OPTIONS méditerranéennes

Technology creation and transfer in small ruminants: roles of research, development services and farmer associations

Edited by:
M. Chentouf, A. López-Francos, M. Bengoumi, D. Gabiña

OPTIONS méditerranéennes

SERIES A: Mediterranean Seminars
2014 – Number 108

CIHEAM

Session 2: Research in sheep and goats: structures, approach, investment and results obtained
Recherche en ovins et caprins : structures, approche, investissements et résultats obtenus

New sheep and goat products: "Mantas" and sausages. An integrated project in co-promotion

A. Teixeira[1,2] and S. Rodrigues[2,3]

[1]Veterinary and Animal Research Centre (CECAV), University of Trás-os Montes e Alto Douro
Quinta de Prados, Apartado 1013, 5001-801 Vila Real (Portugal)
[2]Agrarian School of Polytechnic Institute of Bragança,
Campus Sta Apolónia Apartado 1172, Bragança 5301-855 (Portugal)
[3]Mountain Research Centre (CIMO), Agrarian School of Polytechnic Institute of Bragança
Campus de Santa Apolónia – Apartado 1172, 5301-855 Bragança (Portugal)

Abstract. A project between a research centre, two breeder associations and a meat manufacturing industry was developed to add value to animals with very low commercial acceptability, creating two new products, a raw fresh meat sausage and a processed meat product "manta". The ratio between MUFA+PUFA/SFA was 1.54 g/100 g and 1.55 g/100 g of dry product and protein percentage 17.8%, and 18.8% for ewe and goat sausages, respectively. The most abundant unsaturated fatty acid was the C 18:1 and protein was 44.5 and 51% for ewe and goat "mantas, respectively. Both are balanced products in protein and fat contents resulting in an interesting solution to give added value to animals with very low commercial price.

Keywords. "Manta" – Sausage – Goat meat – Ewe meat.

Nouveaux produits ovins et caprins: "Mantas" et les saucisses. Un projet intégré en co-promotion

Résumé. *Un projet entre un centre de recherche, deux associations d'éleveurs et de l'industrie de la viande a été conçu pour ajouter de la valeur aux animaux avec une très faible valeur commerciale grâce à la création de deux nouveaux produits: une saucisse fraîche et d'un produit de viande traitée "manta". Le rapport entre AGMI + AGPI / SFA ont été 1,54 g/100 g et 1,55 g/100 g de produit sec et la teneur en protéines de 17,8%, et 18,8% pour les saucisses de brebis et de chèvre, respectivement.*

Mots-clés. *"Manta" – Saucisse – Viande de chèvre – Viande de brebis.*

I – Introduction

In Portugal, sheep and goats are produced under an extensive system. Most of the local breeds are raised for milk production and as the lambs and kids cannot compete with milk production for cheese making are slaughtered at 1 to 3 months of age. These young milk fed animals producing light carcasses are very much appreciated by consumers and are traditionally commercialized as quality brands as protected designation of origin (PDO) and protected geographical indications (PGI). However there are animals that come out of these quality brands, particularly the culled ones or those with weight or age that cannot be classified as a PDO or PGI label. These animals have very low consumer acceptability and consequently a low commercial value. A strategy to give value to those animals would be welcome by producers as well as butchers, meat industry or supermarkets. Value may be added by decreasing costs of production or improving relative value of the final product. Meat from such animals is more suitable to process as drought, cured or smoked (Webb *et al.*, 2005). In several countries older and culled animals are slaughtered and its meat is processed as salted, smoked or air dried products, as in Spain the "Cecina de León" (Molinero *et al.*, 2008) or in Italy the "Volin di capra" (Fratianni *et al.*, 2008). We thought, therefore, to develop a project between a research centre (Carcass and Meat Quality and

Technology Laboratory of Agrarian Scholl of Bragança), two breeder associations (ANCRAS – Serrana National Association of Breed Producers and ACOB – Bragançana National Association of Breed Producers) and a meat manufacturing industry (Bísaro Salsicharia Tradicional) to add value to these animals, creating two new products, a raw fresh meat sausage and a processed meat product called "manta" from Serrana goats and Churra Galega Transmontana ewes. The some physicochemical properties of these products are presented.

II – Material and methods

1. Animal sampling, carcass fabrication and meat "manta" processing

Sixteen culled animals, eight Bragançana ewes and eight Serrana goats, ageing between 5 and 9 years old, with an average of 45 ± 5 kg live weight, were randomly selected from several flocks by two breeder associations. Carcasses weighted 20 ± 1.9 kg and were cooled at 4 ± 1°C for an ageing period of 4 days. After carcasses were divided into quarters by a straight cut from the point close to the lower edge of the backbone at the 13th rib and then deboned separating only the long bones and vertebral column, remaining the ribs in the anterior quarter and preventing muscles from being separated, so that resembled a blanket (manta) of meat. Mantas (8 for animal/specie) were then salted and placed on top of each other, like piles, separated by 5cm of coarse marine salt, during 96 h in fridge with a constant temperature of 4ºC and relative humidity of 75% (Fig. 1). Every 12 h the piles were moved, throwing down the upper ones, redistributing the pressure. At the end mantas were washed removing the excess of salt and air-dried in a room with a temperature of 8-10º C with a relative humidity of 60-70% during 48 h. Finally, samples were vacuum packed.

Fig. 1. "Mantas" fabrication.

2. Sausages fabrication and sampling

A total of 140 goats and 140 ewes ageing between 5 and 7 years old, with an average of 20 kg carcass weight were used from November 2010 until May 2011 and distributed over in 20 goats and 20 ewes per month. Carcasses were deboned and cleaned from nerves, tendons and connective tissues before raw meat have been processed at the manufacturing meat industry. Raw meat (75 to 80% of goat or ewe) was then mixed and minced with 15 to 20% of fatty cuts of Bísaro pork belly, and adding the ingredients: salt, peppers, bay leaves, water, garlic, rendimix® and flavorex® 4000. The mixture was then stuffed into 34-36 mm pork casings, hung and stabilized in a climate chamber at 13°C and 80% of relative moisture, packaged in a polyamide polyethylene bags and stored in a refrigerator at 4°C (Fig. 2). Every month a sample of two sausages per specie were randomly taken to analyze a total of 12 sheep (N = 12) and 10 goat (N = 10) sausages.

Fig. 2. Sausages fabrication.

3. Physicochemical analysis

Meat samples were assessed in *subscapularis*, *semimembranosus* and *Longissimusdorsi* mucles in fresh meat as well as in salting and air-dried mantas. A total of 12 sheep (N = 12) and 10 goats (N = 10) with 8 repetitions sausages were used. Protein determination was carried out following the Portuguese standard NP 1612, 2002). Hydroxyproline determination was performed according to the Portuguese 104 standard NP 1987, 2002). For the oxidation index was measured the concentration of Thiobarbituric Acid Reactive Substances (TBARS expressed in terms of malondialdehyde, MDA equivalents) in mg MAD eq./ kg sample according to the Portuguese standard NP 3356, 2009). Fat determination was performed using the 125 BÜCHI Fat Determination System (AOAC International) which consists of the Extraction Unit B-815 for simultaneous extraction/saponification of the fatty acids, and the Fat Determination B-820 which determines the fat content based on the isolated fatty acids by means of gas chromatography. Samples were prepared in accordance with the Portuguese standard NP 1613 (1979). All analysis were made in triplicate and the mean was used as final data.

4. Statistical analysis

An analysis of the variance (ANOVA) with Type III sums of squares was performed using the GLM (General Linear Model) procedure of the SPSS software, version 17.0 (SPSS, Inc). The effect of meat origin (goat or ewe) on the physicochemical composition of "mantas" and sausages was studied. Means were compared using Tukey´s test or Dunnett T3.

III – Results and discussion

1. Sausages

We found no significant differences in moisture between sausages groups (Table 1). The protein content was significantly ($P < 0.01$) higher in goat meat sausages than ewe meat sausages, 18.8% and 17.8% respectively very close to the values found by Ibañez *et al.* (1997). Moisture content obtained is relatively high comparatively to other kinds of sausages, mainly dry and cured ones. Such difference is related to the technological process, once our sausages were not smoked. Ambrosiadis *et al*., 2004), in a study of traditional sausages in Greece, found great variability in moisture content between 33.7% and 64.4%. The most abundant fatty acids were oleic acid (C18:1) followed by palmitic acid (C16:0), stearic acid (C18:0) and linolenic acid (C18:2). The individual amounts of these fatty acids influenced the different fractions that characterize the monounsaturated fatty acids (MUFA), saturated fatty acids (SFA) and polyunsaturated fatty acids (PUFA). The mean total fat content of fresh sausages was 45.11 g/100 g and 32.55 g/100 g of dry product, for ewe and goat sausages, respectively. Significant differences were found between ewe and goat sausages for SFA as well as MUFA and PUFA, and the goat sausages had a relatively lower fat content. Gadiyaram and Kannan, 2004) also have found lower fat content in chevron sausages than beef or pork sausages. As per recommended dietary guidelines of WHO/

Japanese Heart Association/ American Heart Association the ideal ratio of SFA:MUFA:PUFA should be 1:1.5:1 (Kris-Etherton, 1999; and FAO/WHO, 2008). The ratio between MUFA+PUFA/SFA we found in fresh sausages of ewe was 1.54 g/100 g of dry product and in fresh sausages of goat meat was 1.55 g/100 g of dry product, without significant differences among samples. For dietary fat intakes of 20-40% the ideal balance would seem to approximate 1:1.3:1 for SFA:MUFA:PUFA (Hayes, 2002). Then, it seems that our sausages are a balanced product in fat content, mainly compared with other products as the traditional sausage in Turkey "Sucuk" which has 0.00 g/100 g of MUFA+PUFA/SFA ratio. According to Yildiz-Turp and Serdaroğlu, 2008) the most abundant fatty acid in traditional sausage in Turkey was oleic acid, followed by palmitic acid, stearic acid, such as sausages made from sheep and goat meat studied. The ratio MUFA+PUFA/SFA in traditional sausage in Turkey "Sucuk" level was 0.80 g/100 g. This ratio is lower in this type of sausages than in fresh sausages made from ewe and goat meat studied in this work. The sausages made from goat and ewe are healthier compared with these traditional Turkey sausage.

Table 1. Moisture (%), protein (%), total fat (%) and fatty acids composition (g/100 g dry sausage) of fresh sausages made from meat of sheep and goat (Mean ± SD, n = 12/10)

	Sheep (N = 36)	Goat (N = 30)	Significance
Moisture	59.31 ± 6.59	61.07 ± 5.38	NS
Protein	17.83 ± 1.35 a	18.83 ± 1.16 b	**
Total Fat	45.11 ± 11.77 b	32.55 ± 7.71 a	***
C8:0	0.22 ± 0.04 a	0.24 ± 0.05 b	*
C12:0	0.18 ± 0.10	0.17 ± 0.05	NS
C14:0	1.21 ± 0.18 b	0.93 ± 0.17 a	***
C16:0	8.72 ± 2.43 b	6.28 ± 1.58 a	***
C16:1	1.42 ± 0.46 b	1.14 ± 0.26 a	**
C18:0	5.24 ± 1.06 b	3.59 ± 1.00 a	***
C18:1	17.53 ± 5.25 b	12.26 ± 3.42 a	***
C18:2	4.81 ± 1.79 b	3.77 ± 1.09 a	*
C18:3	0.63 ± 0.20 b	0.53 ± 0.13 a	*
C20:1	0.32 ± 0.11	0.28 ± 0.08	NS
C20:4	0.18 ± 0.07	0.17 ± 0.05	NS
SFA	16.53 ± 3.51 b	11.95 ± 2.52 a	***
MUFA	20.10 ± 6.04 b	14.21 ± 3.89 a	***
PUFA	5.82 ± 2.11 b	4.46 ± 1.37 a	*
PUFA + MUFA	25.92 ± 8.04 b	18.67 ± 5.08 a	***
PUFA + MUFA/SFA	1.54 ± 0.20	1.55 ± 0.21	NS

NS. – not significant; *P ≤ 0.05 – significant;**P ≤ 0.01 – very significant; ***P ≤ 0.001 – extremely significant.

2. "Mantas"

No significant differences were found for TBARS (Thiobarbituric acid reactive substances), protein and ashes contents between ewe and goat mantas but the second ones showed moisture 6.5% significantly higher (Table 2). Both mantas have high protein content, 23.9%) as well as similar products as jerked beef, which has 24.67% protein according to Cristian, 2006). The greater amount of fat content of ewe mantas was SFA while in goats was MUFA thought ewe mantas had higher MUFA content. The differences in fat content and fat partition found between this two sheep and goats processed meat products have also been recorded in fresh meat under several production systems as Tshabalala *et al*., 2003) between indigenous goat and sheep breed in South Africa, Sen *et al.*, 2004) studying the carcass and meat composition of sheep and goat under semiarid conditions and

Pearce *et al*., 2010) evaluating the role of saltbush pastures in the quality of sheep and goat meat. The most important saturated fatty acids in both mantas were C16 (palmitic), C18:0 (stearic) and the content of these fatty acids were significantly higher in ewe than in goat mantas. The saturated fat in ewes and goat mantas, particularly the higher presence of C16 and C18 was similar to the values found by Facco, 2009) for charque but less than the quantities recorded in charque and jerked beef by Correia *et al*., 2003).The most abundant unsaturated fatty acids were the C18:1, the C18:2 nd the ratios UFA/SFA MUFA/SFA PUFA/SFA although healthy favorable in both products were better in goat mantas confirming the tendency according to Pearce *et al*., 2010) for goats to deposit a healthier fatty acid composition and the studies by Lee *et al*., 2008) which have observed higher levels of unsaturated fat in the meat of goats compared to lambs fed the same diet.

Table 2. Means ± SE of Moisture (%), Protein (%), TBARS (mg MAD eq/kg sample) and fatty acid profile of longissimus dorsi muscle (g/100 g of total fatty acid methyl esters) of ewe and goat mantas. Effect of specie

N = 48	Ewe	Goat	Significance
Moisture	44.49 ± 0.70	50.95 ± 1.09	**
Protein	23.93 ± 1.80	23.99 ± 1.67	NS
TBARS[a]	2.16 ± 0.23	1.87 ± 0.33	NS
C4	0.03 ± 0.02	0.06 ± 0.02	NS
C8	0.13 ± 0.01	0.14 ± 0.01	NS
C10	0.06 ± 0.02	0.06 ± 0.02	NS
C12	0.05 ± 0.01	n.q	
C14	0.51 ± 0.04	0.43 ± 0.05	NS
C16	2.89 ± 0.21	1.80 ± 0.30	**
C18	2.49 ± 0.19	1.02 ± 0.27	***
C16:1	0.39 ± 0.04	0.39 ± 0.06	NS
C18:1	5.46 ± 0.40	3.21 ± 0.56	***
C18:2	0.87 ± 0.06	0.44 ± 0.09	***
C18:3	0.17 ± 0.02	0.03 ± 0.03	*
C20:4	0.02 ± 0.01	0.04 ± 0.01	NS
IM Fat	14.89 ± 1.02	8.97 ± 1.45	***
Σ SFA	6.17 ± 0.39	2.53 ± 0.55	***
Σ MUFA	5.85 ± 0.43	3.60 ± 0.61	***
Σ PUFA	1.05 ± 0.08	0.52 ± 0.11	***
UFA/SFA	1.12 ± 0.08	1.60 ± 0.19	***
MUFA/SFA	0.95 ± 0.07	1.38 ± 0.18	***
PUFA/SFA	0.17 ± 0.02	0.21 ± 0.04	***

SFA – saturated fatty acids, MUFA – monounsaturated fatty acids, PUFA – polyunsaturated fatty acids.
[a] mg MAD eq./ kg sample
n.q – not quantified
*p< 0.05; **p< 0.01; ***p< 0.001; NS – not significant.

IV – Conclusions

The ratio between MUFA+PUFA and SFA were 1.54 g/100 g and 1.55 g/100 g of dry product and protein percentage 17.8%, and 18.8% for ewe and goat sausages, respectively. The most abundant unsaturated fatty acid was the C 18:1 and protein was 44.5 and 51% for ewe and goat "mantas. Both are balanced products in protein and fat contents resulting in an interesting solution to give added value to animals with very low commercial price.

Acknowledgements

The authors thank the PRODER, Medida 4.1 "Cooperação para a Inovação" for funding the research project nº: 020260013013 "New goat and sheep processed meat products".

References

Ambrosiadis J., Soultos N., Abrahim A. and Bloukas, J.G., 2004. Physicochemical, microbiological and sensory attributes for the characterization of Greek traditional sausages. In: *Meat Science*, 66, pp. 279-287.

Correia R.T.P., Biscontini and Telma, M.B., 2003. Influência da dessalga e cozimento sobre a composição química e perfil de ácidos graxos de charque e jerkedbeef. In: *Ciência e Tecnologia de Alimentos*, 23, pp. 38-42.

Cristian H.M.P.G., 2006. Jerked beef fermentado. Desenvolvimento de nova tecnologia de processamento. In: Universidade Estadual de Londrina, pp. 70-72.

Facco E.M.P., Lage M.E. and Godoy H.T., 2009. Influence of Vitamin E Supplemented Diet on Charque Quality and Lipid Stabilization. In: *Brazilian archives of Biology and Technology*, 52, pp. 729-736.

FAO/WHO, 2008. Interim summary of conclusions and dietary recommendations on total fat and fatty acids. In: Join FAO/WHO Rxpert Consultation on Fats and Fattty Acids in Human Nutrition, WHO, Geneva.

Fratianni F., Sada A., Orlando P. and Nazzaro F., 2008. Micro-electrophoretic study of sarcoplasmic fraction in the dry-cured goat raw ham. In: *The Open Food Science Journal*, 2, pp. 89-94.

Gadiyaram K.M. and Kannan G., 2004. Comparison of textural properties of low-fat chevon, beef, pork and mixed-meat sausages. In: *South Africa Journal Animal Science*, 34, pp. 168-170.

Hayes K.C., 2002. Dietary fat and heart health: in search of the ideal fat. Asia Pacific. In: *Journal of Clinical Nutrition*, 11, pp. 394-400.

Ibáñez C., Quintanilla L., Cid C., Astiasarán I. and Bello J., 1997. Dry fermented sausages elaborated with *Lactobacillus plantarum – Staphylococcus carnosus*. Part II: Effect of partial replacement of NaCl with KCl on the proteolytic and insolubilization processes. In: *Meat Science*, 46, pp. 277-284.

Kris-Etherton P.M., 1999. Monounsaturated fatty acids and risk of cardiovascular disease. In: *Journal Nutrition*, 129, pp. 2280-2284.

Lee J.H., Kannan G., Eega K.R., 270 Kouakou B. and Getz W.R., 2008. Nutritional and quality characteristics of meat from goat and lamb finished under identical dietary regime. In: *Small Ruminant. Research*, 74, pp. 255-259.

Molinero C., Martínez B., Rubio B., Rovira J. and Jaime I., 2008. The effects of extended curing on the microbiological physicochemical and sensorial characteristics of Cecina de León. In: *Meat Science*, 80, 370-379.

NP-1612, 1979. Carnes, derivados e produtos cárneos. Determinação do teor de azoto total. Método de referência. Lisboa: IPQ.

NP-1613, 1979. Carnes, derivados e produtos cárneos. Determinação da matéria gordatotal. Método de referência. Lisboa: IPQ.

NP-3356, 2009. Método Produtos da pesca e da aquicultura. 291 Determinação do índice de ácidotiobarbitúrico (TBA espectrofotométrico). Método de referência. Lisboa: IPQ.

Pearce K.L., Norman H.C. and Hopkings D.L., 2010. The role of saltbush-based pasture systems for the production of high quality sheep and goat meat. In: *Small Ruminant Research*, 91, pp. 29-38.

Sen A.R., Santra A. and Karim S.A., 2004. Carcass yield, composition and meat quality attributes of sheep and goat under semiarid conditions. In: *Meat Science*, 66, pp. 757-763.

Sobrinho S.A.G., Zeola N.M.B.L., Souza H.B.A. and Lima T.M.A., 2004. Qualidade da carne ovina submetida ao processo de salga. In: *Ciência e Tecnologia de Alimentos*, 24, pp. 369-372.

Tshabalala P.A., Strydom P.E., Webb E.C. and Kock H.L., 2003. Meat quality of designated South African indigenous goat and sheep breeds. In: *Meat Science*, 65, pp. 563-570.

Webb E.C., Casey N.H. and Simela L., 2005. Goat meat quality. In: *Small Ruminant Research*, 60, pp. 153-166.

Yildiz-Turp G. and Serdaroğlu M., 2008. Effect of replacing beef fat with hazelnut oil on quality characteristics of sucuk – A Turkish fermented sausage. In: *Meat Science*, 78, pp. 447-454.