POLISH JOURNAL OF NATURAL SCIENCES
Abbrev.: Pol. J. Natur. Sc., Vol 24(2): 113–121, Y. 2009

DOI 10.2478/v10020-009-0011-0

FAT THICKNESS AND THE LONGEST BACK MUSCLE MEASUREMENT OF CARCASSES OF FATTENERS SLAUGHTERED AT DIFFERENT WEIGHT

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Key words: fatteners, fat thickness, the longest back muscle measurements, different carcass weight.

Abstract

The research was conducted on 286 fattener carcasses chosen from mass population in three different regions of the country. On the carcasses, fat thickness measurements were performed on the carcass cross section as well as fat and the longest back muscle thickness measurements on two cross sections of the loin. Carcasses, depending on their weight, were divided into three groups, i.e. of the average weight of about 70, 80 and 90 kg. Research showed that the increase of carcass weight by about 10 kg in the case of fatteners bought by meat plants caused statistically significant increase of fat thickness and measurement results of the longest back muscle in all measured points. The increase of carcass weight from 70.0 to 80.0 kg caused relatively small increase of fat thickness (about 2 mm), and higher increase of the longest back muscle height (about 5mm), however the increase of carcass weight from 80.0 to 90.0 kg, influenced greater increase of fat thickness (about 5 mm), and smaller increase of the longest back muscle (about 2 mm). In the classification system, where one takes into account fat thickness and the longest back muscle height when estimating the meat percentage, we may expect small decrease of carcass meatiness at carcass weight increase to 85.0 kg, and having exceeded this weight, greater decrease of carcass meat percentage may be expected.

GRUBOŚĆ SŁONINY I POMIARY MIĘŚNIA NAJDŁUŻSZEGO GRZBIETU TUSZ TUCZNIKÓW PODDAWANYCH UBOJOWI PRZY RÓŻNEJ MASIE

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Słowa kluczowe: tuczniki, grubość słoniny, pomiary mięśnia najdłuższego grzbietu, różna masa tusz.

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Abstrakt

Badania przeprowadzono na 286 tuszach tuczników wybranych z pogłowia masowego w trzech różnych regionach kraju. Wykonano pomiary grubości słoniny na przepołowieniu tuszy oraz pomiary grubości słoniny i mięśnia najdłuższego grzbietu na dwóch przekrojach polędwicy. Tusze podzielono na trzy grupy, tj. o średniej masie ok. 70, 80 i 90 kg. Badania wykazały, że wzrost masy tusz (tuczników skupowanych przez zakłady mięsne) o ok. 10 kg, spowodował statystycznie istotny wzrost grubości słoniny i wartości pomiarów mięśnia najdłuższego grzbietu we wszystkich badanych punktach. Wzrost masy tusz od 70,0 do 80,0 kg powodował stosunkowo niewielki wzrost grubości słoniny (ok. 2 mm), a większy wzrost wysokości mięśnia najdłuższego grzbietu (ok. 5mm). Wzrost masy tusz od 80,0 do 90,0 kg wpłynął natomiast na większy wzrost grubości słoniny (ok. 5 mm), a mniejszy mięśnia najdłuższego grzbietu (ok. 2 mm). W systemie klasyfikacji, w którym w trakcie określania mięsności tusz bierze się pod uwagę grubość słoniny i wysokość mięśnia najdłuższego grzbietu, można się spodziewać niewielkiego obniżenia mięsności tusz, gdy wzrasta ich masa do 85,0 kg. Po jej przekroczeniu można spodziewać się większego obniżenia mięsności tusz.

Introduction

Optimum carcass weight at which fatteners should be slaughtered is in the centre of interest of pig suppliers as well as meat plants. It is a common knowledge that fatteners of lower weight use smaller amount of feed for 1 kg of gain and have lower slaughter yield factor and higher meat percentage, whereas from fattener carcasses of higher weight we obtain heavier muscles and their meat is more useful as for consumption and processing (BAROWICZ et al. 2006, BUCK 1963, KOĆWIN-PODSIADŁA et al. 2000, ŁYCZYŃSKI et al. 2006, WAJDA 1973, DASZKIEWICZ and WAJDA 2004, Włodawiec 2006). Mostly, these researches were conducted on the fatteners of the chosen breed or cross-bred pigs and they cannot be directly transposed onto mass population. That is why, performing the measurement on the representative sample of fatteners given for slaughter will make it possible to estimate correctly a pricelist of fattener carcass purchase and implementing proper system of rewarding producers for providing meat plants with fatteners of optimum carcass weight.

The objective of this thesis was to define the influence of different carcass weight (70, 80, 90 kg) on fat thickness and the longest back muscle measurements of the fatteners bought by meat plants.

Material and Methods

The research was conducted on 286 carcasses of fatteners which represented mass population of pigs bought in the country. That is why before the choice of carcasses for research was made, the analysis of fat variation level of 14 650 carcasses of fatteners bought by seven meat plants in the different

regions of the country was performed (BORZUTA et al. 2003, GRZEŚKOWIAK et al. 2002). The data gathered in that way enabled to point three ranges of fat cover thickness and was the basis to select such carcasses for the research, which would represent fattener population in the country (WINARSKI 2006). The selection of the carcasses for the research was based on the fat thickness, the equal number of gilt and barrow carcasses and correct division of carcasses into equal half-carcasses. Carcasses for the research originated from raw material background of three meat plants located in different regions of Poland, having different raw material background, i.e.: Ł-Meat in Łuków (93 carcasses), Morliny near Ostróda (62 carcasses), Prime Food in Przechlewo (131 carcasses).

Fattener slaughter was conducted in agreement with regulations of meat industry, and carcasses fulfilled the definition of pig carcass stated in EU regulations (*Council Regulation...* 1984). After about 45 minutes from beginning the bleeding, carcasses were weighed (up to 0,1 kg precision), and after chilling fattener carcasses in Meat Plant in Łuków and Przechlewo they were transported by car coolers to "Morliny" Meat Plant for dissection.

On the left half-carcasses, the following measurement were performed with caliper:

- Fat thickness on the back on the level of last rib,
- Fat thickness over head edge and the centre of *gluteus medius* muscle, i.e. in the so-called points of cross I and cross II.

Half-carcasses were divided into elements according to WALSTRA and MERKUS methodology (1996). After that, loin was cut behind last and between 3rd and 4th thoracic vertebrae, counting from the end of thoracic section of the spine. On obtained cross sections in two points (Figure1), i.e. in the distance of 6 and 7 cm from the division line of the carcass into half-carcasses (so-called points C6 and C7) fat thickness and the longest back muscle height (*m. longissimus dorsi*) was measured. Measurements of height and width of the longest back muscle were the basis to estimate the area of eye of the loin (KIELANOWSKI et al. 1955).

In order to define the influence of carcass weight on the analysed features, the gathered data was divided in the course of statistical calculations into three groups, i.e. carcasses of the weight 60.0 to 76.0 kg (98 carcasses), 76.1 to 85.0 kg (117 pieces.) and over 85.1 kg (71 pieces).

In the statistical calculations, arithmetic mean was taken into account as well as standard deviation for the analysed features, and the significance of statistical differences between the means from the groups with the help of Duncan test. In the statistical calculations, StatSoft STATISTICA software version 7.0 PL was used (ZIELIŃSKI 1999).

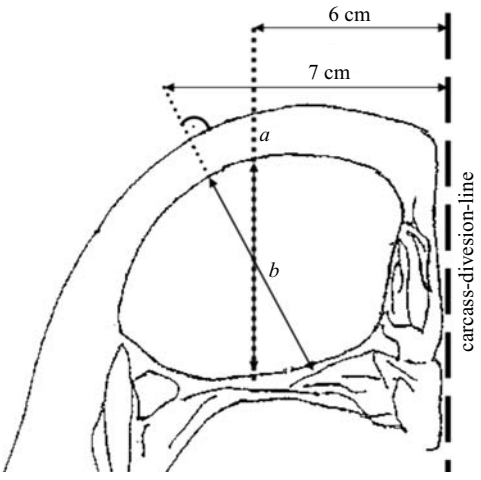

Fig. 1. *Longissimus dorsi* muscle measure points

Results and Discussion

In Poland, just as in most EU countries, classification system EUROP includes into fattener commodity group also gilt and barrow carcass weight of which amounts from 60.0 to 120.0 kg. The initial research (BORZUTA et al. 2003, GRZEŚKOWIAK et al. 2002) showed that the fatteners bought by meat plants usually had the weight between 60.0 to 100.0 kg. Having that on mind, in order to asses the influence of carcass weight on the values of the linear measurements, three ranges were acquired of average carcass weight, i.e. 70, 80 and 90 kg.

The average weight of analysed carcasses was near the assumed one and amounted to 69.80; 80.37 and 90.77 kg, and the difference between means in the analysed groups was about 10 kg (Table 1). The highest variability of carcass weight was found in the group of carcasses of the highest weight (90 kg) and it amounted to 4.75 kg, whereas the smallest variability appeared in the group of carcasses of the weight amounting to 80 kg (2.64 kg). The differences between the means for half-carcass weight were about 5 kg and similar tendency was found for this feature as for weight variability in the analysed groups. Average weight of fattener carcasses included in the own research amounted to 79.33 kg. and was near the average weight of carcasses of fatteners purchased in the country, given by LISIAK and BORZUTA (2003).

Table 1

Carcass weight (kg) and fat thickness measurements (mm)

Specification	Statistics	Carcass weight		
		60.0–76.0 $n=98$	76.1–85.0 $n=117$	85.1–120.0 $n=71$
Hot carcass weight	$\bar{x}$	69.80^A	80.37^B	90.77^C
	s	3.78	2.64	4.75
Half carcass weight	$\bar{x}$	34.12^A	39.25^B	44.30^C
	s	1.90	1.31	2.38
Fat thickness:				
on the back	$\bar{x}$	18.35^A	22.09^B	26.61^C
	s	4.78	5.46	7.00
over cross I	$\bar{x}$	23.15^A	24.45^B	31.82^C
	s	5.47	6.16	6.21
over cross II	$\bar{x}$	15.17^A	17.71^B	22.62^C
	s	4.41	5.73	6.53
on the level of the last thoracic vertebrae*	$\bar{x}$	14.81^A	17.26^B	22.45^C
	s	5.19	6.82	7.88
between 3rd a 4th thoracic vertebrae*	$\bar{x}$	17.08^A	20.18^B	25.39^C
	s	5.75	7.30	7.71
on the level of the last thoracic vertebrae**	$\bar{x}$	13.23^A	15.71^B	20.31^C
	s	4.91	6.38	7.54
between 3rd a 4th thoracic vertebrae**	$\bar{x}$	14.97^A	17.86^B	22.86^C
	s	5.15	6.72	7.38

* – measure performed 6 cm from carcass division line
** – measure performed 7 cm from carcass division line
Means in rows with different letters are significantly different at $p \leq 0.01$ (*A, B, C*)

The main objective of the thesis was to analyze the influence of carcass weight on the measurements of fat thickness and the longest back muscle, which were assessed in the points in which the measurements of carcass meat percentage in EUROP system are performed by the means of ultrasonic or optical-needle probes.

First thing to discuss is the influence of carcass weight on the measurements of fat thickness, performed on the carcass cross section i.e. on the back, on I and II cross (Table 1). The measurement on the back was the basis of the selection of carcasses for research, whereas measurements on I and II cross are the basis to estimate meat percentage of pig carcasses in the EUROP classification system with the help of so-called electronic calipers (BORZUTA 1998). The research proved that the increase of carcass weight is accompanied by the significant increase of fat thickness in all acquired measurement points. Similar growth of fat thickness with the increase of carcass weight was discovered in other research (BUCK 1963, KOĆWIN-PODSIADŁA et al. 2000, ŁYCZYŃSKI et al. 2000, MELLER 1992, WAJDA 1973). Nevertheless, fat thickness in the analysed carcasses was about

1 cm thinner than fat thickness of carcasses of fatteners purchased in the same region of country in 1973 (WAJDA 1973).

Analysing the difference between the means of the examined groups we may find out that fat thickness on the back increased equally with carcass weight increase, whereas fat thickness on cross I and II increased relatively slowly (1.30 to 2.54 mm) with carcass weight increase from 70 to 80 kg, and significantly faster increase of thickness (4.90–7.37mm) is observed with carcass weight increase from 80 to 90 kg. It should also be stated that together with carcass weight increase, the growth of standard deviation value was observed for all analysed fat thickness measurement on carcass cross section.

In the research on fat thickness measurement usefulness for carcass meat percentage estimation it was stated that the highest correlations with carcass meatiness are obtained for fat thickness measurements on the loin cross section (WAJDA et al. 2005). In own research on the loin cross section, fat thickness was measured on the level of last thoracic vertebrae and between 3rd and 4th thoracic vertebrae, counting vertebras from the end, and 6 or 7 cm from the half-carcass cross line (Table 1). In those places, in order to assess meat percentage according to EUROP classification system, fat thickness is usually measured with optical needle and ultrasonic probe. The data shows that, together with the growth of carcass weight, fat thickness increased significantly in those points, and, as in the case of fat thickness measurements on cross I and II, the increase of fat thickness was lower with carcass weight growth from 70 to 80 kg, and over twice as big with carcass weight increase from 80 to 90 kg.

Apart from fat thickness measurements according to EUROP classification system, the measurements of cross section of the longest back muscle are also used, as they are regarded to be as a good indicator of carcass meatiness (WAJDA et al., 2004). In the post-slaughter classification system EUROP (BORZUTA 1998, LISIAK 2002), the measurements of this muscle height which were taken into account, were performed in the same measurement places as fat thickness measurement. The research proved that the values of the measurements of the longest back muscle thickness significantly increased together with the growth of carcass weight (Table 2). Also, together with carcass weight growth we can observe a significant increase of measurement values for the longest back muscle width and eye of loin area. It should be added as well that the increase of "eye" of loin area measurements was higher in the case of carcass weight growth from 70 to 80 kg than at carcass weight growth from 80 to 90 kg. The results (Table 1, Table 2) prove that carcass meatiness estimated on the basis fat thickness and the longest back muscle

measurements decreases relatively slowly together with the increase of their weight in the case of carcass weight up to 85 kg, whereas above this level, fat thickness increases faster and the growth of the longest back muscle height is lower.

Table 2

Longissimus dorsi muscle measurements (mm)

Specification	Statistics	Carcass weight		
		60.0–76.0 $n=98$	76.1–85.0 $n=117$	85.1–120.0 $n=71$
LD muscle height:				
on the level of the last thoracic vertebrae*	$\bar{x}$	53.08^{A}	58.78^{Bb}	60.85^{Cc}
	s	8.63	8.07	8.25
between 3rd a 4th thoracic vertebrae*	$\bar{x}$	47.65^{A}	53.44^{Bb}	55.14^{Cc}
	s	7.81	7.10	7.19
on the level of the last thoracic vertebrae**	$\bar{x}$	55.33^{A}	60.78^{Bb}	62.44^{Cc}
	s	9.64	7.83	6.86
between 3rda 4th thoracic vertebrae**	$\bar{x}$	50.14^{A}	56.73^{Bb}	58.03^{Cc}
	s	8.49	8.04	7.26
LD muscle width:				
on the level of the last thoracic vertebrae*	$\bar{x}$	91.67^{A}	95.73^{Bb}	97.48^{Cc}
	s	6.14	6.31	8.45
between 3rd a 4th thoracic vertebrae*	$\bar{x}$	90.03^{A}	94.35^{B}	96.46^{C}
	s	6.18	6.27	6.35
Eye of loin area (cm^2)				
on the level of the last thoracic vertebrae*	$\bar{x}$	39.20^{A}	45.22^{B}	47.75^{C}
	s	8.34	8.20	9.41
between 3rd a 4th thoracicvertabrae*	$\bar{x}$	34.58^{A}	40.5^{B}	42.76^{C}
	s	7.62	7.29	7.43
on the level of the last thoracic vertebrae**	$\bar{x}$	40.83^{A}	46.70^{Bb}	48.91^{Cc}
	s	8.80	7.81	8.08
between 3rd a 4th thoracic vertebrae**	$\bar{x}$	36.34^{A}	42.97^{Bb}	44.95^{Cc}
	s	7.83	7.61	7.44

* – measure performed 6 cm from carcass division line
** – measure performed 7 cm from carcass division line
Means in rows with different letters are significantly different at $p \leq 0.01$ (*A, B, C*) and $p \leq 0.05$ (*b, c*)

Conclusions

1. The increase of carcass weight of fatteners bought by meat plants by about 10 kg (i.e. from the weight from 70.0 to 80.0 kg and from 80.0 to 90,0 kg) caused statistically significant increase of fat thickness and the longest back muscle measurement value in all examined points.

2. The increase of carcass weight from 70.0 to 80.0 kg resulted in relatively small increase of fat thickness (about 2 mm), and higher increase of the longest back muscle height (about 5 mm), whereas the growth of carcass weight from

80.0 kg to 90.0 kg influenced the higher increase of fat thickness (about 5 mm) and smaller growth of the longest back muscle (about 2 mm).

3. In the classification system, where one takes into account fat thickness and the longest back muscle when estimating meat percentage, one may expect a slight decrease of meatiness with the growth of carcass weight to do 85.0 kg, and over this weight, higher decrease of the carcass meat percentage may be expected.

Translated by MAJA WINARSKA

Accepted for print 3.03.2009

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