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Application of Ultrasound in Lamb Meat Production

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Keywords

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Abstract

Lamb meat production is perceived as a more important source of income than wool and milk production from sheep. Although the lamb meat is a valuable food source, the idea that it is too fatty by consumers makes it difficult to compete with other meat products. Lamb meat producers are directed to produce low fat and fleshy lamb carcasses by consumers. The purpose of this survey is to provide information on using of ultrasound technology in lamb meat production.

Introduction

The lamb meat is preferred as the source of red meat in the most of the regions of Turkey (Yilmaz et al.,2016). Although lamb meat is an important source of nutrient, it is thought to be too fatty by consumers and its consumption decreases in many countries.

To prevent this situation, lambs are forwarded to slaughter at early age in order to obtain low fat carcass. Such technics result in a reduction in carcass yield and income per lamb. Fatty carcasses cause economic loss, lead to unnecessary labor and feed consumption. Improving the quality of carcass is important for supplying the consumers' demands for lean lamb meat and expectations of regarding health and flavor (Ceyhan A., 2013). Due to these reasons, various breeding programs are carried out to increase the carcass quality.

To assess carcass quality, techniques such as X-ray tomography, nuclear magnetic resonance, ultrasound and bioelectrical impedance methods are used (Stanford et al.,1998). It has been reported that carcass yield characteristics can be determined quickly and economically without any damage on live animals via ultrasound device (Stanford et al., 2001).

Ultrasound Technology

Ultrasound is defined as sound frequency over 20 Hertz (kHz). Medical ultrasound devices use sound waves in ranging between 1-20 megahertz (MHz). The piezoelectric (pressure-electric) effect is utilized to get such high frequency sound.

Ultrasound probes contain multiple piezoelectric crystals like quartz which are interconnected electronically and vibrate in response to an applied electric current. The crystal expand and collapse when applied Electrical energy and sound waves are generated as a result of vibrations. As the sound waves pass through the tissues, some of them are reflected and generate vibrations in the crystals. As a result of the vibration, the crystals convert the sound waves into electrical signals. The ultrasound device regulate the electrical signals and transmit them toward the monitor to produce the tissue images (Chan and Perlas, 2011).

Ultrasound technology has been reported to be an important device for the selection of breeding based on ultrasound measurement data obtained from live animals for selection in genetic progression programs or for determining the marketing period in terms of fat and muscle composition in carcasses (Fernandez et al.,1997; Cemalet al.,2004, 2007 and Vardanjaniet al.,2014).

Carcass measurement via ultrasound

Different researchers (Teixeira et al., 2006; Ripoll et al., 2009; Orman et al., 2010 and Vardanjani et al., 2014) reported that the correlation between ultrasound measurements of live animals and carcass measurements was important. Fernandez et al., (1997) determined high level correlations between ultrasound measurements from the midst of the 12th and 13th ribs in ribeye muscle area (Musculus longissimus dorsi) and real measurements after slaughtering in Manchego, Merino and Ile de France X Merino cross-breed lambs. The correlations for ribeye muscle area, depth and backfat thickness were 0.88, 0.56 and 0.74 respectively. The same researchers indicated that the use of ultrasound on the live animal was done after the wool was removed from the measurement areas by shearing. This process was realized to improve image retrieval. Then the ultrasound probe (transducer) were placed between 12th-13th ribs lateral to the vertebral column and parallel to the rib following physical palpation and preparation. After obtaining ultrasound images all measurements were done. Ultrasound imaging of the ribeye muscle between 12th and 13th ribs and ultrasound application on live animal are presented in Figure 1.

Karaca et al., (2012) reported that ribeye muscle measurements were generally performed between 12th and 13th ribs and that the thickness of the fat on this muscle gave information about the total amount of fat in the carcass and the measurements that made in this area were accepted internationally. Karakas and Ile de France X Akkaraman (BC 1) X Karakas (F1) cross-breed male lambs were divided into two different slaughter age (22 weeks and 27 weeks)by Gokdal et al., (2004). In the Karakas and young age groups some correlations were determined between the depth of the ultrasonic eye muscle and the actual depth of eye muscle obtained from the carcasses. They were notified as 0.38 and 0.59 respectively. Ormanet al.,(2010) reported that correlation between ultrasound measurements of backfat thickness, eye muscle depth and eye muscle area and the actual measurements obtain from the carcasses were 0.93, 0.64 and 0.88 respectively in 30 kg female Ivesi lambs and the correlations between same traits of 40 kg female lambs were 0.76, 0.77 and 0.84 respectively. The same researchers found that the correlations between same traits of 40 kg male lambs were 0.84, 0.69 and 0.88 respectively. Vardanjani et al., (2014) studied on the Torki - Ghashghaii lambs and found that the male lambs correlation between ultrasound measurement of backfat thickness, eye muscle depth, eye muscle width and eye muscle area and the carcass measurements were important and were 0.70, 0.54, 0.77 and 0.80 respectively.

Figure 1. Ultrasound images at 12-13th thoracic vertebra (left) and use of ultrasound on the live animal (right). This images were quoted from the application phase of H. AVCI's thesis study.

Use of ultrasound measurements in genetic progress programs

It has been reported by Wilson D. E., (1992) that ultrasound technology can be used in genetic progress programs for animal husbandry. Many researchers use the ultrasound technology in genetic improvement programs to get the fat and muscle tissue to the desired level. Simm et al., (2002) reported that ultrasound technology could be used to reduce fat levels in selection programs.

Simm et al., (2002) found that the difference between selection index which was applied in order to improve the production of low fat meat from Suffolk lambs and control group for live weight at 150 day old, backfat thickness, eye muscle depth were 4.88 kg; - 1.1 mm; + 2.8 mm respectively. Maxa et al., (2007) reported in their study that on average 100 day-old Suffolk lambs for live weight direct and maternal heritabilties were 0.17 and 0.08 for the eye muscle depth were 0.16 and 0.04 and for backfat thickness were 0.08 and 0.03 respectively. Conington et al., (2001) found on the Scottish black-faced in the average 17-week-old weaned lambs that the heritability of weaning weight, eye muscle depth and backfat thickness were 0.22, 0.30 and 0.25 respectively.

Conclusions

Accurate estimation of carcass composition in live animals is great importance in meeting the demand of consumers for low-fat lamb. In recent years, it has been seen that ultrasonic measurements obtained from live animals are safely used in selection programs in order to improve carcass quality for genetic progress and determination of marketing periods (Wilson D. E. 1992; Simm et al., 2002; Cemal et al., 2007 and Conington et al., 2001). It has been reported that ultrasound technology is included in the selection programs in order to obtain low fat and plenty of meat and positive results have been obtained in different regions of the World (Lewis et al., 1996; Simm et al., 2002 and Marquez et al., 2012). It would be important to put into practice of ultrasound technology in selection programs which will be applied in order to increase the carcass quality by creating suitable conditions for the lamb producing enterprises in developing countries.

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