COMPARISON OF PHYSICOCHEMICAL AND SENSORY PROPERTIES OF EMULSION-TYPE SAUSAGES MADE WITH OSTRICH MEAT, BEEF AND TURKEY MEAT

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Abstract – Physicochemical and sensory quality of emulsion-type sausage produced from ostrich meat was compared to beef and turkey sausage. Three different emulsion type sausages were prepared according to a traditional formulation. The highest values for water holding capacity, emulsion stability and foaming capacity were obtained in the sausages formulated with ostrich meat. The maximum force values of the ostrich sausage were significantly lower than that in the beef and turkey sausages, besides, the organoleptic properties were significantly improved. The emulsion-type sausage prepared with ostrich meat exhibited the higher quality in the physicochemical and organoleptic characteristics and thus may recommend an acceptable product to the meat industry. The results of this study indicated that the manufacture of sausages from ostrich meat is a viable option for an industry that is largely involved in releasing its products to the fresh meat market.

Key Words – Emulsion-type sausages, Ostrich meat, Beef, Turkey meat

I. INTRODUCTION

The ostrich industry is growing rapidly in many countries other than South Africa (the origin of ostriches) [1]. The characteristics of ostrich meat, which make it interesting for the retailing market, are its tenderness and a pleasant taste. It has favorable nutritional properties [2]. Also ostrich meat has high final pH (> 6.0), which is beneficial for the colour and water-binding capacity of meat, but is undesirable for keeping quality and flavors [3].

Successful application of ostrich meat in cooked sausages, fermented sausages and burgers have been reported [2, 4, 5].

There is a paucity of information regarding the use of ostrich meat in emulsion-type sausages production. The objectives of the present study were to investigate the physico-chemical and sensory quality of an emulsion-type sausage produced from ostrich meat and to compare them with similar sausages made with beef and turkey meat.

II. MATERIALS AND METHODS

Sausage manufacturing

Fan fillet muscles (*M. iliofibularis*) from 3 carcasses (12 to 14 months age) blue neck male ostrich, *Longissimus dorsi* muscles from 3 carcasses of 2 years old male Holstein cattle and pectoral muscles from 3 months old male turkey were obtained from the local abattoirs.

Three emulsion type sausages were made according to the traditional formulation with ostrich, beef and turkey meats. The average quantities of the ingredients were: 60% minced meat, 3% potato starch, 2.5% sodium chloride, 20% water (ice form), 0.5% corn oil, 0.3% sodium phosphate, 0.037% ascorbic acid, 0.075% sodium nitrite, 2.1% spices, 5.5% dry skim milk, 3.5% wheat flour, 2.5% gluten. They were chopped in a bowl chopper and the dough of sausages were stuffed in the synthetic casing of 100 mm diameter and cooked in a water bath at 73 ºC for 5h. After showering with cold water they stored at 4 ºC for 24 h. All analyses were made in duplicate on the samples after removing the case.

pH
pH measurement was performed on the diluted homogenates (15 g of sample with 150 ml of deionized water) using pH meter.

Folding test
The test was carried out by folding a 3-mm thick sausage sample into halves and quarters [6].

Water Holding Capacity (WHC)
WHC Was determined using a method described by Guerrero and Arteaga [7].

Emulsion Stability (ES)
The method of Wang and Zayas [8] with some modification was used for measurement of the ES.

Foaming Capacity (FC)
FC was determined in triplicate using the method described by Makri and others [9] with slight modification.

Texture profile analysis (TPA)
TPA was performed on sausage at room temperature with a texture analyzer TA-XT_2 (Stable Micro Systems, Survey, England). The texture profile parameters including hardness (N. Sec), springiness, gumminess (N. Sec), chewiness (N. Sec), cohesiveness, max force (N), shear force (N) and slop (N/Sec) were determined as described by Bourne [10].

Sensory evaluation of manufactured sausages
Sensory evaluations were performed by a total of 21 untrained panelists who were instructed to record their ratings using a 10-point scale for odor, color, texture, taste, juiciness and general quality of the produced sausages. Scores of 10 for best and 0 for worst quality parameters were used (pleasant odor = score of 10 and unpleasant odor = score of 0; bright pink color = score of 10 and dark color = score of 0; form texture = 10 and a spongy sausage = 0; pleasant taste = 10 and unpleasant beany taste and poor mouth feel = 0; moist juiciness = 10 and dry juiciness = 0).

III. RESULTS AND DISCUSSION

Physicochemical analysis

The high pH value measured in ostrich sausage could be due to the special characteristics of its meat, which has an ultimate pH of 6.0. Ostrich meat is often classified as an intermediate meat type because of its pH ranging between normal (pH>5.8) and extremely dark, firm and dry meat (pH<6.2), also known as DFD [11]. This difference may be due to the fact that WHC of ostrich meat is slightly higher than beef and turkey (Table 1).

Folding results were not significantly different among three different sausages (P>0.05) (Table 1).

Functional properties
Table 1 shows the results on the functional properties of sausages. WHC showed differences (P<0.05) between 3 formulations. The lowest values for WHC were obtained in the sausages formulated with turkey meat (Table 1). The high WHC due to a high ultimate pH of ostrich meat was retained, even when the meat was subjected to severe processing procedures such as grinding and cooking. Purchase [12] reported that the greater the pH, the greater the WHC. Ostrich meat, which has an ultimate pH of 6.0, expects to reveal a high WHC [13].

Table 1 Mean ± SD values of physicochemical and functional properties of different types of emulsion-type sausages

Types of meat in formulation	pH	Folding	Water Holding Capacity (%)	Emulsion Stability (%)	Foaming Capacity (%)
Ostrich	5.86 ± 0.11	3.00 ± 0.00	3.06±0.05 [a]	61.33±1.05 [a]	64.33±1.13 [a]
Beef	5.74 ± 0.05	2.75 ± 0.50	2.55±0.14 [b]	52.66±0.90 [b]	56.43±0.89 [b]
Turkey	5.80 ± 0.06	2.50 ± 0.58	2.02±0.06 [c]	44.80±0.55 [c]	53.30±0.70 [c]

Note: [a,b,c] values in the same column bearing different letters are significantly different (p<0.05).

ES and FC were different among three formulas (P<0.05) (Table 1). The highest ES and FC values were obtained for formula 1. Usually two factors affecting the emulsifying and foaming properties of muscle; the amount of soluble protein available which is under the influence of pH, and the efficiency of the protein to emulsify fat [14] which is mostly affected by the protein structures. In ostrich meat the higher pH results in higher solubility of meat proteins, hence higher ES and FC. According to Sosulski and Fleming [15] emulsifying activity of proteins depends upon the hydrophilic-lipophilic balance of proteins which in turn is highly controlled by pH. The variation in meat products ES and FC may be influenced by a variety of factors such as differences in formulation and ionic strength, functionality of meat proteins, concentration and characteristics of fat, and other factors.

Texture analysis

Texture analysis showed that the maximum force values of the ostrich sausage were significantly lower compared to beef and turkey sausages (p<0.05). A lower force indicated a more tenderness in meat product (Table 2). Cavestany et al. [16] reported that the variation in textural properties of meat products may be due to variety of factors such as differences in formulation, ionic strength, particularly meat protein functionality, concentration and characteristics of fat.

Table 2 Mean ± SD values of texture profile analysis (TPA) of different types of emulsion-type sausages

Texture profiles	Types of meat in formulation		
	Ostrich	Beef	Turkey
Hardness (N.Sec)	36.52 ± 8.15	44.17 ± 2.77	50.44 ± 14.55
Springiness	0.96 ± 0.01	0.93 ± 0.05	0.94 ± 0.05
Cohesiveness	0.81 ± 0.04	0.82 ± 0.05	0.82 ± 0.01
Gumminess (N.Sec)	29.74± 7.50	36.37± 2.40	41.81± 12.60
Chewingness (N.Sec)	28.66± 7.43	34.04 ± 2.68	39.61± 12.16
Max force (N)	92.99± 6.95 [a]	139.33± 10.71 [b]	133.33± 16.55 [c]
Shear force (N)	26.36± 4.03	21.61± 0.78	27.780± 3.29
Slop (N/Sec)	5.48±0.53 [a]	7.26±0.50 [ab]	8.34±1.38 [b]

Note: [a,b,c] values in the same row bearing different letters are significantly different (p<0.05).

Sensory evaluation

The results of organoleptic properties of the sausages produced from ostrich, cattle and turkey meat are shown in Table 3. Odor and color of the sausages produced from ostrich meat were significantly better than the other two sausages (P<0.05). Ostrich meat sausage showed better taste and juiciness compared to cattle and turkey meat products (P<0.05). Ostrich sausages obtained the highest scores for general quality followed by beef and turkey meat sausages (P<0.05).

IV. CONCLUSION

The results of this study indicated that the manufacture of sausages from ostrich meat is a viable option for an industry that is largely involved in releasing its products to the fresh meat market. The sausages obtained from ostrich meat, although having a dark appearance, still shows good general quality and offers an acceptable product with regard to its chemical composition. The sausage formulated with ostrich meat exhibited the highest general quality in the organoleptic evaluation.

Table 3 Mean ± SD values of sensory evaluation carried out in different types of emulsion-type sausages

Types of meat in formulation	Odor	Color	Texture	Taste	Juiciness	General quality
Ostrich	7.38 ± 0.97 [a]	7.95 ± 0.80 [a]	7.05 ± 1.07	7.81 ± 1.12 [a]	7.62 ± 0.74 [a]	7.48 ± 1.17 [a]
Beef	6.67 ± 1.02 [b]	6.48 ± 0.93 [b]	6.86 ± 0.96	6.81 ± 0.93 [b]	6.62 ± 1.07 [b]	6.52 ± 0.87 [b]
Turkey	6.62 ± 1.07 [b]	4.90 ± 0.83 [c]	6.90 ± 1.14	6.48 ± 0.87 [b]	5.00 ± 1.14 [c]	6.00 ± 1.18 [b]

Note: [a,b,c] values in the same column bearing different letters are significantly different ($p<0.05$).

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