

Comparison of fatty acid profile of *longissimus dorsi* muscle in indigenous Lori cattle reared under rural and semi-industrial production system

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Abstract

In this study, the effects of production system and slaughter season on ratio of ω -6: ω -3 fatty acids (FA) and ratio of poly-unsaturated FA to saturated FA (P:S) of meat in indigenous Lori cattle were investigated. In total, 20 Lori bulls (12-15 month) were fed either with 100% forage based diet (rural) or with 60% forage and 40% concentrate (semi-industrial) were slaughtered either during spring or during fall season. Meat samples (100 g) were dissected from *longissimus dorsi* muscle between rib12th and 13th and were homogenate either without fat (lean meat) or with subcutaneous fat (fat meat). Meat fat was extracted and methylated in one-step method and FA profile was determined.

Spring meat compared to fall meat had higher oleic acid (8.1 vs. 5.9%) and less linoleic acid (33.4 vs. 37.8%). Neither production system nor slaughter season showed any significant effects on P:S ratio. Lean meat had higher P:S ratio than fat meat (0.4 vs. 0.1). Ratio of ω -6: ω -3 in lean meat was lower than that in fat meat (6.2 vs. 7.9). Rural meat had lower ratio of ω -6: ω -3 than semi-industrial (5.2 vs. 8.9). In conclusion, lean meat of Lori cattle had healthy P:S ratio (0.4). Rural meat had lower ratio of ω -6: ω -3 than semi-industrial meat presumably due to higher forage intake in rural production system. Thus Lori beef meat produced in rural system proposes healthier meat for consumers in respect to ω -6: ω -3 ratio.

Keywords: beef, Indigenous Lori cattle, polyunsaturated fatty acids, production system,

Introduction

Red meat is a component of a healthy diet with good balance of essential amino acid and important micronutrient (Biesalski 2005; Williams 2007). Red meat is known as source of bioavailable iron and zinc and also contains

magnesium, copper, cobalt, phosphorus, chromium, nickel and most importantly selenium. Red meat provides thiamin, riboflavin, pantothenic acid, folate, niacin, B₆ and B₁₂ (Williams 2007). However, red meat is blamed for its link with cardiovascular and other chronic diseases mainly because of its high saturated fatty acids (SFA) and low polyunsaturated fatty acids (PUFA) content (McAfee et al 2010). Fatty acid profiles of ruminants products (meat and milk) generally originates from ingested feedstuff. Ruminant diet has usually less than 5% fat per dry matter and α -linolenic acid (C18:3) and linoleic acid (18:2) are the two abundant fatty acids in ruminant feedstuff. However, ruminant products (meat and milk) have high percentage of SFA but low percentage of PUFA due to ruminal biohydrogenation of fatty acids (Jenkins et al 2008). Thus, it is not surprising that the ratio of PUFA to SFA (P:S ratio) in red meat is far from recommended ratio (i.e., >0.4).

Red meat is also source of two important groups of long chain fatty acids in healthy diet; ω -3 and ω -6 fatty acids (Williams 2007). The known ω -3 family are α -Linoleic acid (ALA, C18:3), eicosapentaenoic acid (EPA, C20:5), docosapentaenoic acid (DPA, C22:5) and docosahexaenoic acid (DHA, C22:6). Linoleic acid (LA, C18:2), gamma-linolenic acid (GLA, C20:3) and arachidonic acid (AA, C20:4) are the main members of ω -6 family. Red meat is the main dietary source of DPA because DPA accumulate in mammals but not in sea animals (Givens et al 2006). Both ω -3 and ω -6 fatty acids are imperative for human nutrition and are critical for body functions (Di Pasquale 2009). The low amount of ω -3 family and extra amount of ω -6 family in most of the foods lead to an unbalanced ratio of omega-6 to omega-3 (ω -6: ω -3 ratio). This ratio in the most of industrial and conventional animal products (meat and milk) has been reported to be 15:1 to 20:1, whereas the recommended ratio of ω -6: ω -3 ratio is 2:1 to 4:1 (Simopoulos 2002). A large number of studies has shown direct links between unbalanced ω -6: ω -3 ratio and many human chronic diseases (Simopoulos 2008). Therefore there is an urgent need to modify or to propose alternative sources of meat with healthier ω -6: ω -3 ratio (Kouba and Mourot 2011).

Beef meat in many countries (including Iran) is produced either in rural or semi-industrial production system. Basically, animals in these two production systems are indigenous or cross breeds which fatty acid profile of their product are not yet fully determined. In semi-industrial production system animals are usually fed by 40% concentrate and 60% forages. The forage part of the ration during spring contains green forages whereas agricultural by products (such as different kinds of straw) are main fibrous part of the diet during summer and early autumn. Similarly, cattle in rural production system are fed by green forages and grazed in natural ranges during spring but they are fed agricultural by products during summer and autumn. Therefore, the nutritional background of cattle that are sacrificed at two seasons are different though the proportion of forage in daily ration is similar. The differences in animal nutrition in semi-industrial and rural system at different sacrifice seasons might affect the fatty acid profile of the meat. On the other hand, red meat is consumed either as lean meat (with low fat) or as minced meat (with high fat content) which the differences in their fatty acid are not clearly know. Therefore, in the present study fatty acid profile of red meat of indigenous