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# The influence of the season of slaughter and hot carcass weight on the meatiness of fatteners from the mass population

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**The aim of this study was to analyse the influence of the season of slaughter and hot carcass weight (HCW) on the meatiness of fatteners from the mass population, obtained from one of the meat plants located in central-eastern Poland. The investigations were conducted in 2012 on a total of 8,820 fatteners, in winter (February) – 1861 carcasses, spring (May) – 2334, summer (July) – 2127 and autumn (October) – 2498. Lean meat content was estimated using an ULTRA FOM 300 apparatus manufactured by the Danish company SFK--Technology. Additionally, the study material was assigned to three groups according to hot carcass weight (HCW): I – HCW <79 kg, II HCW – 79-87 kg and III – HCW >87 kg. The season of the slaughter was found to the influence the meatiness of the carcass, the thickness of the Longissimus dorsi (LD) muscle, and fat thickness. The highest meatiness and lowest fat thickness were noted in the carcasses of fatteners slaughtered in winter. Heavier animals (with hot carcass weight above 87 kg) were shown to have lower meatiness by about 0.8 percentage points and about 2-3 mm greater fat thickness than lighter ones (HCW below 87 kg). There was also found to be an interaction between the season of the slaughter and hot carcass weight for the traits analysed. Favourable meatiness and fat thickness at the $S_1$ point was noted for carcasses with HCW from 79 to 87 kg. Except in winter, their meatiness and fat thickness at the $S_1$ point was similar to that of the lightest carcasses (HCW below 79 kg), while longissimus muscle thickness (except in autumn) was at the level of the heaviest carcasses (with HCW above 87 kg).**

**KEY WORDS: fatteners / season of slaughter / hot carcass weight/ meatiness**

Pig production, determined by consumer preferences and demands, is currently oriented towards obtaining high quality slaughter products with low fat content. Lean meat content has been improved by the introduction of the EUROP classification system, raising it from 43% in 1993 [10] to 56.6% in 2012 [12]. Since 2000 a change has also

been noted in the preferences of the meat industry, which began to look for material with higher hot carcass weight while maintaining high lean meat content [17, 18]. According to Koćwin-Podsiadła et al. [5] and Tereszkiewicz et al. [15], environmental factors, including climate, can negatively affect animals' metabolism, resulting in differences in their pre-slaughter weight and changes in fat cover, thereby leading to a reduction in carcass value.

The aim of the study was to analyse the effect of the season of the year when pigs are slaughtered and their hot carcass weight (HCW) on the lean meat content of fattening pigs from the mass population. The source of the pigs was farms supplying fattened pigs to a meat plant in east-central Poland.

## Material and methods

The study was conducted on 8,820 carcasses of fattening pigs from the mass population. The pigs were obtained from farms supplying fattened pigs to a meat plant in east-central Poland in four seasons of 2012: 1,861 carcasses in winter (February), 2,334 in spring (May), 2,127 in summer (July), and 2,498 in autumn (October). The hot weight of the unskinned carcass, without kidneys and kidney fat, was determined on an electronic track scale (accurate to 0.1 kg). The percentage content of meat in the carcass was estimated using an ULTRA FOM 300 apparatus manufactured by the Danish company SFK-Technology (with a regression equation developed in 2003), on the basis of measurements of the thickness of the backfat and the *longissimus dorsi* muscle (LD) taken at the height of the last rib (points $MM_1$ and $S_1$) and between the third and fourth ribs (points $MM_2$ and $S_2$), counting from the end, 7 cm from the line where the carcass is divided into half-carcasses.

In view of the hot carcass weight preferences of the meat plant (79-87 kg) and the system of premiums taking this parameter into account in determination of payments to producers, the analysis of results included three ranges of hot carcass weight: I <79 kg, II – 79-87 kg and III >87 kg.

Statistical analysis of the results was performed using STATISTICA 7.1 PL software, by two-way analysis of variance with non-orthogonal comparisons, taking into account the effect of the season of the year, hot carcass weight and the interaction of these two experimental factors for the features tested in the study [11]. Significance of differences between mean values was verified by Tukey's test. Also determined in the study was the percentage of carcasses assigned to each conformation class according to the EUROP system for the hot carcass weight ranges and seasons of the year.

## Results and discussion

The pig carcasses had lean meat content of 55.80 ±3.82% and a mean hot carcass weight of 89.23 ±11.38 kg (Tab. 1). These values were 0.7 p.p. and 1.67 kg lower than in monitoring conducted by the Ministry of Agriculture and Rural Development in 2012 [13].

**Table 1**
Effect of the examined factors on analysed traits and mean values

| Trait | $F_{emp.}$ | | | Total (n=8820) |
|---|---|---|---|---|
| | Season of slaughter | Hot carcass weight | Interaction (season × hot carcass weight) | |
| Hot carcass weight (kg) | 30.00$^{xx}$ | 101.05$^{xx}$ | 39.00$^{xx}$ | 89.23 ±11.38 |
| Lean meat content (%) | 56.00$^{xx}$ | 63.00$^{xx}$ | 5.00$^{xx}$ | 55.80 ±3.82 |
| LD thickness at $MM_1$ (mm) | 66.70$^{xx}$ | 174.60$^{xx}$ | 5.60$^{xx}$ | 58.22 ±6.55 |
| LD thickness at $MM_2$ (mm) | 132.40$^{xx}$ | 210.60$^{xx}$ | 12.70$^{xx}$ | 57.75 ±6.79 |
| Fat thickness at $S_1$ (mm) | 26.53$^{xx}$ | 313.44$^{xx}$ | 2.20$^{x}$ | 15.38 ±4.84 |
| Fat thickness at $S_2$ (mm) | 71.39$^{xx}$ | 282.31$^{xx}$ | 0.99$^{x}$ | 15.42 ±5.07 |

$^{x}$Statistically significant at $p \leq 0.05$
$^{xx}$Statistically significant at $p \leq 0.01$

The season of slaughter (irrespective of hot carcass weight) was found to significantly differentiate the percentage content of meat in the carcass and the thickness of the LD muscle and backfat. The highest meat content and lowest fat cover were noted in the carcasses of the pigs slaughtered in winter (Tab. 2). The meatiness of the pig carcasses slaughtered in winter, at 56.83%, was about 1.0-1.3 p.p. higher than in pigs slaughtered in other seasons. In spring, summer and autumn the average lean meat content of the carcasses was similar, and the differences were not confirmed statistically. This was reflected in both the thickest LD muscle measured at points $MM_1$ and $MM_2$ (from about 1.0-1.3 to about 2.8-4.0 mm), and the thinnest backfat (0.35-1.5 and 0.45-2.38 mm for points $S_1$ and $S_2$, respectively), as compared to the pigs slaughtered in spring, summer and autumn. It should also be noted that carcass weight was highest in the pigs from winter slaughter—6-7 kg higher than in those slaughtered in summer and autumn (Tab. 2). It is difficult definitively explain the differences in the meat content of carcasses of pigs slaughtered in spring and winter, which also had the highest carcass weight. The explanation probably lies in the significantly greater backfat thickness noted in the carcasses of pigs slaughtered in spring as compared to winter (Tab. 2).

A study by Antosik et al. [1] on pigs from the mass population showed that the carcasses of pigs slaughtered in autumn had the highest percentage meat content and the thickest LD muscle at point $MM_1$ (58.5% and 62.24 mm), while animals slaughtered in the spring had the lowest meat content. In addition, when these authors [1] studied the correlations between meat content estimated with an ULTRA-FOM 300 apparatus and

**Table 2**
The influence of season on carcass quality traits

| Trait | Season | | | |
|---|---|---|---|---|
| | spring | summer | autumn | winter |
| Number of carcasses | 2334 | 2127 | 2498 | 1861 |
| Hot carcass weight (kg) | $92.08^{C}$ ±10.92 | $85.31^{A}$ ±10.38 | $87.13^{B}$ ±9.89 | $92.96^{C}$ ±12.72 |
| Lean meat content (%) | $55.34^{A}$ ±4.22 | $55.59^{A}$ ±3.96 | $55.66^{A}$ ±3.51 | $56.83^{B}$ ±3.32 |
| LD thickness at $MM_1$ (mm) | $58.70^{B}$ ±6.33 | $57.13^{A}$ ±7.02 | $57.32^{A}$ ±6.35 | $60.08^{C}$ ±6.05 |
| LD thickness at $MM_2$ (mm) | $58.57^{C}$ ±6.58 | $57.84^{B}$ ±6.95 | $55.60^{A}$ ±6.92 | $59.51^{D}$ ±5.90 |
| Fat thickness at $S_1$ (mm) | $16.25^{C}$ ±5.14 | $15.30^{B}$ ±5.06 | $15.10^{AB}$ ±4.75 | $14.75^{A}$ ±4.13 |
| Fat thickness at $S_2$ (mm) | $16.62^{D}$ ±5.44 | $15.79^{C}$ ±5.36 | $14.87^{B}$ ±4.75 | $14.24^{A}$ ±4.26 |

A, B, C, D – mean values with different letters differ statistically at $p \leq 0.01$

the thickness of the backfat and LD muscle, they found that meat content was more highly correlated with backfat thickness measured at points $S_1$ and $S_2$ ($r=-0.81^{**}$ and $-0.71^{**}$respectively) than with the thickness of the LD muscle ($r=-0.64^{**}$). Tereszkiewicz et al. [15] analysed the effect of the season of fattening on the carcass value of Duroc pigs assessed at SKURTCh (Pig Slaughter Performance Control) stations and found no differences in the meat content of animals fattened in summer and winter, but the pigs from the winter period had somewhat thinner backfat at all measurement points and their carcass weight was 0.41 kg higher than that of animals fattened in summer. Similar results to those of Tereszkiewicz et al. [15] on the effect of the season of slaughter on the carcass value of pigs were reported by Garcia-Rey et al. [3], who analysed 1,257 pigs from five different groups of crossbreeds with contributions of the Duroc, Landrace and Polish Large White breeds. Tereszkiewicz et al. [15] noted the highest meat content in pigs slaughtered in autumn and the lowest in those slaughtered in spring. In the study by Garcia-Rey et al. [3], the season of slaughter did not differentiate hot carcass weight, but the authors noted that the carcass weight of pigs with the highest meat content was about 1 kg higher in animals slaughtered in autumn than in those slaughtered in winter (90.91 and 89.33 kg, respectively). Rodriguez-Sanchez et al. [14] also found no statistically confirmed effect of the season of slaughter (summer or winter) on hot carcass weight, which in animals slaughtered in winter was about 2 kg higher than in pigs slaughtered in summer.

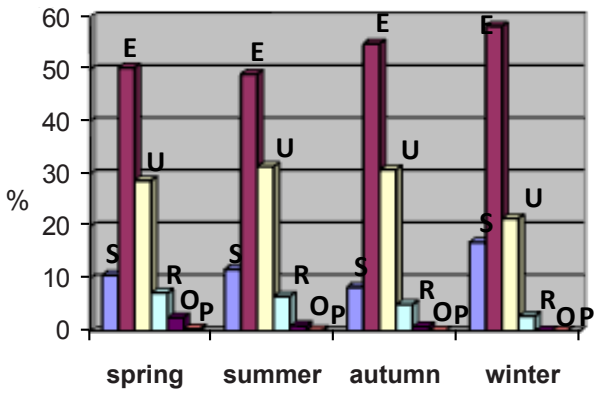



Fig. 1. Percentage share of carcasses in different EUROP meat classes depending on the season of the slaughter

The results described above on the effect of slaughter season on the percentage content of meat in the carcass and on the thickness of the backfat and LD muscle were reflected in the percentages of carcasses in each class of the EUROP classification system depending on the season of slaughter (Fig. 1). The highest percentage of carcasses with meat content above 55% (classes S and E) was noted in winter (75.22%). Moreover, none of the carcasses obtained in winter had meat content of under 45% (classes O and P), whereas in the remaining seasons the percentage of carcasses in these classes ranged from 0.84% in the autumn to 2.96% in the spring. Hot carcass weight (irrespective of the season of slaughter) significantly differentiated lean meat content and the thickness of the LD muscle and backfat (Tab. 3). The heaviest carcasses (HCW III) had significantly ($p \leq 0.01$) thicker LD muscles, but also the thickest backfat at both measurement points, which was reflected in their lower meat content (by about 0.6-0.8 p.p.) in comparison with lighter carcasses (HCW II and I) – Table 3. The carcasses with the lowest weight, not exceeding 79 kg (HCW I), were also shown to have the highest meat content (similar to that of carcasses in the hot carcass weight range of 79-87 kg) and the thinnest backfat at points $S_1$ and $S_2$. It should be noted that the group described above also had the thinnest LD muscle.

The previously cited study by Antosik et al. [1] showed that meat content estimated with an ULTRA-FOM 300 apparatus was more correlated with backfat thickness than the thickness of the LD muscle, which was also indicated by Koćwin-Podsiadła et al. [6] and by Borzuta et al. [2]. Moreover, Lisiak and Borzuta [9] found that the old regression equation from 2003, as compared to the new one from 2011, estimated lower meat content; this difference in the case of heavy carcasses (90-100 kg) from conformation classes E and U was 1-1.5 p.p.

**Table 3**
The influence of hot carcass weight on carcass quality traits

| Trait | Hot carcass weight (kg) | | |
|---|---|---|---|
| | I <79 | II 79-87 | III >87 |
| Number of carcasses | 1592 | 2174 | 5054 |
| Hot carcass weight (kg) | $72.84^{A}$ ±5.62 | $83.26^{B}$ ±2.28 | $96.96^{C}$ ±7.35 |
| Lean meat content (%) | $56.32^{B}$ ±3.48 | $56.17^{B}$ ±3.59 | $55.48^{A}$ ±3.99 |
| LD thickness at $MM_1$ (mm) | $55.26^{A}$ ±7.18 | $57.75^{B}$ ±6.56 | $59.36^{C}$ ±6.00 |
| LD thickness at $MM_2$ (mm) | $54.51^{A}$ ±7.64 | $57.29^{B}$ ±6.66 | $58.97^{C}$ ±6.18 |
| Fat thickness at $S_1$ (mm) | $13.26^{A}$ ±4.55 | $14.58^{BC}$ ±4.47 | $16.39^{C}$ ±4.80 |
| Fat thickness at $S_2$ (mm) | $13.32^{A}$ ±4.56 | $14.69^{B}$ ±4.73 | $16.40^{C}$ ±5.12 |

A, B, C – mean values with different letters differ statistically at $p \leq 0.01$

Slaughter weight and the related hot carcass weight is a significant factor determining carcass value and the yield of prime cuts, elements obtained from boning, or meat of various classes obtained from trimming of pig carcasses [17, 18]. The results obtained in

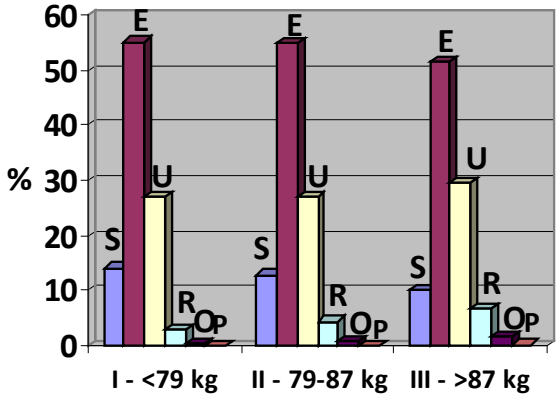
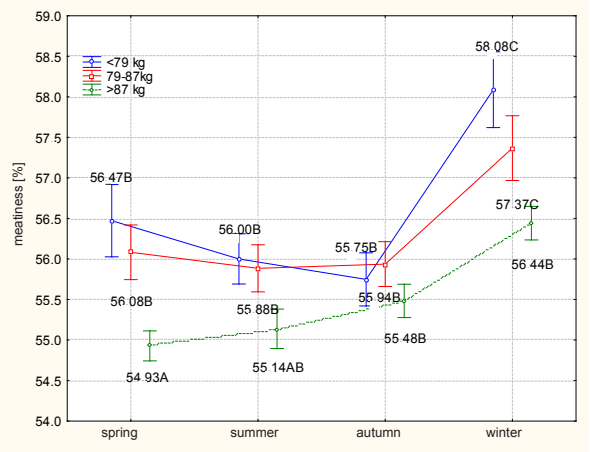



Fig. 2. Percentage share of carcasses in different EUROP meat classes taking into account hot carcass weight ranges

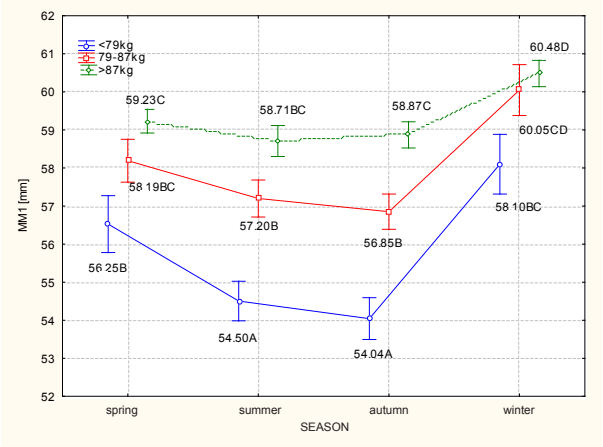
the present study on the effect of hot carcass weight on meat content and the thickness of the backfat and LD muscle were reflected in the percentage of carcasses in individual conformation classes according to the EUROP classification system, depending on the hot carcass weight range. The percentage of class S and E carcasses whose weight did not exceed 87 kg (HCW I and II) was 69.4% and 67.84%, respectively, while in the case of the heaviest carcasses, weighing over 87 kg (HCW III), it was about 6 p.p. lower, at 61.66% (Fig. 2).

The results described are confirmed in a study by Łyczyński et al. [12], who showed that slaughter of pigs with a hot carcass weight exceeding 90 kg resulted in a decrease in the percentage content of meat in the carcass and a statistically confirmed increase (in comparison with lighter carcasses – HCW 70-90 kg) in backfat thickness and the depth of the eye of the loin. A study by Gardzińska et al. [4] on three-breed crosses (Polish Landrace x (Duroc x Pietrain)) found that slaughter of pigs weighing more than 120 kg (as compared to lighter animals) leads to a decrease in the percentage content of meat in the carcass and a statistically confirmed increase in backfat thickness. Koćwin-Podsiadła et al. [7] and Krzęcio et al. [8] showed that in the case of slaughter of pigs whose hot carcass weight does not exceed 92 kg it is possible to maintain high meat content with an acceptable increase in fat cover. Zybert et al. [16] also found that in the case of an increase in hot carcass weight from 70-80 kg to 80.1-90 kg conformation can be maintained at the same level, with a small (not statistically confirmed) increase in fat cover.



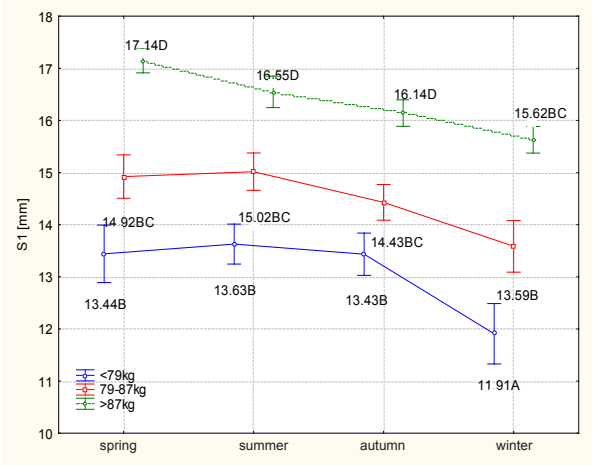

A, B, C – mean values with different letters differ statistically at p≤0.01

Fig. 3a. Interaction of season of slaughter and hot carcass weight for lean meat content




A, B, C, D – mean values with different letters differ statistically at p≤0.01

Fig. 3b. Interaction of season of slaughter and hot carcass weight for LD thickness at $MM_1$




A, B, C, D – mean values with different letters differs statistically at p≤0.01

Fig. 3c. Interaction of season of slaughter and hot carcass weight for fat thickness at $S_1$ point

An interaction of the factors analysed was also found for meat content, the thickness of the LD muscle at point $MM_1$ and backfat thickness at point $S_1$. During the summer and

autumn, as compared to the spring, the percentage content of meat in the carcasses of the lightest pigs (HCW <79 kg) was lower (by 0.47 and 0.59 p.p., respectively), whereas among carcasses with HCW >87 kg there was a significant ($p \leq 0.01$) increase in meat content (by 0.55 p.p.) between spring and autumn (Fig. 3a). The most favourable results for the features analysed were noted in the case of the carcasses weighing from 79 to 87 kg, for which backfat thickness measured at point $S_1$ in all seasons except winter was similar to that of the lightest carcasses, while the thickness of the LD muscles in each season (except autumn) did not differ statistically from carcasses weighing more than 87 kg (Figs. 3b and 3c).

To sum up, the results obtained indicate that the material tested did not differ significantly from the national average meat content, and a considerable percentage of carcasses were in classes S or E. The carcasses of pigs slaughtered in winter were heaviest, and also had the highest ($p \leq 0.01$) meat content and LD muscle thickness and the smallest backfat thickness at both measurement points. In slaughtering animals with a hot carcass weight exceeding 87 kg we should also expect a decrease in mean meat content (by about 0.8 p.p.) and a considerable increase in fat cover (by about 2-3 mm) in comparison with lighter carcasses (not exceeding 87 kg). In terms of the interaction between the season of the year and hot carcass weight, the most beneficial parameters for the features analysed were noted for the animals with hot carcass weight from 79 to 87 kg. In terms of meat content and backfat thickness at point $S_1$ the carcasses of these animals (except for backfat thickness at point $S_1$ measured in winter) did not differ statistically in individual seasons from carcasses whose weight did not exceed 79 kg, while the thickness of the LD muscle (except in autumn) was similar to that of the heaviest carcasses (over 87 kg).

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