EFFECT OF DIFFERENT MEAT ON ITALIAN "SALAMI" QUALITY

Marino R.*, Albenzio M., Caroprese M., Della Malva a., Santillo A., Sevi A.

Department of Production and Innovation in Mediterranean Agriculture and Food System (PrIME)
University of Foggia. Via Napoli, 25 - 71100 Foggia (Italy)
*Corresponding author (phone: +390881589330; fax: +390881589331; e-mail: r.marino@unifg.it)

Abstract— The effects of different meat on quality of Italian "salami" were investigated. Salami were manufactured using meat from buffalo, Podolian young bulls and donkey, respectively, and compared with traditional salami from pork meat. In particular, nutritional, texture and sensory properties were assessed at the end of ripening time.
Different meat caused significant differences in the unsaturation level of fatty acids of salami. Salami manufactured with meat from donkey showed lower ($P < 0.05$) saturated fatty acid and higher ($P < 0.01$) polyunsaturated fatty acids than salami from buffalo meat, beef and pork; the highest fatty acids ω 3 ($P<0.01$) content were found in donkey and Podolian young bulls salami. In addition salami from donkey meat and podolian beef showed better nutritional indexes than other salami showing lower ω6/ω3 ratio and atherogenic and trombogenic indices. Salami from donkey, buffalo and podolian cattle meat showed higher score for color (($P < 0.01$) and flavour ($P < 0.01$) than traditional salami. Salami manufactured from donkey meat showed higher tenderness than other salami. These results showed that a clear potential exists to produce salami by using alternative meat to the traditional pork

Index Terms—"alternative" meat, nutritional properties, salami, sensorial profile

I. INTRODUCTION

In the last years food demands have been transformed and modified; there is an increasing consumer interest in products with high energetic and nutritional value. Consumers prefer meat that is authentic, tasty, rich in protein and low in lipid and cholesterol content (Resurreccion, 2004). Several works were aimed to reduce the fat content of salami but few works deals with substitution of pork meat. Podolian cattle are a local breed of Southern Italy, well adapted to the difficulty of the surrounding environment thus the animals display longevity and disease resistance. This cattle produce meat characterised by a beneficial content of polyunsaturated fatty acid (Marino et al., 2006). The Italian buffalo population has greatly increased in the past decades and shows a tendency for further expansion; animals were reared using semi-extensive system. In Italy, the consumption of buffalo meat is relatively unknown, even though we appreciate buffalo milk, used to produce mozzarella D.o.p.. Recently, in many countries of the Mediterranean area, interest in donkey rearing is increased, due to interest in the nutritional properties of donkey meat for infant nutrition (Salimei *et al.*, 2004). On the contrary, the consumption of donkey meat is relatively unknown, even if donkey meat has low fat and cholesterol content and high protein content .
Therefore, the aim of this work was to study the effects of different meat on nutritional and organoleptic properties of salami and compared them with traditional salami manufactered with pork meat

II. MATERIALS AND METHODS

The salami of podolian young bulls, buffalo and donkey meat, respectively ,were prepared in a sausage industry under traditional conditions. Each type of meat was trimmed by pork back fat (10% w/w) and fat and were mixed with salt, pepper, fennel seeds, powdered milk and natural aroma left overnight at 2°C. After filling the salami were placed at 4°C for 3 days then were placed for20 days in the ripening room where they remained under the following conditions: during the first five days, temperature decreased from 25°C to 15°C and relative humidity (RH) decreased from 90% to 65%. The final ripening step was carried out at 13°C and 75-80% RH. The salami were analyzed after 22 days of ripening to evaluate the following parameters: microbiological analyses, colour analyses, sensory analysis, nutritional and mechanical properties.
Lipids were extracted according to Bligh and Dyer (1959), duplicate samples of chloroform extract, were methylated according to ISO-IDF (2002). Gas-chromatograph analysis for fatty acids methil esteres determination was performed using an Agilent 6890N instrument equipped with a HP-88 fused-silica capillary column (length 100 m, internal diameter 0.25 mm, film thickness 0.25μm). Individual FAMEs peaks were identified by comparing their retention times with those of standards (Matreya). Atherogenic and thrombogenic indices were calculated according to Ulbricht and Southgate (1991)
WBSF was measured on five parallelepipeds (1 cm^2 in cross-section) cutted from each sample and sheared by an Instron Universal Testing machine (Model 3343), equipped with a Warner-Bratzler shear device. For each muscle a mean value was calculated and used for statistical analysis. A consumer test was carried out with a panel composed of

students and staff of the University of Foggia (80 persons) for sensorial analysis. The consumers were asked to evaluate colour, odour, flavour, taste and tenderness of salami. The samples were evaluated for acceptability using a 9-point hedonic scale (1= extremely dislike; 9 = like extremely). Data were subjected to an analysis of variance, using the GLM procedure of the SAS statistical software (1999). Least squares means were evaluated using the PDIFF and STDERR options of SAS. Sensory values were normalised standardising each assessor by his standard deviation in order to reduce the effect of the different use of the scale.

III. RESULTS AND DISCUSSION

Different meat, significantly, affected chemical composition of salami (data not shown); the protein content varied from 27.55% (traditional salami) to 31.55% (donkey salami) and the fat content to 26.62% (Podolian salami) from 35.88% (traditional salami).

Table 1 shows fatty acids profile of donkey, buffalo and beef salami compared with pork salami. Different meat caused significant differences in the unsaturation level of fatty acids of salami. Salami manufactured with meat from donkey showed lower ($P < 0.05$) saturated fatty acid and higher ($P < 0.01$) polyunsaturated fatty acids than salami from buffalo meat, beef and pork. No literature references were found for fatty acids of donkey salami, even if Paleari et al.(2003) in horsemeat cured products found the highest content of PUFA compared to other animals The highest fatty acids ω 3 ($P<0.01$) content were found in donkey and Podolian young bulls salami. These result could be due to outdoor rearing system for donkeys and Podolian cattle with a greater availability of fresh grass to the diet; indeed, it is known a predominance of C18:3 ω3 (precursor of the ω-3 series) in grass lipids. Therefore, the fatty acid profile of these meat products is similar to that of raw material. In particular, salami from donkey and Podolian young bulls have a higher content of very long chain (VLC) fatty acids, such as eicosapentenoic EPA ($P < 0.01$), and docosahexenoic DHA ($P<0.05$) acids than buffalo and pork salami as shown in table 2. The highest percentage of EPA and DHA in salami of donkey and Podolian young bulls are indicative of a nutraceutical properties of these meat; among the ω-3 PUFA, these fatty acids have been reported to have a wide range of biological effects, which are beneficial for human health. EPA and DHA have been demonstrated to have a role in prevention of heart diseases and some cancers and obesity/type-2 diabetes (Simopoulos, 2002). DHA is also important during pregnancy for cerebral and retinal tissues development and reduces the incidence of premature birth (Givens, Kliem, & Gibbs, 2006).

Table 1-Fatty acids composition (%) of salami manufactured with meat from different animal species (means ± SE)

	Animal species					
	Donkey	Buffalo	Podolian young bull	Pig	SEM	Effects-P
C14:0	1.62 b	2.59 a	1.78 b	1.38 b	0.22	*
C16:0	22.85 b	25.05 a	23.21 b	24.70 a	0.28	**
C18:0	8.05 c	14.43 a	13.65 b	14.08 a	0.21	**
C18:1	37.2 c	39.93 b	40.21 b	43.06 a	0.31	*
C18:2 ω6	11.98 b	11.05 d	10.98 c	11.08 a	0.22	*
C20:4 ω6	1.3 a	0.16 c	0.25 c	0.25 b	0.03	*
C18:3 ω3	0.65 a	0.36 b	0.62 a	0.35 b	0.06	*
C20:5 ω3	0.35 a	0.18 b	0.32 a	0.02 c	0.05	**
C22:6 ω3	0.25 a	0.11 b	0.22 a	0.08 b	0.03	*
SFA	36.75 c	44.58 a	43.07 ab	40.37 b	1.01	*
MUFA	49.69 a	43.57 c	44.82 bc	47.56 ab	0.98	*
PUFA	14.53 a	11.85 b	12.39 b	11.78 b	0.56	**
n3	1.25 a	0.60 bc	1.16 ab	0.45 c	0.15	**
n6	13.28 a	11.25 b	11.23 b	11.33 b	0.38	*

NS= not significant; *= P<0.05;**= P<0.01; ***= P<0.001.

In addition salami from donkey meat and podolian beef showed better nutritional indexes than other salami showing lower ω6/ω3 ratio and atherogenic and trombogenic indices as shown in table 2. Although the PUFA/SFA and ω6/ω3 ratios of meat are important factors from the human nutrition standpoint, specific saturated and polyunsaturated fatty

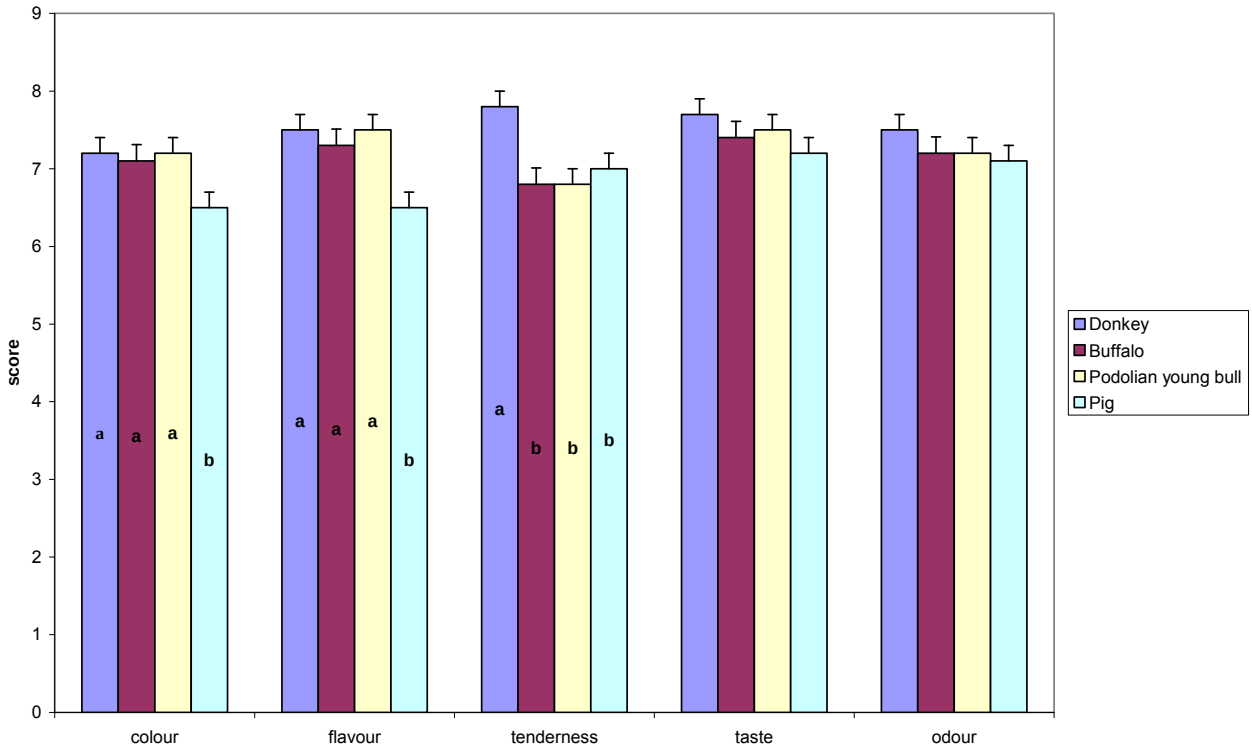
acids have opposite metabolic effects. The estimate of atherogenic and thrombogenic indices quantifies the fatty acids that can promote or prevent atherosclerosis and coronary thrombosis.

Table 2-Nutritional indices of salami manufactured with meat from different animal species (means ± SE)

	Animal species					
	Donkey	Buffalo	Podolian young bull	Pig	SEM	Effects-P
P/S	0.42 a	0.27 b	0.28 b	0.29 b	0.04	*
n6/n3	10.62 c	18.75 b	9.68 c	25.18 a	0.35	**
AI	0.51 b	0.68 a	0.56 ab	0.64 a	0.05	*
TI	1.07 b	1.73 a	1.42 ab	1.65 a	0.08	**

NS= not significant; *= P<0.05;**= P<0.01; ***= P<0.001.

Figure 1 shows sensory profile os salami from different animal species. Consumers rated all products at scores well above the central point (5 = neither pleasant nor unpleasant) and above 7 (pleasant). Salami from donkey, buffalo and podolian cattle meat showed higher score for color ((P < 0.01) and flavour (P < 0.01) than traditional salami. It is also known that the flavour of meat is influenced by its fatty acid composition, probably the lowest ω-3 fatty acid content and the highest ω6/ω3 ratio of traditional salami manufactured from pork meat could have affected meat flavour. In addition consumers appreciated the darker colour of donkey, buffalo and Podolian salami due to the innate characteristics of their meat.
Salami manufactured from donkey meat showed higher tenderness evalaluated by consumer test and lower WBS (data not shown) resulting more tender than other salami.



IV. CONCLUSION

These results showed that a clear potential exists to produce salami by using alternative meat to the traditional pork
The examinated species responded most favourable to the expectations in the production of salami. In addition, donkey and Podolian young bulls salami showed a higher nutritional value (higher content of polyunsaturated and ω-3 fatty acids, better nutritional indices) than traditional salami manufactursd using pork meat Thus donkey and Podolian cattle

meat can give an additional resource to local farmers in addition to milk production and typical products with their own niche in the marketplace could be created.

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