



Damascus kids' slaughter, carcass and meat quality traits in different production systems using antioxidant supplementation



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ABSTRACT

This study intended to investigate slaughter, carcass and meat quality characteristics of Damascus male kids reared under different production systems and antioxidant effect (Vit E). The kids, housed in pen groups and grazing groups, were equally divided for production systems and later each group was again equally divided for determination of Vit E effect. Production systems and Vit E were found to have no significant effect on slaughter and carcass traits. Differences between production systems were found significant for meat pH_{2,4}, water holding capacity, cooking loss, tenderness, ether-extractable lipid and some color characteristics and concentrate feed supplemented with Vit E was effective on TBARS values. Each of the fatty acids except C18:2 n6 was affected by the production system but Vit E influence was superior on long-chain fatty acids. Grazing kids had a lower percentage of total SFA, n6, n6/n3, AI and TI ratio, while kids housed in pens had the lowest percentage of total UFA, NV and n3 ratio. On the other hand, kids that consumed supplemental Vit E had a higher percentage of total UFA, ratio of UFA/SFA, n3 and lower percentage of SFA, ratio of n6/n3, AI, TI compared to the kids fed by non-supplemental concentrate feed with Vit E. In accordance with the meat fatty acid composition, meat obtained from the kids that grazed and consumed supplemental Vit E was healthier than that of those housed in pen kids and non-supplemental Vit E consumed kids.

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1. Introduction

Goats are raised for their milk, meat and mohair and in general, they are important protein sources of animal origin for indigent people especially in developing countries (Ekiz et al., 2010; Zervas and Tsiplakou, 2011). Traditionally, goat feeding includes grazing which increases the usefulness of farmland that is otherwise unsuitable for cultivation or semi-arid regions. Goat feeding is based on pasture grazing though production systems range from highly extensive to very intensive, based on natural grazing and supplementary feeding (Zervas and Tsiplakou, 2011). In the East Mediterranean region of Turkey, fattening of kids is usually performed either under intensive conditions or in semi-intensive systems.

Public subsidies and benefits focus on small ruminants that graze on pasture. The number of grazing goat holdings has decreased slightly in most European countries. Difficulty of finding shepherds, difficulties related to grazing, decreases in grazing areas, raises in land prices, use of more productive breeds that are less adapted to grazing, lack of recognition for the quality of grazing products and low profit margin of farms are the main reasons for this decrease (Delgado-Pertinez et al., 2013). So, it is important that compared to pasture and pen based production systems.

According to Turkish Statistical Institute, total goat population in Turkey was 10.8 million head in 2004, composed mostly of hair goats (TUIK, 2014). However, in recent years, an increasing demand to dairy type goat breeds, especially Damascus and crossbreed of Damascus, by breeders is observed in the east Mediterranean region of Turkey, especially in the coast regions (Özsoy et al., 2013) due to better breeding and feeding conditions. Although there are reports about milk production and milk quality characteristics for Damascus in Turkey (Güler et al., 2007; Güney et al., 2006), there are no studies about slaughter, carcass, meat quality traits and antioxidant

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effect on meat. While Damascus kids weigh 3.2 kg at birth, adult weight is 55–65 kg and 70–90 kg in does and bucks, respectively (Güney et al., 2006).

Especially in developed countries where high incidence of cardiovascular diseases is observed, consumers demand high quality and convenient meat products with natural flavor and taste (Karami et al., 2011; Wood et al., 2008). Goat meat is leaner than lamb and beef since it incorporates less subcutaneous, intramuscular fat and more internal fat (Colomer-Rocher et al., 1987; Webb et al., 2005). Most researchers report that diet, production systems, age and breed influence the fatty acid profile and other quality parameters of meat such as color, water holding capacity (WHC), tenderness and antioxidant capacity (Dhanda et al., 2003b; Kannan et al., 2001; Karami et al., 2013; Yilmaz et al., 2009).

The dietary antioxidants can be delivered to the muscle where the immune system would counteract the action of pro-oxidant (Descalzo and Sancho, 2008). Vitamin E (Vit E) is the primary protective antioxidant (Leibovitz et al., 1990). While ruminant diets supplemented with Vit E, as antioxidant resource, have been studied as a means of improving meat oxidative stability (Aksu et al., 2004; Karami et al., 2011; Macit et al., 2003a,b), the reports about antioxidant effect of Vit E on meat quality parameters (pH, WHC, tenderness, chemical composition of meat, color, fatty acid composition etc.) in goats are rather limited. It is known that degradation of unsaturated fatty acids (UFA) decrease due to Vit E. For this reason, UFA levels are protected in rumen (Clarke and Armitage, 2002; Leibovitz et al., 1990). This protection is provided by block of UFA in cellular and sub cellular membrane phospholipids peroxidation (Murray et al., 2004). For this reason, involvement in metabolism of Vit E via diet may provide protection of UFA within tissue structure. Thus, the long chain fatty acids in the diet will be indirectly protected from rumen bio-hydrogenation (Konyalıoğlu, 2001). On the other hand, the protective effect of Vit E in intracellular area may be continued during storage (ageing time) and due to meat processing technology (Karami et al., 2010b, 2011; Macit et al., 2003b) used in the process. Due to all these considerations, supplemental Vit E to diet may positively contribute to both better meat quality characters especially good fatty acid composition and limitation of malondialdehyde (MDA) level.

While one of objectives of this study was to investigate fattening performance, carcass and meat quality traits of Damascus kids under different production systems, the other objective was to investigate whether Vit E supplementation was effective in Damascus kids for improving meat quality traits in two different management systems.

1.1. Material and method

1.2. Animal welfare

Research protocol of the current study was approved by the Animal Ethic Committee of Mustafa Kemal University (Approval number: 2011-08/15-13).

1.3. Animals and experimental diet

The study was carried out at a private goat enterprise in East Mediterranean region of Turkey, located at 36°N and 39°E, at an altitude of 82 m above sea level. The kids were dewormed (Ivermectin + Clorsulon and Foksim) and vaccinated (enterotoxaemia, foot and mouth diseases, peste des pestis ruminants) during the quarantine period of 21 days and were adapted to the experimental diets and pens for 14 days. A total 48 weaned kids with age of 90 days, average initial body weight of 15 kg, male kids from Damascus breed randomly divided to four groups were used. Kids

were placed into four fattening pens (1 m² of floor space per kid) prepared for each group. The first two groups, pen control (PC) and pen + Vit E (P + VE), were housed all time in pens and they were named as pen groups (Production Systems I). While group PC was fed with commercial concentrate feed, group P + VE was fed by adding 450 mg/kg of Vit E to concentrate feed. Kids in the pen group were fed ad libitum and given lentil hay 200 g per animal/day. The following two groups, grazing control (GC) and grazing + Vit E (G + VE), went to pasture for grazing two times (during morning between 06:00–10:00; in the afternoon between 15:00–19:00) each day and were housed in pens all day except pasture times and they were named as grazing groups (Production Systems II). The artificial pasture with 0,46 decare corn planted per kid was 1 km away from the pens. Grazing groups were fed with measured concentrate feed: 700 g per animal/day and did not consume roughage in pen. Similarly to pen groups, while group GC was fed with commercial concentrate feed, group P + VE was fed by adding 450 mg/kg of Vit E to concentrate feed. Vit E added to concentrate feed was processed at manufacturing stage. Composition, nutrient content and fatty acid composition of the concentrate feed are shown in Table 1. Table 2 displays the group design of the study.

1.4. Slaughter procedure and carcass characteristics

The kids selected for slaughter were weighed after fasting for 12 h with free access to water. The kids were transported to experimental slaughter unit, at approximately 25 km away from fattening pens, with lorry according to animal welfare and ethics rules and animals were rested two hours until slaughter time. Then, kids were again weighed and their slaughter weights were recorded. Six kids from each group were slaughtered using standard commercial procedures. Hot carcass weight of each kid was recorded after the removal of non-carcass components (head, skin, feet, lungs, trachea, heart, liver, spleen, gastro-intestinal tracts and testicles). Dressing percentage was calculated by dividing hot carcass weight to slaughter weight. Then, the carcasses were chilled at 4 °C for 24 h and cold dressing percentages were calculated by dividing cold carcass weight to slaughter weight. Some carcass measurements such as carcass length (from the caudal edge of the last sacral vertebra to the dorso-cranial edge of the atlas), internal carcass length (length from the cranial edge of symphysis pubis to the cranial edge of the first rib), leg length (length from the symphysis pubis to the tarsal-metatarsal joint), chest circumference (circumference measurement of chest at the widest rib area), chest width (widest chest measurement between left and right side at the rib area), chest depth (maximum distance between the sternum and the back of carcass at the sixth thoracic vertebrae) were measured. Leg compactness (leg weight/leg length; kg/m) and carcass compactness (cold carcass weight/carcass length; kg/m) indexes were calculated (Ekiz et al., 2010; Santos et al., 2007).

Kidneys and perinephric–pelvic fat were separated and weighted before they were calculated together. Cold carcasses were cut according to the procedure reported by Colomer-Rocher et al. (1987). The carcasses were symmetrically halved and the left side was cut between 13th thoracic and first lumbar vertebrae. Fat depth and muscle area were measured at this level. While *M. longissimus dorsi* (MLD) area was drawn on parchment and measured with the help of planimeter, back fat thickness was quantified with a calliper. The left side carcasses were then cut into primal cuts, namely: leg, foreleg, neck, back + loin and breast + flank. This part of carcass was used to determine tissue composition and was dissected into muscle, fat and bone according to the procedures of Fisher and De Boer (1994).

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