

Comparison of Two Methods Using Measurement of the Surface Area of *M. Longissimus Dorsi* (MLD)*

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Summary: The purpose of study was to compare two different methods to measure the *M. longissimus dorsi* (MLD) surface area. For this aim, planimeter method and a new method with Autocad software programme were evaluated. MLD areas from 47 samples from Hemřin and Tuj breeds and 63 samples from Saanen, Honamlı and Hair breeds were used. In planimeter method, traced MLD area by hand to acetate paper transferred into squared centimetres. In the new procedure, the surface area of the MLD was traced onto acetate papers and then transferred to a computer by scanning. The AutoCAD software program was used to calculate the area of the MLD.

Statistically significant ($P < 0.001$) correlation coefficients between two methods were detected as 0.999 and 0.998 for Hemsin and Tuj lambs and 0.996, 0.988 and 0.994 for Saanen, Hair and Honamlı kids, respectively. Correlation coefficient of whole data was 0.995. In the study, there was also found that, time savings can be considered as a notable factor for Autocad method (134.45 second) than the planimeter metod (255.70 second) ($P < 0.001$).

According to findings, the Autocad method can be used as a time saving practical usage instead of planimeter method. Also, this technique can be combined with the some image capturing methods, to reach the reliable results in a short time.

Keywords: Autocad, *Musculus longissimus dorsi*, planimeter, surface measuring

M. Longissimus Dorsi (MLD) Kasının Kesit Alanının İki Farklı Yöntemle Ölçümünün Karşılaştırılması

Özet: Çalışma, *M. longissimus dorsi* (MLD) kesit alanının iki farklı yöntemle ölçümünün karşılaştırılması amacıyla yapılmıştır. Bu amaç için planimetre ve yeni bir teknik olarak Autocad yöntemleri kullanılmıştır. Çalışmada 47 baş Hemřin ve Tuj ırkı erkek kuzu ile toplam 63 baş Saanen, Honamlı ve Kıl keçisi erkek oğlak kullanılmıştır. Planimetre yönteminde, elle asetat kağıdına çizilen MLD alanları santimetre karelik kağıtlara aktarılmıştır. Yeni bir yöntem olarak sunulan metotta ise aydınır kağıdındaki çizimler bilgisayar ortamına aktarılmıştır. Sonrasında Autocad çizim programı kullanılarak MLD kesit alanı belirlenmiştir.

İki yöntem arasındaki fenotipik korelasyon istatistiksel açıdan önemli olup ($P < 0.001$), Hemřin ve Tuj kuzuları için sırasıyla 0.999 ve 0.998; Saanen, Kıl keçisi ve Honamlı keçisi oğlakları ise sırasıyla 0.996, 0.988 ve 0.994 olarak belirlenmiştir. Tüm veriler için ise korelasyon katsayısı 0.995 olarak hesaplanmıştır. Bunun yanı sıra çalışmada, Autocad ile yapılan ölçümlerde (134.45 saniye), planimetre ile yapılan ölçümlere (255.70 saniye) göre daha az zaman harcandığı belirlenmiştir ($P < 0.001$).

Çalışma bulgularına göre, Autocad yöntemi, zaman tasarrufu sağlaması açısından planimetre yöntemine göre daha pratik bir yöntem olarak kullanılabilir. Ayrıca, bu teknik kısa bir sürede güvenilir sonuçlara ulaşmak için bazı görüntü yakalama yöntemleriyle birleştirilebilir.

Anahtar kelimeler: Autocad, *Musculus longissimus dorsi*, planimetre, alan ölçme

Introduction

Foods of animal origin provide micro- and macro-nutrients required for the metabolism and contain also numerous functional compounds possessing positive impacts for health [4]. Meat features main

nutrient in human nutrition due to its characteristics such as being easy to produce among foods of animal origin, its taste, high biological value, substantiality, and its sufficient and balanced nutrients such as vitamin B complexes, various minerals, and es-

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sential amino acids [2, 8, 17]. When meat yields of livestock come into question, generally the amount of carcass obtained from animals is considered but the amount of edible meat in the carcasses comes in to prominence economically. At this point, surface area of the muscle of M. longissimus dorsi (MLD) is important in terms of providing information about the amount of edible meat and it's content in the carcass. There is a high correlation between the rate of meat and the rate of valuable meat in the carcass and surface area of MLD muscle found on the surface of cross section in 12-13th intercostal space where carcasses are divided into quarters. Meat rate in carcasses, which are slaughtered in the same live weight, may change according to MLD surface area [12]. Therefore, it is important to calculate MLD surface area rapidly by using reliable methods.

The study was conducted in order to measure cross sectional area of MLD by two different methods and to compare the obtained results.

Material and Method

In the study, 47 male lambs of Hemşin and Tuj breeds and 63 male kids of Saanen, Honamlı, and

Hair goat breeds which had been slaughtered within the scope of projects supported by national institutions were used. Area of *Musculus longissimus dorsi* (MLD) from cross section between 12-13th ribs on left half carcass of slaughtered lambs and kids was drawn on a tracing paper and then cross sectional area of MLD was calculated by two different methods. While the drawings on tracing paper were measured with the planimeter in the first method; the drawings on tracing paper were transferred to computer environment in the method represented as a new process in the study. Cross sectional area of MLD was then determined by using Autocad [1] drawing program.

In statistical comparison of the data, Minitab 16.1 statistical software [10] was used. An intense descriptive statistical analysis was first applied to the data. Therefore, correlation coefficients of the measurements were calculated and tabulated by using Pearson Correlation test. Average time savings for planimeter and Autocad method were detected using a digital stopwatch and also recording with a digital camera by same measurer.

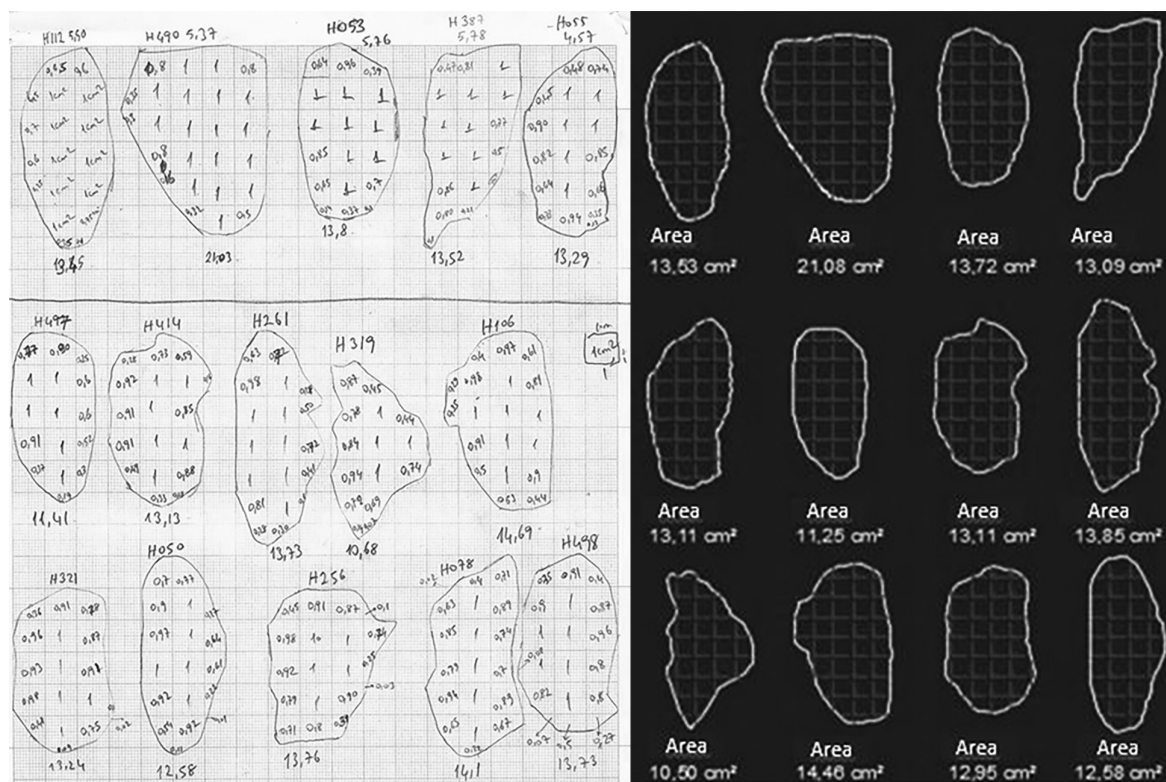


Figure 1. Planimeter method and Autocad method for detection of MLD surface area of lambs

Results

Table 1 shows MLD area and average measurement time values and also phenotypic correlations between cross sectional area values of MLD measured with planimeter and values measured with Autocad program for lambs and kids in the study. As the table is examined, positive strong correlations between planimeter and Autocad program for both methods were seen ($P < 0.001$). In the study, it was determined that while values of MLD area calculated with planimeter and Autocad program for Hemşin lambs were 13.60 cm² and 13.73 cm²; these values were 12.84 cm² and 12.99 cm² for Tuj lambs, respectively. Phenotypic correlation coefficients between two methods mentioned were also found as 0.999 and 0.998 for Hemşin and Tuj lambs, respectively. In the study, positive and statistically

significant correlations determined between planimeter and Autocad methods for kids of Saanen, Hair, and Honamlı goats were 0.996, 0.988, and 0.994, respectively; higher values were found in kids of Honamlı goat in terms of MLD areas [11.26 cm² and 11.44 cm²). Correlation coefficient is also found as 0.995 for whole data in the study.

In the study, average time savings for two methods were also presented in Table 1. According to this, while time spends for both planimeter and Autocad method were 134.45 seconds and 255.70 seconds, as seen, lower values (nearly one-half) were detected for each sample for Autocad method than planimeter method and also significant differences were also found for average measurement times ($P < 0.001$).

Table 1. Comparison of planimeter and Autocad method ($\bar{X} \pm S_x$)

	Lambs			Kids		Lambs and Kids
	Hemşin	Tuj	Saanen	Hair	Honamlı	Overall
Number of animal	24	23	15	22	26	110
MLD area (cm ²)						
- Planimeter	13.605±0.750	12.844±0.432	9.210±0.415	9.453±0.42	11.267±0.755	11.436±0.620
- Autocad	13.735±0.755	12.996±0.435	9.225±0.428	9.549±0.460	11.445±0.733	11.671±0.682
CC for MLD area	0.999***	0.998***	0.996***	0.988***	0.994***	
CC for MLD area (overall)	0.998***			0.993***		0.995***
Average measurement time (second)	***	***	***	***	***	***
- Planimeter	268.06±1.02	257.21±1.20	247.02±1.13	245.38±1.36	262.21±1.42	255.70±1.39
- Autocad	148.04±0.48	139.16±0.42	122.13±0.44	125.20±0.50	137.04±0.29	134.45±0.41

***: $P < 0.001$; All the determined correlations and time saving between two method were statistically significant ($P < 0.001$) CC: Coefficient of correlation

Discussion and Conclusion

Implementation of new technique in the livestock sector is very important to entegrate daily technical development. Currently, livestock industry is one of the fastest growing sector in developing countries. This growth is driven by the rapidly increasing demand for livestock products [5, 16].

Today's livestock farming has notably visible examples in terms of adapting technologies, produced for different fields, into the sector. Increasing the number of these samples will contribute to further involvement of technology into the ap-

plication fields of husbandry and consequently to development of the ways to obtain data safer and more rapid. In agreement these purposes, computer programs with digitizing video images are currently employed in biological research for a lots of purposes. Such programs include features allowing automated measurements to reduce errors and differences conferred by operators [6, 19].

While it is possible predict MLD area *in vivo* using ultrasound and computer tomography; carcass traits are determined in the cross-section of the *longissimus* muscle obtained between the 12th and 13th thoracic vertebra in most cases. The main difficulty

in implementing planimeter method is the need for good fixation of the figure on the desktop, because if it moves, it is necessary to restart the measurement procedure [7]. There were various reports related to computer technology and magnetic resonance imaging, one of the technical measurements with the comparison of conventional measurements of MLD [3, 15, 18] In the other hand, the correlation coefficients (r) were reported as 0.50-0.70 between ultrasonic and actual measurements (planimeter) [11, 13, 14].

Similarly the current study, Karolyi et al [9] reported that it was possible to use image tool software showing greater precision in measuring MLD area than standard planimeter method. In addition to this, Ferreira et al [7] reported higher correlation coefficient (0.97) for MLD area values determined by the digital and the planimeter methods ($P < 0.001$). In the same research, the digital method overestimated MLD area in relation to that obtained by the planimeter method in accordance with the current study.

There are limited scientific researches related to specific methods to evaluate goat carcass. Consequently, researchers have been obliged to adapt bovine or ovine methodologies [19]. In this study, it was also aimed to take carcass measurements by using a program which has found an application field in drawing and architecture lambs and also kids.

In conclusion, using accurate and objective methods for determining carcass traits is so important in terms of obtaining facility for effort and time savings. The Autocad method can be used as a time saving practical way instead of planimeter method and also this method may be a more appropriate alternative to implement a rapid quality control system of MLD area. This method should be applied the samples from directly obtained from carcass measurements. Also, this technique can be combined with the some image capturing methods, to reach the reliable results in a short time.

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