuidade do processo tecnológico do abatedouro frigorífico estudado. Mas, alerta-se para a urgente necessidade de adequações dos procedimentos e técnicas implementadas que

Palavras-chave:

Indústria da carne

Reciclagem

Resíduos

Maranhão

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resultarão em modernização da gestão produtiva, avanços tecnológicos da estrutura industrial e ganhos econômicos, além de estar em sintonia com os princípios de preservação ambiental. Enfatiza-se, ainda, para a necessidade premente de fiscalizações mais rigorosas por parte do Serviço de Inspeção Oficial e de Defesa Agropecuária Estadual no abatedouro frigorífico avaliado.

INTRODUCTION

Historically, slaughterhouses had always dealt with environmental issues. Back in the 19th and 20th centuries, these businesses were often settled close to rivers and their waste was discharged in waterbodies or buried. Society started claiming for the need of solving issues created by this industrial sector (bad smell and contamination) as it became aware of the subject. These issues lead to the devaluing of real estates located close to slaughterhouses and, more importantly, to disease outbreaks (LIBRELOTTO; FERROLI, 2015).

At the late 20th century, stricter regulations and stronger claim by society have headed towards slaughterhouses, mainly when it comes to environmental issues and humanized animal-slaughtering processes (SILVA; GERUDE NETO, 2018). However, even now, at the 21st century, these businesses – be them of public or private nature – still apply unsustainable production and consumption standards and do not follow the environmental legislation, such as Resolution n.40, from May 13th 2011, of the National Environment Council (CONAMA) (BRASIL, 2011). Such a denial in enforcing the legislation inevitably leads to environmental losses, impairs public health and hinders the local economy. Thus, the main challenge faced by this sector lies on finding economic balance among production cost, emission control and profitability, in the sector (NUNES SERAFIM et al., 2018).

Large amounts of liquid, semi-solid and solid waste, such as blood, waste water, fat, viscera, cartilage, meat shavings, animals or their parts (scraped by sanitary inspection), leather, bones, among others, result from beef cattle slaughtering. These elements are highly polluting; therefore, they must be subjected to specific processing (RABELO; SILVA; PERES, 2014; NUNES SERAFIM et al., 2018). According to Pierre; Araújo (2017), regardless of their origin, all waste types can have their discharge mitigated by the detailed analysis of their use features, potential and consequences. They can support food production whenever they are well-managed, as well as enhance soil physical, chemical and biological condition and also present excellent energetic-recycling potential.

Waste processing and destination by slaughterhouses change due to local and regional features. A good example of waste use lies on the application of processed blood due to the separation, use and trade of its components (plasma, albumin and fibrin). It can also be sent to greasers as raw-material for blood flour production – it is often used in animal feed and fertilizer formulations (RABELO; SILVA; PERES, 2014).

Bovine breeding in Maranhão State has been very important for the beef cattle sector in Northeastern Brazil is the last few years given the states' huge territory available for this activity. Maranhão ranks 12 among beef cattle producer states in the country in number of animals; estimates have shown that it will count on approximately 10.8 million animals by 2031 (CSR-UFGM, 2017). The favorable condition for beef production (beef cattle herd, sanitary conditions allowing foot-and-mouth disease-free cattle due to vaccination, and strategic geographic position) allows inferring that the volume of waste processed by this sector will increase in the years to come, since market structuring is still in course. Accordingly, the aim of the current study was to report the technical procedures adopted for the use of bovine fetal blood (BFB), omasum and ears from beef cattle slaughtered in a slaughterhouse in São Luís County, Maranhão State.

CASE REPORT

The technical visitation to a slaughterhouse registered at Municipal Inspection Service (M.I.S) in São Luís County, Maranhão State, which has environmental license to work in the market, evidenced the use of omasum and ears from slaughtered beef cattle and of BFB from pregnant females slaughtered at different gestational stages. The management department of this slaughterhouse was formally asked to allow the observation of different waste-use processing stages. The present study was approved by the slaughterhouse's board of direction.

The referred slaughterhouse has its main activity based on beef cattle slaughtering; it slaughters approximately 120 Nellore crossbred-animals/day. The animals come from several counties in Maranhão State and from other Brazilian states. The processed meat fulfils the demand of supermarkets, grocery stores and local free fairs; therefore, it is an important economic activity in the herein addressed county (SANTOS et al., 2014; SILVA; GERUDE NETO, 2018).

The following methodological procedures were put in place to reach the research aim: (i) field study substantiated by three technical visitations to the slaughterhouse after its management approved the observation procedure – visits were scheduled for August 2019, with weekly intervals between visitations (they aimed at helping better understand the waste generation and use processes in the slaughterhouse); (ii) analysis of slaughterhouse records about waste destination; and, (iii) photographic records to improve the analysis of waste-use conditions.

After removing the pregnant uterus from the abdominal cavity of the female slaughtered in the room for BFB use, it is conveyed to the viscera sector (called “fataria and triparia”, at the slaughterhouse) through a masonry pipeline called “chute” (Kick). Only one employee was in charge of removing this waste based on the following procedures: (i) opening the pregnant uterus to remove the fetus and to put it on a stainless steel table, at lateral

decubitus position, to the right; (ii) incision at the height of the fourth rib, which should be broken in order to make it possible seeing the heart in the thoracic cavity (Figure 01a); (iii) insertion of a blood-collection bag cannula in the ventricular portion of the heart and traction of the pelvic limbs in order to pump the blood into the collection bag - the bag was positioned gravity-wards in order to allow better pumping the BFB into the bag (Figure 01b).

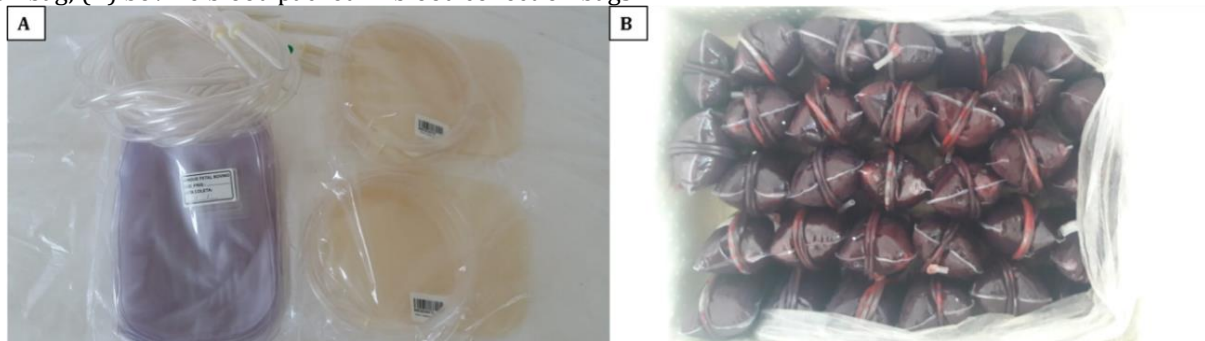
Figure 01. Bovine fetal blood collection in a slaughterhouse in São Luís County, Maranhão State: (A) incision on the thoracic cavity, at the height of the fourth rib; (b) insertion of the blood collection bag cannula in the heart of the bovine fetus.



BFB was collected in 500 to 1,000-mL simple model sterile blood collection bags (Figure 02a). According to observation *in loco*, the volume in each bag would

depend on the size of the fetus, it could range from 500 to 1,500 mL of blood (Figure 02b). Thus, one bag could be enough to at most two fetuses, at the time.

Figure 02. Fetal blood collected in a slaughterhouse in São Luís County, Maranhão State: (A) 500-mL simple model blood collection bag; (B) bovine blood packed in blood collection bags.



Bags with BFB are taken to isothermal boxes filled with ice (produced at the slaughterhouse) after blood collection (Figure 03); ice was removed from the box as it started to melt. The price paid for each bag with blood was R\$15.00, on average. Based on records of waste dispatch in the slaughterhouse, the bags were traded by a middleman¹ and sent to Imperatriz County, Maranhão State and, from there, to Belo Horizonte City, Minas Gerais State.

Figure 03. Isothermal box used to store bovine fetal blood collected in a slaughterhouse in São Luís County, Maranhão State.



¹ **Middleman:** free salesman who works with reselling the product to other buyers.

With respect to bovine omasum, after the evisceration stage in the slaughter room, stomachs are taken to the “fataria e triparia” sector through the “chute” pipeline. Different from rumen, reticulum, abomasum and small and large intestines, it is mechanically separated from the other gastric partitions.

All omasum use processing is carried out in a room by the “fataria e triparia” sector; approximately eight employees were in charge of processing this waste based on the following procedures: (i) opening the omasum and manually removing the macro residues (Figure

04A); (ii) washing it in plastic boxes filled with chlorine-free water at room temperature (Figure 04B); (iii) mechanical removal of micro-residues with the aid of a concrete mixer; (iv) placing the omasum on a stainless steel table to manually remove the membranes coating the gastric partition (Figure 04c); (v) immersion of it in 500-L plastic boxes filled with water and 25Kg of sodium chloride (NaCl) at fine grain size (fine-grain common salt) – it is the brine stage (Figure 04D); (vi) using the concrete mixer to remove brine excess; and (vii) dry slugging by alternating fine-grain common salt and omasum layers (Figure 04E and F).

Figure 04. Beef cattle omasum use processing in a slaughterhouse in São Luís County, Maranhão State: (A) Omasum opening and macro residue removal; (B) Omasum washing in chlorine-free water at room temperature; (C) manual removal of membranes coating the omasum; (D) omasum brining; (E) fine-grain sodium chloride in water tank; (F) dry omasum slag.



The life span of omasum salted at the slaughterhouse is 15 days, at most. The price paid for each processed omasum is R\$7.00, on average; its trade is carried out by a middleman who negotiates with a Chinese trader (dispatch records). Chinese people use it as ingredient for soup preparation.

The ear set accounts for the generation of two waste types, namely: ear and big ear. The auricular muscles and the insertion point of the ear into the skull are cut. The insertion point is cut at the joint between the ear shell and the anti-helix of the external ear (big ear).

The ear is stored in polypropylene containers and weighed on manual scale until reaching mean waste mass of 22 Kg (Figure 5A). This product is sold, *in natura*, by traders called “fateiros”; they take this material to local markets in non-refrigerated trucks, on a daily basis.

The big ear is stored in Coarse-grained NaCl (coarse salt), which corresponds to the dry slag stage. Next, it is kept in covered 500-L plastic water tank, in the room next to the “fataria e triparia” sector for, approximately, eight days (Figure 5B). Finally, it is sold to other salesmen from Paraná State. Both waste types, ear and big ear, are sent for pet feed production, mainly dog feed.

Figure 5. Ear and big ear from beef cattle slaughtered in a slaughterhouse in São Luís County – MA: (A) ear, *in natura*, stored in plastic boxes before trading; (B) big ear stored in sodium chloride.



DISCUSSION

Decree 9.013 from March 29th, 2017, of the Agriculture, Fishing and Supply Ministry (MAPA) regulates the sanitary and industrial inspection of animal-origin products. It defines slaughterhouses as a business focused on slaughtering beef products, as well as on receiving, handling, packing, labeling, storing and dispatching slaughter-origin goods. Slaughterhouse facilities must have an industrial cold chamber in order to be able to receive, handle, process, pack, label, store and dispatch edible and non-edible goods (BRASIL, 2017, p. 7).

Based on the definition above, although the herein assessed business is registered at M.I.S, it uses unacceptable production standards according to the legislation set for processed food and, consequently, for BFB, omasum and ear use, mainly when it comes to facility infrastructure and equipment, hygiene procedures and technological processing.

Silva; Gerude Neto (2018) and Alexandrino Neto (2019) reported three slaughterhouses in São Luís County, Maranhão State; these businesses are in charge of beef distribution in the local market. According to these authors, these three businesses, including the herein assessed one, presented minimal and precarious infrastructure for beef cattle slaughtering, although they were certified by M.I.S. They stated that these slaughterhouses can expose final consumers and the environment to several issues, be them environmental (permanent bad smell, soil and waterbody contamination) or sanitary (attraction of disease-transmission agents). The precarious conditions were often observed in the assessed slaughterhouse throughout the three technical visitations.

Based on the legislation in force, the need of properly processing and discharging all waste types deriving from animal slaughtering, be it sanitary or environmental, is unquestionable. Therefore, presenting how waste types are stored and used is as important as showing how they are generated. However, it is essential taking into account the need of adjusting processes used by these companies to the Brazilian Legislation, for example, to RIISPOA and Standard (IN) n. 34 from May 28th, 2008, issued by MAPA (BRASIL, 2008). Standard n. 34 approved the Technical Regulation of Hygienic, Sanitary and Technological Inspection of Animal Waste Processing and the Document Model of Animal Waste Transportation.

IN 34/2008, at Art. 47 says: "It is demanding to technically describe all processes from animal waste obtainment to the finished good". Art. 48 states that "it is essential taking effective measures to avoid contamination of finished goods due to direct and indirect contact at different processing stages". The single paragraph of this Article addresses that "it is forbidden to put any product obtained during processing

on the floor". Finally, according to Art. 49, "production process flow must be ordered and unidirectional, it must have all necessary equipment to produce a specific good". Therefore, based on what was observed during the technical visitations and on the photographed records (Figures 03, 04 and 05), the assessed waste-processing stages at the slaughterhouse are not in compliance with legal demands. Differently from what is expressed in Art. 47, and based on the records of the slaughterhouse itself, BFB and omasum use does not meet the legislation.

It is also important highlighting that the three assessed waste types are economically and commercially important, since they are accountable for business income due to the (i) value paid for the good, mainly for BFB and omasum; (ii) the allocation of employees to perform functions inherent to slaughtering procedures specific for waste use processing; and (iii) slaughterhouse facility extension through a renovation, even a non-conform one, in the room close to the "fataria and triparia" sector for exclusive waste-use processing.

It is essential weighing the non-conformities observed for all non-edible animal-origin byproducts. The processing procedures must follow the Model "E" Sanitary Inspection Certification (CIS-E) label approved by Ordinance n. 51, from September 19th, 1977 (BRASIL, 1978). The sanitary conditions in force are neglected at BFB, ear and big ear transport; thus, it is important highlighting that the irregular transport of animal-origin products and waste is a factor posing huge risk to the outbreak of diseases that have strong impact on the national livestock sector as observed by Melo et al. (2016) and De Melo et al. (2018). Therefore, controlling the use and destination of these waste types can minimize the occurrence of sanitary issues.

The three technical visitations showed a large amount of slaughtered pregnant female bovines, including at the final gestational trimester. Alexandrino Neto (2019) assessed solid waste generation during beef cattle slaughtering in the herein assessed sector and found that of the 86,122 animals slaughtered between 2016 and 2018, 73.22% were females. With respect to Art. 113, in Decree 30.691, from March 29th, 1952, it must be avoided slaughtering bovine female at the final gestational trimester (more than two thirds of the normal gestational time) (BRASIL, 1952).

Most fetuses derive from the slaughter of pregnant females; their blood started being removed from their hearts at the slaughterhouse facility in 2018, for trading purposes. BFB is used as supplement for cell culture media due to its composition rich in vitamins, amino acids, growth factors and fatty acids. However, despite the unquestionable benefits provided by this waste, BFB use in the assessed location triggers humanitarian and sanitary discussions.

BFB removal demands having the fetus' heart pumping (condition observed *in loco*) in other words, its heartbeat must remain detectable at incision and fourth rib fracture time; otherwise, blood coagulates. Despite the lack of numbness and the bleed of pregnant females - which implies lack of blood input for mother and fetus -, it is known that fetuses are more resistant to anoxia than animals in any other phase of extra-uterine life. Therefore, the fact that the fetus' heart remains pumping during cardiac puncture evidences that it is alive and can be in pain (due to the applied procedure and to the inevitable terminal bleed). Accordingly, as the fetus is not numbed or anesthetized before cardiac puncture, it is possible inferring that the method adopted at the slaughterhouse represents ethical issues that deserve further consideration.

There was no room exclusive for BFB collection, and it can cause the indirect and direct contamination of this waste at several processing stages. This situation adds to the structural and hygienic non-conformity of the assessed slaughterhouse, as already mentioned at the beginning of the discussion section. Besides, there is the risk of slaughtering animals carrying infectious diseases, such as bovine brucellosis, as reported by Santos et al. (2007). This same issue concerns omasum, ear and big ear use.

The international trade of bovine omasum with China is not in compliance with the Brazilian sanitary legislation: Bill n. 7.889, from November 23rd, 1989. This legal document addresses the inspection competences of Municipal Agriculture Secretariats or Bureaus, which is only valid for municipal trading operations (BRASIL, 1989). In addition, sanitary certification is not issued before waste dispatch and transport.

CONCLUSIONS

The present study is the first to report bovine fetal blood, omasum and ear use in Maranhão State. The use of these waste types has great commercial value, besides being feasible and a way to go on with the technological process in the assessed slaughterhouse due to environmental demands imposed to this sector. However, it is important calling the attention to the urgent need of adjusting the implemented techniques and procedures to the Brazilian legislation, be them sanitary, hygienic and humanitarian. They must be in compliance with environmental preservation principles and with the management of basic human needs. It is important emphasizing the need of rigorous inspections by the Municipal Inspection Service and by the State Defense in the assessed location, since its activity can also be followed in other slaughterhouse facilities in Maranhão State.

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