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FULL LENGTH ARTICLE

Effect of gender on quality and nutritive value of dromedary camel (*Camelus dromedarius*) *Longissimus lumborum* muscle

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Abstract This study aimed to determine the effect of gender of dromedary camel *longissimus lumborum* (contents of collagen, amino acids and fatty acids). Fourteen *Longissimus lumborum* (LL) muscles (7 males and 7 females) were collected from 2 to 3 year-old. Animals were fattened by herders and slaughtered following commercial slaughterhouse procedures in Sudan. Samples were collected between the 1st and 5th lumbar vertebrae of the right carcass side. There was no gender difference in intramuscular fat content, insoluble OH proline as well as total OH proline (μg/DM). No significant differences were found among amino acids composition between genders. However, muscles from female camels had significantly ($P < 0.05$) higher arginine (1460 mg/100 g) than males (1460 mg/100 g). The results showed no significant differences between genders for total saturated fatty acid (SFA), mono-unsaturated fatty acid (MUFA) and polyunsaturated fatty acid (PUFA) proportions in camel meat. Significant differences were revealed for some specific MUFA and PUFA (18:1 delta 10–11 *trans*, ×1.51, ($P = 0.05$), CLA (*trans*11, *cis* 9 18:2, ×1.33% ($P = 0.11$) and *trans*10, *cis* 12 18:2, ×5.7, ($P = 0.03$) in females muscles. PUFA/SFA ratio was found closer to the recommended value for human nutrition (0.45). Also the n-6/n-3 ratio was

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lower than the recommended values for healthy human diets (4.0). All together, these results indicated high nutritive value of dromedary camel meat compared to meat from other farm animals.

1. Introduction

Sudan ranks the second in the world after Somalia with 4.787 million heads of camels and camel meat production of 140,000 tons FAOSTAT (2013). The role of camel as food source is being accepted and camel scientists noted that the camel has an unfathomed potential for satisfying the dietary and medical needs of humans (Faye and Esenov, 2005). The local consumption of camel meat had increased especially from young camels due to their nutritional value (Kadim et al., 2008). The demand for camel meat appears to increase for health reasons, as camels produce meat with relatively less fat than cattle and sheep (El-Faer et al., 1991; Dawood and Alkanhal, 1995 and Kadim et al., 2008). Camel has a good meat potentials in arid tropics and developing countries and beneficial for heat patients due to low fat content (Mahmud et al., 2011). In some areas, camel meat is also used as a cure for diseases such as hyperacidity, hypertension, pneumonia and respiratory disease (Kurtu, 2004). The mature, fattened one-hump camel dresses out at 55.8% of live body weight (456 kg) and 63.6% of empty body weight yielding 56% meat, 19% bone and 13.7% fat (Yousif and Babiker, 1989). The nutritive value of camel meat could be similar or sometimes superior compared to meats from other animals as indicated previously in the literature. Camel meat has been compared with meat from other farm animals (beef, lamb, goat and chicken) and found to have more moisture, less fat, less ash and similar protein contents (Elgasim and Alkanhal, 1992; Dawood and Alkanhal, 1995 and Kadim et al., 2008). The ratio of indispensable to dispensable amino acids in camels was 0.85, very similar to 0.86 reported for cattle, 0.83 for lamb and 0.90 for goat (Elgasim and Alkanhal, 1992 and Dawood and Alkanhal, 1995). Its muscle content of insoluble and total collagen hydroxyproline (OH-proline) was 28.7 and 46.11 μg/g fresh muscle reported respectively in Arabian camels (Siddiqi et al., 2000). On the other hand, fat is a vital nutrient with many functions in the human body (e.g. energy provider, carrier of fat-soluble vitamins, component of cell membranes, the basic substance of hormones, and second messengers) and also important for sensory characteristics of food (e.g. flavour and texture), however dietary fat intake is also associated with health problems (see e.g. McAfee et al., 2010 and Schmid, 2011). In addition, fatty acid composition plays an important role in meat quality. It is known that not only the amount but also the nature of the fatty acids (saturated *vs.* unsaturated fatty acids, n-6/n-3 ratio, etc) plays a major role in maintaining human health (Dilzer and Park, 2012). Fatty acid profile of camels was comparable to other camelids like llama (Rawdah et al., 1994 and Polidori et al., 2007). Feeding has been proved to lower the effect of rumen hydrogenation on fatty acids in beef and increasing favourable lipids in cattle meat (omega-3 acid, C18:3, the UFA C18:1, as well as the SFA's palmitic and stearic acid), recommending roughage and especially pasture feeding (Dimov et al., 2012a,b).

Concurrently with these facts, it is important to investigate the value of dromedary camel meat. Little information is available regarding meat chemical composition, collagen content, amino acids and fatty acids composition in both genders of the dromedary camel. The aim of the present study was to determine the effect of gender on the nutritive value of the one humped desert camel *longissimus lumborum* muscle.

2. Materials and methods

2.1. Animals and muscle samples

Fourteen, (2–3 year-old) dromedary camels (7 from each sex) were used. Animals were slaughtered in a commercial slaughter house in Omdurman province, Sudan as described previously by Yousif and Babiker (1989). Samples of *Longissimus lumborum* (LL) muscle were removed from the right carcass side between the 1st and 5th lumbar vertebrates, and then transported to meat science lab, Faculty of Animal production University of Khartoum, Sudan in an insulated box filled with ice 60 min post slaughter. Connective tissues and visible fat were removed from each muscle sample, placed in plastic bags and kept for 24 h at 2–3 °C. Muscle colour co-ordinates (*L*, *a* and *b*) and muscle pH were determined using a Minolta CR100 chromameter (Minolta Co., Ltd., Japan) and portable pH meter (Hanna waterproof pH meter, Model H I 9025, Italy) with temperature adjusting probe inserted at the same depth each time into a fresh section of the muscle. Samples were then vacuumed and stored at −18 °C and transported to France in insulated box filled with dry ice. Chemical composition was determined at CIRAD-Baillarguet, Montpellier, France after grinding of muscle samples to a homogeneous mass and then dried over night at 80 °C according to the standard methods of AOAC (2000). The following chemical analyses were achieved at INRA-Theix, France.

2.2. Muscle collagen content

One to two hundred g of LL muscle was chopped into cubes (2–3 cm), vacuumed and stored at −20 °C until the subsequent collagen analysis. Approximately 100 g of the frozen samples was homogenized using household cutter; freeze-dried for 48 h then ground using coffee grinder to produce a fine powder and stored at 4 °C in plastic bottles sealed with parafilm. The stored samples were solubilized following the procedure of Hill (1966) and Listrat et al. (2001). Freeze-dried samples was rehydrated for 1 h in 15 ml of buffer (0.23 M NaCl, 25 mM Tris–HCl, pH 7.4) and heated in water bath at 75 °C for further 1 h, and then centrifuged for 15 min at 4000*g* at room temperature. The supernatant which represents the soluble collagen discarded and the pellet (insoluble collagen) was dried in oven for 1 h at 45 °C to eliminate the supernatant. Ten millilitres of 6 N HCl was added to the dried pellets (insoluble collagen)

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