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Martina Franca donkey meat quality: Influence of slaughter age and suckling technique

P. De Palo[a], A. Tateo[a], A. Maggiolino[a,*], R. Marino[b], E. Ceci[a], A. Nisi[c], J.M. Lorenzo[d]

[a] Department of Veterinary Medicine, University "Aldo Moro" of Bari, S.P. per Casamassima, km 3, 70010 Valenzano, BA, Italy
[b] Department of Agricultural Food and Environmental Sciences, University of Foggia, Via Napoli, 25-71121 Foggia, Italy
[c] Free Lance DVM, Italy
[d] Centro Tecnológico de la Carne de Galicia, rúa Galicia no 4, Parque Tecnológico de Galicia, San Cibrao das Viñas 32900, Ourense, Spain

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ABSTRACT

This work aimed to evaluate the effect of suckling technique and slaughter age on Martina Franca donkey meat quality. Twenty Martina Franca male foals were involved in the trial. Foals naturally assumed colostrum within 4 h from birth. Afterwards, 10 foals were partially artificially suckled (AS), and 10 foals were naturally suckled (NS). All the foals were weaned at 180 d, then housed indoors and fed the same diet. Ten donkeys were slaughtered at 12 months and the other 10 at the age of 18 months. Samples of *Longissimus thoracis et lumborum* (LTL) were taken from each foal for chemical analysis, then rheological parameters, oxidative profile, colorimetric parameters and fatty acid profile were assessed. Older donkeys (18 months) fed with natural milk presented the highest intramuscular fat (IMF) and meat protein content. From a dietary view point, IMF acid composition showed a more favourable profile in meat from artificially-reared donkeys compared to naturally-suckled ones.

1. Introduction

Donkeys (*Equus asinus*) have been used worldwide since ancient times as draught animals in agriculture and for transporting people (Polidori, Pucciarelli, Ariani, Polzonetti, & Vincenzetti, 2015). Mechanization has reduced this need, leading to lower numbers of domestic equid, which has even led some asinine and horse breeds to become endangered. However, some donkey and horse breeds have been repositioned for milk (Centoducati, Maggiolino, De Palo, & Tateo, 2012) and meat (De Palo, Maggiolino, Lestingi, & Tateo, 2009) production. Moreover, male foals on dairy farms are mainly set aside for meat production in order to increase profits. The introduction of artificial suckling techniques, even in dairy equid breeding, could raise milk production figures and reduce foal fasting times. Indeed, the traditional technique for donkey's milk production involves separating foals from their dams for not < 4 h before each milking session (De Palo, Maggiolino, Milella, Centoducati, Papaleo, Tateo, 2016a). During this separation, foals are forced to fast as they are unable to assume enough solid feed to satisfy their nutritional requirements, especially during the first weeks of life. The artificial suckling system could thus be a way of lengthening the separation of foals from their dams, thus increasing the hours dedicated to milking over the course of the day (De Palo, Maggiolino, Milella et al., 2016a). In addition, these authors revealed that artificial suckling positively affects growth performance in donkey foals, with higher weight gain in the first 6 months of life, and higher final live weight and carcass weight at 12 and 18 months old.

Consumer's interest in animal products is influenced by the perception of a food's "healthiness" which, in the case of meat, is largely related to intramuscular fat (IMF) content, fatty acid profile and cholesterol content (McAfee et al., 2010). Thus, taking account of all the above, the aim of this study was to assess the effect of artificial suckling and slaughtering age on the physicochemical parameters, rheological characteristics and fatty acid profile of Martina Franca donkey meat obtained from foals slaughtered at 12 and 18 months of age.

2. Materials and methods

2.1. Animal treatment and sampling

This study was approved by the Ethics Committee for animal testing–CESA (process number 58337-X/10). Twenty Martina Franca jennies and their male foals were randomly included in the trial. At birth, all foals naturally suckled colostrum from their dams. Afterwards, foals were randomly assigned to two experimental groups: 10 were

* Corresponding author.
E-mail address: aristide.maggiolino@uniba.it (A. Maggiolino).

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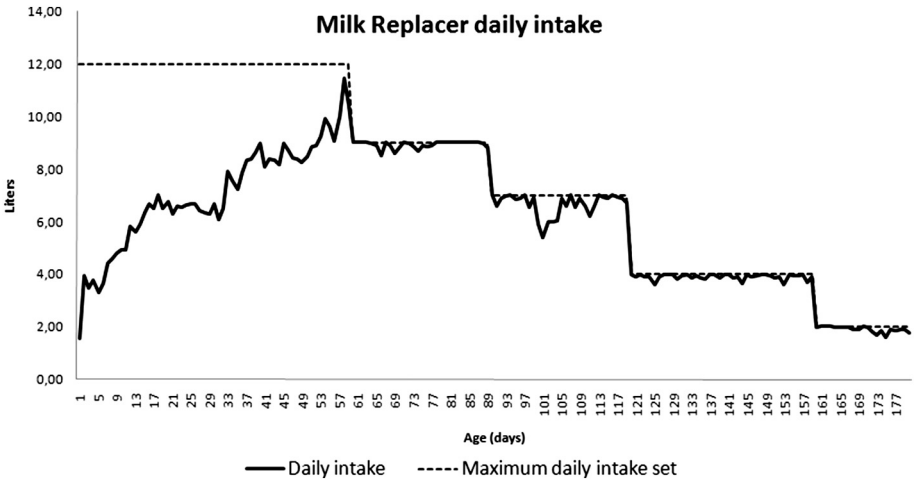

Fig. 1. Maximum amount of daily available artificial milk and mean milk intake.

partially artificially suckled (AS), and 10 were naturally suckled (NS) (Fig. 1). From 0800 h to 2000 h, both groups were separated from their mothers in order to allow the milking procedures to take place; the foals were kept in two different stalls, identical in size, environmental and structural conditions, with *ad libitum* fresh water, foal starter feed (2% DM of live body weight) and oat hay (*ad libitum*) (Martin-Rosset, 1990) in creep feeding trough. The AS group was kept in a stall equipped with an automatic calf-suckling machine (Urban CalfMom, Urban Gmbh & Co. KG, Wüsting, Germany) equipped with two suckling stations. Each station was modified for the foals' dimensions and by replacing calf teats with others measuring 6 cm in length and 3 cm in maximum diameter, as described by Tateo, Maggiolino, Padalino, and Centoducati (2013a). During these hours, each group was fed with foal starter feed, hay and water, but the AS group also had access to milk replacer.

Initially, the AS foals were encouraged to drink milk from a bottle containing milk replacer, offered to them near the feeding station. This was done until the foals started independently consuming milk from the feeding station. This occurred within the first 12 h. A commercial calf milk replacer was used (Table 1) added with calcium carbonate (0.3%) and lactose (6%) (Martin-Rosset, Vermorel, Doreau, Tisserand, & Andrieu, 1994) to modify cow's milk in order to create a chemical composition similar to natural donkey milk. Milk powder was automatically diluted in warm water at 40 °C to a concentration of 6%. The fatty acid profile was analyzed in triplicate by sampling both kinds of milk (donkey milk and milk replacer) used for suckling, on samples collected every 30 days, and it is reported in Table 2. The feeding machine operated continuously.

Both NS and AS groups were weaned at 182 ± 7 days (26 ± 1 week) of life. The AS group had milk replacer available during the daytime when they were separated from their dams until 180 days of life, while the NS group only had water and solid feed at their disposal. Each foal in the AS group was equipped with a transponder fixed to a lightweight collar round its neck, which was used by the automatic suckling machine to recognize individual animals. The machine was settable both for suckling frequency and for total daily amount of milk replacer available per foal. The frequency for all animals and during the entire trial was set at 1 suckling bout per hour, so the recorded and programmed total amount of milk replacer per foal was equally subdivided into the 12 daytime suckling bouts. The maximum amount of

Table 1
Composition of starter, oat hay and milk replacer offered to donkeys.

	Starter	Oat hay	Milk replacer[a]
DM	86.5%	88.8	–
Protein	17.1%	11.4	26%
Fat	5.76%	2.75	22%
Fibre	10.4%	34.2	0.05%
Ash	6.8%	10.8	6.5%
Neutral detergent fibre	27.7%	55.4	–
Acid detergent fibre	13.4%	38.9	–
Acid detergent lignin	2.6%	7.1	–
Horse forage units, n/kg of DM	0.85%	0.48	–
Digestible protein, g/kg	108.4%	20.4	–
Sodium	–	–	0.7%
Vitamin A	–	–	50,000 IU/kg
Vitamin D_3	–	–	5000 IU/kg
Vitamin E	–	–	100 mg/kg
Vitamin C	–	–	100 mg/kg
Iron (iron (II) sulphate)	–	–	80 mg/kg
Zinc (zinc sulphate)	–	–	70 mg/kg
Manganese (manganese sulphate)	–	–	55 mg/kg
Copper (copper (II) sulphate)	–	–	8 mg/kg
Iodine (calcium iodate)	–	–	1 mg/kg
Selenium (sodium selenate)	–	–	0.25 mg/kg

[a] Composition: cow milk serum protein concentrate, whey without lactose, sweet whey, coconut oil, palm oil, wheat protein concentrate, wheat flour.

Table 2
Fatty acid composition of natural and artificial milk (expressed as % of total fatty acid methyl esters).

Fatty acids	Natural milk	Artificial milk
C11:0	1.59	1.62
C12:0	11.02	9.75
C13:0	0.08	0.25
C14:0	8.28	6.38
C14:1	0.64	0.97
C15:0	0.54	0.67
C15:1	0.26	0.58
C16:0	25.31	21.97
C16:1	4.89	2.72
C17:0	0.59	0.12
C17:1	0.47	0.74
C18:0	2.94	11.84
C18:1 trans	0.05	0.36
C18:1 n − 9	27.12	33.49
C18:2 n − 6	15.24	7.27
C18:3 n − 3	0.44	0.48
C20:0	0.05	0.06
C20:3 n − 3	0.28	0.17
C20:3 n − 6	0.05	0.08
C20:5 n − 3	0.03	0.15
C21:0	0.05	0.14
C22:1	0.08	0.19
SFA[a]	50.45	52.8
MUFA[b]	33.51	39.05
PUFA[c]	16.04	8.15

[a] SFA: saturated fatty acids.
[b] MUFA: monounsaturated fatty acids.
[c] PUFA: polyunsaturated fatty acids.