Italian Journal of Animal Science

ISSN: (Print) 1828-051X (Online) Journal homepage: https://www.tandfonline.com/loi/tjas20

Llama Meat Nutritional Properties

P. Polidori, C. Renieri, M. Antonini & G. Lebboroni

Llama Meat Nutritional Properties

P. Polidori[1], C. Renieri[1], M. Antonini[2], G. Lebboroni[1]

[1] Dipartimento di Scienze Ambientali. Università di Camerino.
Via Circonvallazione 93, 62024 Matelica (MC), Italy
[2] ENEA Centro Ricerche Casaccia. Via Anguillarese 301, 00060 S. Maria di Galeria (Roma), Italy.

Corresponding author: Paolo Polidori. Dipartimento di Scienze Ambientali. sezione di Produzioni Animali, Università degli Studi di Camerino, Via Circonvallazione 93, 62024 Matelica (MC), Italy - Tel. +39 0737 403426 - Fax: +39 0737 403402 - Email: paolo.polidori@unicam.it

ABSTRACT: The aim of this study was to determine the chemical composition of the muscle *Longissimus thoracis* taken from 20 llama males, reared in the Andean region, slaughtered at an age of 25 months and at a mean final body weight of 74kg. Llama meat showed a low fat (3.51%) and cholesterol content (58.16mg/100g), a good protein content (22.42%) and an ash content of 3.06%. The Warner-Bratzler shear force values determined in llama meat was 6.56 kg/cm^2. This study confirmed that llama meat is healthy and nutritious, and represents a good source of proteins for Andean population.

Key words: Llama, Meat Quality, Chemical Composition, Nutritional Properties.

INTRODUCTION – Among the species of camelids raised in south America, guanaco (*Lama guanicoe*) and vicu?a (*Vicugna vicugna*) are wild, while llama (*Lama glama*) and alpaca (*Lama pacos*) are domesticated (Pérez *et al.,* 2000); all of them are best known for the fiber they produce. Camelids, including llama, are not true ruminants even though they have a rumen; they have three instead of four stomach compartments, the omasum being continuos with the abomasum (Polidori *et al*., 2007). Llamas are raised for wool, meat and hides, and sometimes used for carrying loads. Recently, the nutritional relevance of llama meat has increased, because this kind of meat is an important source of protein for the Andean population (Cristofanelli *et al*., 2005). The aim of this study was to evaluate the chemical composition and the nutritional characteristics of llama meat reared in the Andean highlands.

MATERIAL AND METHODS – The study involved 20 llama males, raised in the experimental station of Arequipa, in Peru, at 4650m above sea level in the district of Toccra. Animals were reared in extensive conditions on natural pastures characterized by grassland varieties typical of the Andean highlands. The animals were transported to a local commercial beef slaughter house at 25 months of age, with a mean final body weight of 74kg and slaughtered using the same methodologies applied in south America for beef cattle. All carcasses were cooled (1°C) for 24h, then were halved with a band saw. Samples weighing approximately 350g were removed from muscle *Longissimus thoracis* at the 8th rib; chemical composition and cholesterol content of muscle *Longissimus thoracis* were determined using the methods described by Babiker *et al*. (1990). Warner-Bratzler shear force values were determined two days after slaughtering on muscle samples cooked in a water bath at 70°C for 90 min. (Kadim *et al*., 2006).

RESULTS AND CONCLUSIONS – Chemical composition of muscle *Longissimimus thoracis* taken from llama carcasses is shown in Table 1. The most relevant data regarding meat nutritional characteristics is the low value of fat content, while protein content is very close to that one normally determined in other kind of red meats (Lawrie, 1985). Cholesterol content (58.16mg/100g) determined in llama meat samples is very similar to the values obtained in farmed red deer stags (Cristofanelli *et al*., 2004). The value of shear force determined in llama meat samples (6.56kg/cm^2) was very similar but lower to that one determined by Kadim *et al*. (2006) in the same muscle of Omani Arabian camels slaughtered at similar age. No other values of shear force have been previously obtained in meat taken from south american camelids, so it is impossible to make a comparison with the results of this study (Table 1). Llama meat nutritional properties obtained in this study show an interesting kind of alternative red meat; this meat represents an important food resource for people living in some south American countries (Neely *et al*., 2001), but can be considered very interesting also for people living in north America and/or Europe. In fact llama meat does appear to offer some advantages compared to other red meats because fat and cholesterol content are not high, as already stated by Coates and Ayerza (2004), especially if compared with other kind of meats. Production of llama meat, together with natural fiber production from these animals, represents a good strategy to increase the income of farmers in the Andean highlands. It will be very interesting to deepen in the future the knowledge about micro and macro elements contained in meat coming from south American camelids like llama, considering the accepted nutrient role of certain minerals, as indicated specifically for beef muscles by Barge *et al*. (2005). Llama meat is mainly produced in Argentina and Chile, while alpaca meat is mostly produced in Peru and Bolivia (Pèrez *et al*., 2000); the taste of the two different kind of meats is not the same, as indicated for alpaca and llama cooked meat by Neely *et al*. (2001) using an electronic nose technology. These authors concluded their study affirming that human sensory panels are still be required to define the desired product quality and also to calibrate the instrument. The results of this study confirm the need of more extensive studies to fully characterise llama meat and to deepen the knowledge on this kind of meat that has been theorised as providing health benefits (Polidori *et al*., 2007).

Table 1. Chemical composition of *Longissimus thoracis* muscle (mean±s.e.).

	Llama (n=20)	Minimum	Maximum
Moisture (%)	71.00±1.87	67.81	79.32
Fat (%)	3.51±0.01	0.89	5.76
Protein (%)	22.42±1.21	17.83	25.86
Ash (%)	3.06±0.77	1.79	4.19
Cholesterol (mg/100 g)	58.16±3.44	46.19	68.22
Shear Force Value (kg/cm2)	6.56±0.73	4.11	8.98

Table 2. Comparison of chemical composition of *Longissimus thoracis* muscle in llama, pork and beef.

	Llama	Pork[1]	Beef[1]
Moisture (%)	71.0	70.7	72.2
Fat (%)	3.51	7.1	7.8
Protein (%)	22.4	20.7	18.6
Cholesterol (mg/100 g)	58.1	74	69

Source 1: Balasini, 2000.

The research was supported by DECAMA Project, funded by European Union.

REFERENCES – **Babiker**, S. A., El Khidir, I. A., Shafie, S. A., 1990. Chemical composition and quality attributes of goat meat and lamb. Meat Sci. 28:273-277. **Balasini**, D., 2001. Zootecnica applicata – Bovini e Bufali. Calderini Edagricole, Bologna, Italy. **Barge**, M.G., Piccone, G., Barge, P., Cignetti, A., 2005. Preliminary results on mineral content of some beef muscles. Ital. J. Anim. Sci. 4(Suppl. 2):272-274. **Coates**, W., Ayerza, R., 2004. Fatty acid composition of llama muscle and internal fat in two Argentinian herds. Small Rum. Res. 52:231-238. **Cristofanelli**, S., Antonini, M., Torres, D., Polidori, P., Renieri, C., 2004. Meat and carcass quality from Peruvian llama (*Lama glama*) and alpaca (*Lama pacos*). Meat Sci. 66:589-593. **Cristofanelli**, S., Antonini, M., Torres, D., Polidori, P., Renieri, C., 2005. Carcass characteristics of peruvian llama (*Lama glama*) and alpaca (*Lama pacos*) reared in the Andean highlands. Small Rum. Res. 58:219-222. **Kadim**, I. T., Mahgoub, O., Al-Marzooqi, W., Al-Zadjali, S., Annamalai, K., Mansour, M.H., 2006. Effects of age on composition and quality of muscle *Longissimus thoracis* of the Omani Arabian camel (*Camelus dromedaries*). Meat Sci. 73:619-625. **Lawrie**, R. A., 1985. Meat Science, Oxford, GB. **Neely**, K., Taylor, C., Prosser, O., Hamlyn, P. F., 2001. Assessment of cooked alpaca and llama meats from the statistical analysis of data collected using an “electronic nose”. Meat Sci. 58:53-58. **Pérez**, P., Maino, M., Guzmán, R., Vaquero, A., Köbrich, C., Pokniak, J., 2000. Carcass characteristics of llamas (*Lama glama*) reared in central Chile. Small Rum. Res. 37:93-97. **Polidori**, P., Renieri, C., Antonini, M., Passamonti, P., Pucciarelli, F., 2007. Meat fatty acid composition of llama (*Lama glama*) reared in the Andean highlands.Meat Sci. 75:366-368.