Manufacturing of blood sausages

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UTILISATION OF SLAUGHTERHOUSE BLOOD AS AN EDIBLE BY-PRODUCT OF MEAT: MANUFACTURING OF BLOOD SAUSAGES

Industry Sector: Cattle and Small Stock

Research Focus Area: Animal Products, Quality and Value-adding

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EXECUTIVE SUMMARY

Introduction

In the production of food for human consumption, the generation of by-products and waste is an integral part of the production chain. In meat production, blood is the first by-product that is obtained after slaughter. In most cases, it is discarded instead of being efficiently used. Discarding of blood presents a serious environmental issue because of its high pollutant capacity. On the other hand, blood has the potential to be collected and processed to generate high value-added food ingredients/products. In some areas of the world (Europe, Latin America and Asia) and to different degrees, blood is utilised as an edible meat by-product. However, in South Africa utilisation of slaughterhouse blood has not been explored in the making of food products, although there are some ethnic groups that eat cooked livestock blood in South Africa. The manufacturing processes and quality traits of this ethnic meat by-product has not been scientifically characterised in South Africa. Instead, products are home-made, and their processing methods and product characteristics are not well known. This fact suggests the need for more studies related to this traditional meat by-product. The lack of studies on this kind of food presents a serious risk to the ethnic groups of such food since they are in danger of losing their quality and traditional identity. In addition, with the current migration phenomena from rural to urban areas and the subsequent ageing of the population, some traditional meat products known now may disappear, which might result in cultural impoverishment. Therefore, the optimisation of livestock blood as an alternative food product in the South African food marketplace may be of significant economic value since it offers an additional potential for expanded use of meat by-products in South Africa.

Objective Statement

This research project aimed at processing and preserving highly perishable and underutilised slaughterhouse blood into acceptable food product to enter the South African food marketplace by producing blood sausages.

Project Aims

- To introduce livestock blood as an alternative food product in the South African food marketplace by developing blood sausages
- To evaluate nutritional value and shelf-life of blood sausages
- To evaluate consumer acceptance and purchase intent of blood sausages.

Results

Four treatments of each of bovine (cow) and porcine (pig) blood sausages were formulated and manufactured to contain 0 (no blood), 5, 15 and 30% blood. The sausages were evaluated for nutritional properties, shelf life (chemical and microbiological stability), consumer acceptability and purchase intent.

The results of the nutritional properties of blood sausage showed that blood sausages might play a significant role in human nutrition. The blood sausages had significantly higher protein and iron content compared to sausages containing no blood. All the blood sausages had higher ash content compared to sausages containing no blood, and 30% blood inclusion in sausages had significantly higher ash content than the sausages containing no blood. High ash content in food products implies high mineral content, and that was demonstrated by higher iron content of the blood sausages in the current study. Blood inclusion level did not affect the sodium chloride and sodium contents of the sausages.

The shelf-life studies demonstrated that blood sausages have a good keeping quality. The fat oxidation (measured as thiobarbituric acid reactive substances (TBARS)) increased with the blood inclusion level in the sausage over time. From day 1 to 50, the TBARS values of cow blood sausages ranged from 0.56 -2.5 mg malonaldehyde (MDA)/kg tissue and 0.63 -2.60 MDA/kg tissue for pig blood sausages. According to sensory analysis studies, all the sausages within a TBARS value of 2.5 mg MDA/kg tissues were still within acceptable organoleptic limits. Only 30% pig blood sausages were on the verge of exceeding TBARS values of what is considered the acceptable organoleptic limit.

Regardless of high-water activity and pH of the blood sausages, the blood inclusion level did not affect the microbiological quality of the sausages for the specified storage period. The sausages could be kept for at least 11 days in the overwrap packaging and for 21 days in the vacuum packaging at 4° C without showing adverse effects of storage. In most cases the microbial counts for both cow and pig blood sausages were lower than the acceptable limits of the microbial requirements of the South African National Standards (SANS 885), (2011) and international standards and guidelines. Of all the micro-organisms evaluated, only total bacteria count of the cow blood sausages at 21 days storage period in the vacuum packaging recorded at least 7 log cfu/g in all treatment groups, which is higher than acceptable limit of 6.0 log cfu/g. The bacterial pathogens; Listeria monocytogenes and Escherichia coli were not detected in any of the packaging's for both cow and pig blood sausages.

The consumer sensory analysis was carried out on cow blood sausages in two testing locations i.e. In-house and central location testing. The results of the consumer sensory panel for both in-house and central location testing revealed very similar ratings for all four treatments

groups across all selected sensory attributes. The differences observed for overall acceptability/liking of the sausages for different treatment groups were very small and insignificant, and the blood sausages were generally acceptable to consumers in both testing locations. The frequencies on overall acceptability/liking showed that consumers who liked (score=4) or liked the sausages very much (score=5) were more than consumers who did not like the sausages.

The frequency distribution of consumers attributes liking in the central location was higher for 30% blood sausages compared to other treatment groups in all the selected attributes. The aroma had the highest liking frequencies in all treatment groups compared to other attributes. Colour was rated as the second most attribute, followed by flavour in all the treatments. The texture of the sausages was the least favoured attribute. It was also interesting that 30% blood sausages were scored slightly higher for flavour compared to other treatment groups in both inhouse and central location testing. The results of the purchase intent showed that regardless of blood inclusion level in the sausage, there was a high probability that the consumers would buy the blood sausages. Consumer panellists who showed interest in purchasing the sausages were more than consumers (at least 60 vs 40%) who would not purchase the products. The majority of the panellists were willing to purchase blood sausages at a price between R50-60/kg. The 30% blood sausages had a high purchasing frequency compared to the other treatment groups in both testing locations. Significant differences were recorded for the purchase intent and sausage price in the central location testing for age groups. Older panellists showed more interest in buying the sausages and were willing to pay higher price compared to younger panellists (<R50/kg). The Tsonga ethnic group was willing to pay higher price (R60-70/kg) and, it was the ethnic group that had the highest frequency for overall acceptability of the blood sausages. The cost estimation of the basic formulation of the blood sausages was R38/kg, which was lower than what the panellists were willing to pay for a kg of blood sausage.

During the consumer sensory testing, different names of the cooked livestock blood products were compiled from the response of different ethnic groups. The ethnic groups have different names of these food products in their vernacular language.

Conclusion

The results of this study clearly showed that blood sausages have high nutritional value. They have good keeping quality, provided good manufacturing practices are employed at all times. This study has also revealed that cooked livestock blood is part of the cultural “food basket” of the indigenous people of South Africa and the immigrants living in South Africa. Sensory analysis showed that blood sausages are well accepted by consumers. This is an indication that blood sausages would be acceptable food product and marketable due to its low cost. The consumers get to experience a product that is healthier and possibly cheaper than the conventional sausages found in the marketplace. The study demonstrated that slaughterhouse blood as a by-product of meat is one of the most important food sources that has potential to increase food security in South Africa, if it is efficiently utilised.

Popular Article

Title for Popular Article

FOOD LOSS AND WASTE IN THE BEEF INDUSTRY

1 January 2021

Introduction

Food loss and waste is defined as the decrease in quantity or quality of food along the food supply chain, although in practice there is no commonly agreed definition. Food loss occurs along the food supply chain from harvest up to, but not including, the retail level. For example, any food that is discarded, incinerated or otherwise disposed along the food supply chain and does not re-enter in any other productive utilization. Food waste occurs at the retail and consumption levels, such as food that deviates from what is considered optimal, leftovers, etc. According to FAO, in developing countries food waste and losses occur mainly at early stages of the food value chain and can be traced back to financial, managerial and technical constraints in harvesting techniques as well as storage and cooling facilities. The South African beef industry is one of the fastest growing agricultural sectors, however, animal by-products are not efficiently used. Animal blood is a readily available animal by-product in the abattoirs that can be recovered to reduce food loss. It is estimated that approximately two million cows in South Africa are slaughtered per year and that 12 litres of blood per cow is wasted at the bleeding area.

Abattoirs that process blood, use it for manufacturing of animal feed, such as carcass meal. In other abattoirs blood is treated as waste and is discarded. These abattoirs get rid of blood by burying or spraying it onto the fields to fertilise pastures. The reason for burying blood may be the lack of suitable facilities and technology to properly collect or handle blood. Improper disposal of blood can be a health risk and could be detrimental to the environment. This problem can be alleviated by hygienically collecting blood using a hollow knife so that the blood can be used for human consumption by making the blood sausages and other food products. In order to take part in the reduction of food loss, our meat technology section of the Agricultural Research Council-Animal production (ARC-AP) is currently focusing on the utilisation of the less utilised meat-by products (intestines, organs, and blood) in processed meat products to add meat by-products to the South African processed meat marketplace.

Materials and methods

The blood was hygienically collected from the cattle slaughtered at the experimental abattoir of the ARC-AP. The cattle blood mixed with the beef trimmings and organs was used to manufacture the blood sausages. Laboratory analysis was conducted to determine safety, nutritional value and consumer acceptance of the products as well as purchase intent.

Results and discussions

The results of the study showed that the blood sausages are safe to eat. Regardless of high pH (6.4) and water activity (0.97), microbial growth of the blood sausages remained controlled throughout the storage period of 11 and 21 days at 4°C (normal refrigeration temperature) in the overwrap and vacuum packaging, respectively. Only micro-organisms known to be common in blood-based products and derivatives were assessed. Lipid oxidative stability of the sausages containing high blood content exceeded spoilage limits after at least 25 days of frozen storage in the overwrap packaging. It should be taken into consideration that the preservatives were not used in the formulation. From the nutritional point of view,

the protein content of the blood sausages was approximately 15%, which is comparable to that of lean beef. The iron and ash contents found in the blood sausages were very high compared to that of lean beef. The iron content was 284.28mg/kg on dry basis, and the ash content was 2.9%. High ash content implies high mineral content. However, it should be noted that nutritional value of blood sausage is mainly explained by the ingredients used, such as amount of blood, and many other ingredients used in the formulation (cereals, vegetables, etc.). Literature has shown that the whole blood contains about 18-19% protein similar to that found in lean meat, and that the protein from blood sausages provides essential amino acids such as lysine. This makes it a good complement for cereal. The iron found in blood sausages is mostly haem-iron which is well absorbed by the body, and therefore, useful for food-based strategies designed to combat iron deficiency anaemia. The iron content of blood is as high as 400-500 mg of iron per litre. Utilization of livestock blood in various foods will help to alleviate the protein-energy malnutrition and iron deficiency anaemia. These macro- and micro nutrient deficiency diseases are wide spread in South Africa, especially in poor communities.

Livestock blood also has functional properties such as water binding capacity, fat emulsifying and colouring capacity when used in foods. Edible animal blood is also used as protein and iron enrichers. Besides its nutritional and functional properties, animal blood has sensory properties that are acceptable for human consumption. Our study demonstrated at least 70% acceptability of the blood sausages and some consumers showed interest to purchase such products if they are available in the market. Furthermore, we found that livestock blood has long been used as food in South Africa. Ethnic groups that already eat cooked livestock blood in South Africa mix it with edible offal's (intestines, tripe, tongue, etc). The cooked blood product has different names depending on the ethnic group, for example, it is called 'bobete' in Sotho languages, while it is 'ubende' in Nguni languages. It is obvious that livestock blood is an important part of the cultural "food basket" of the majority of people in South Africa.

Conclusion

In order to reduce food losses, South Africa needs to efficiently use the blood of the animals slaughtered in the abattoirs to make food for human consumption. This will increase food security, reduce environmental pollution and a further incentive will be the increased profits that will be made through adding value to the blood. The utilisation of blood as a by-product of meat is not only economical, but environmentally and ethically appropriate as well.

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