Comparison of textural properties of low-fat chevon, beef, pork, and mixed-meat sausages

K.M. Gadiyaram and G. Kannan[#]

Agricultural Research Station, Fort Valley State University, Fort Valley, Georgia 31030, USA

___

Abstract

Chevon (goat meat) is an ideal source of red meat for the preparation of heart-healthy products because of its lower fat content. This study was conducted to compare the texture attributes of low-fat chevon sausages to those of beef and pork sausages. Two batches each of chevon, beef, pork and mixed-meat sausages with no added fat were manufactured under identical conditions using a commercial sausage seasoning. For each batch, six Spanish goat carcasses, and beef chuck and pork leg cuts from different carcasses were used. The mixed-meat sausage was prepared using equal proportions of chevon, beef and pork lean. Sausages were cooked in a convection oven to an internal temperature of 75 °C, drained and then sampled for analysis. Cooking losses were the lowest in chevon sausages. Fat levels were 2.29, 7.07, 2.77 and 3.02%, respectively, in chevon, beef, pork, and mixed-meat sausages. Hardness and chewiness were not influenced by sausage type. Springiness was higher in chevon, pork, and mixed-meat sausages compared to that of beef sausages. Cohesiveness was high in beef and pork sausages, low in chevon sausages, and intermediate in mixed sausages. The results suggest that textural attributes of chevon sausages are comparable to those of other sausages studied. Incorporation of chevon in mixed-meat sausages may result in a low-fat product with superior water-holding and textural properties.

___

Introduction

The demand for chevon (goat meat) in the United States has increased in the recent years (Glimp, 1995). Chevon is particularly attractive to a health conscious American consumer due to its lower fat content compared to other types of red meat (Park *et al*., 1991). However, chevon is lower in tenderness and flavour than lamb, beef, or pork (Smith *et al*., 1974). Developing value-added products using chevon may mask its characteristic texture and flavour, thus widening the existing market and increasing the number of consumers benefited by this low-fat red meat.

Chevon may be an excellent resource in the preparation of low-fat diets, since the fat content of lean meat is significantly less (James & Berry, 1997). Textural properties of chevon products have not been adequately investigated. Texture profile analysis (TPA) is a useful tool to assess the palatability of a meat product since the objective attributes correlate well with sensory evaluation (Lyon *et al*., 1980). The objective of the present experiment was to compare the textural properties of low-fat chevon sausages with those of beef and pork sausages.

Materials and Methods

The trial was conducted using two batches of sausages. Each batch of chevon sausages was manufactured using meat from six Spanish goat carcasses. Beef chuck and pork leg portions from several carcasses were used for preparing beef and pork sausages respectively. A mixed-meat sausage with equal proportions (by weight) of chevon, beef, and pork was also prepared. Equal weights of chevon, beef or pork lean with no added fat was ground through a 1.27 cm breaker-plate, to which sausage seasonings (A.C. Legg Packing Co., Inc., Birmingham, AL, USA) were added and mixed thoroughly. The seasoning was a blend of salt, red pepper, sage, sugar, and black pepper. The mix was ground again through a 0.4 cm-plate and stuffed into natural pig casings using a sausage stuffer.

Sausages were individually weighed, placed on aluminium pans covered with foil, and cooked in a convection oven (Lindberg/Blue, Model GO 1350SC, Ashville, N.C., USA) to an internal temperature of 75 °C. Cooked sausages were cooled, drained of the fluid and then weighed again to assess cooking losses. The products were kept at 2 °C for 24 h to facilitate removal of cores. The sausages were cut into 1.25 cm-thick

slices and 1-cm cores were removed from the centre of each slice for TPA. The TPA tests were carried out using a TA-XT2 Texture Analyzer (Texture Technologies Corp., Scarsdale, NY, USA) with a 25-kg load cell, a test speed of 360 mm/min, and the cross head set at 75% strain. The cylindrical core samples were placed upright (sample height 1.25 cm) on the stationary perspex platform and compressed by a cylindrical perspex probe (diameter 2.5 cm) attached to the crosshead. In each batch, 10 sausages per product type were evaluated for TPA. The texture attribute value of each sample was an average of values obtained from 4-6 cores.

Proximate composition of sausages (n = 10/batch) was determined according to AOAC (1984) procedures. The data were analyzed as a Randomized Complete Block Design using the General Linear Models procedures in SAS (1992), with batch as the blocking factor. When significant differences were observed by ANOVA, the means were separated using the Least Significant Difference test (LSD).

Results and Discussion

Among the products studied, fat content was the lowest (P < 0.05) in chevon sausage. The fat contents were 2.29, 7.07, 2.77 and 3.02%, respectively, in chevon, beef, pork and mixed-meat sausages. Protein contents of the different types of sausages studied were similar. The protein contents were 20.00, 20.47, 21.39 and 22.03%, respectively, in chevon, beef, pork and mixed-meat sausages. The superior nutritional properties of chevon have been well documented. Chevon is naturally low in fat, probably due to reduced subcutaneous fat deposition in goat carcasses (Kirton, 1970).

Table 1 Texture Profile Analysis of low-fat chevon, beef, pork and mixed-meat sausages

Sausage type Attribute	Beef	Pork	Chevon	Mixed meat	Pooled s.e.m.	P value (ANOVA)
Hardness (g)[1]	2271.8	1716.4	1120.8	1785.8	472.16	0.26
Fracturability[2]	398.3	414.1	1084.1	525.3	444.2	0.30
Springiness (cm)[3]	0.64[b]	0.71[a]	0.74[a]	0.72[a]	0.042	0.01
Cohesiveness[4]	0.29[a]	0.29[a]	0.25[b]	0.27[ab]	0.019	0.01
Gumminess[5]	652.8	500.5	282.3	476.8	152.1	0.17
Chewiness[6]	418.4	354.8	227.2	345.8	79.85	0.46
Resilience[7]	0.12[a]	0.11[ab]	0.10[b]	0.11[b]	0.006	0.05

[ab]Means with different superscripts differ significantly by Least Significant Difference (LSD) test at P < 0.05
[1]Peak force of the first compression
[2]Occurs where the first bite curve has its first significant peak
[3]Distance of the detected height of the product on the second compression / Original compression distance
[4]Area under second curve / Area under first curve
[5]Hardness × Cohesiveness
[6]Hardness × Springiness × Cohesiveness
[7]Area during the withdrawal of the first compression / Area of the first compression

An example of a typical first bite and second bite compression curves obtained for a core sample of chevon sausage is shown in Figure 1. Among the texture attributes, only springiness, cohesiveness and resilience were significantly influenced by sausage type (Table 1, P < 0.05). The distance sample recovers between first and second bites (also known as springiness) was higher in chevon, pork, and mixed sausages compared to that of beef sausages. Cohesiveness was high in beef and pork sausages, low in chevon sausages, and intermediate in mixed sausages. The ability of the core sample to resume its original shape (resilience) was the lowest for chevon. The results suggest that textural attributes of chevon sausages are comparable to those of other types of sausages, since several important attributes were not influenced by sausage type. There is immense potential for chevon to be included in the manufacture of low-fat processed meat foods, without a major influence on the textural properties.

Cooking losses were the lowest (P < 0.05) for chevon sausages compared to the other types of sausages. The cooking losses were 5.52, 19.88, 7.46 and 10.02% in chevon, beef, pork and mixed-meat sausages, respectively. Babiker *et al*. (1990) reported that chevon had lower cooking loss than lamb. The authors stated

that superior water-holding capacity of chevon was responsible for its lower cooking loss.
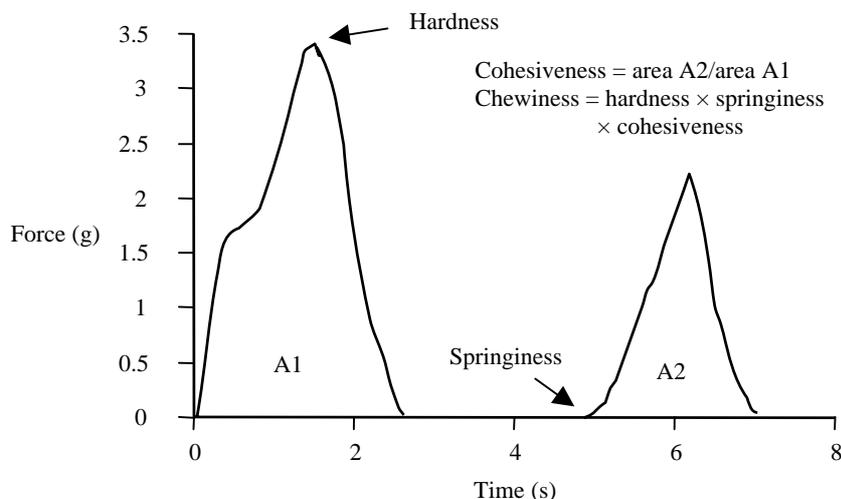
Figure 1 Texture Profile Analysis of low-fat chevon sausage tested using TA-XT2 Texture Analyzer, showing typical first and second bite compression curves

Conclusions

The results indicate that the textural properties of chevon sausages are similar to the other types of sausages studied. Incorporation of chevon in mixed-meat sausages may result in a low-fat product with superior water-holding, nutritional and textural properties. Further studies are required to determine the shelf life of chevon products.

References

AOAC, 1984. Official methods of analysis (14th ed.). Association of Official Analytical Chemists, Inc., Arlington, Virginia, USA.

Babiker, S.A., El Khider, I.A. & Shafie, S.A., 1990. Chemical composition and quality attributes of goat meat and lamb. Meat Sci. 28, 273-277.

Glimp, H.A., 1995. Meat goat production and marketing. J. Anim. Sci. 73, 291-295.

James, N.A. & Berry, B.W., 1997. Use of chevon in the development of low-fat meat products. J. Anim. Sci. 75, 571-577.

Kirton, A.H., 1970. Body and carcass composition and meat quality of the New Zealand feral goat (*Capra hircus*). N. Z. J. Agric. Res. 13, 167-181.

Lyon, C.E., Lyon, B.G., Davis, C.E. & Townsend, W.E., 1980. Texture Profile Analysis of patties made from mixed and flake-cut mechanically deboned poultry meat. Poult. Sci. 59, 69-76.

Park, Y.W., Kouassi, M.A. & Chin, K.B., 1991. Moisture, total fat and cholesterol in goat organ and muscle meat. J. Food Sci. 56, 1191-1193.

SAS, 1992. Statistical Analysis Systems, STAT[R] Software: Changes and Enhancements (Release 6.07). SAS Technical Report, SAS Institute Inc., Cary, North Carolina, USA.

Smith, G.C., Pike, M.I. & Carpenter, Z.L., 1974. Comparison of the palatability of goat meat and meat from four other animal species. J. Food Sci. 39, 1145-1146.