

The effect of weight at slaughter on meat content of carcass and meat quality in hybrid pigs*

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Crossbred fatteners were used from two multibreed crossing combinations: [(Czech Large White × Landrace) × (Pietrain × Hampshire)] – combination A (n=258), and [(Czech Large White × Landrace) × (Duroc × Hampshire)] – combination B (n=249). In both combinations the dams were F₁ crosses (Czech Large White × Landrace). The mean live weight of fatteners at slaughter was 111.6 and 112.7 kg in A and B combination, respectively. Fatteners of each combination were divided into six slaughter live weight groups (from 80 to 130 kg).

With increasing slaughter weight the backfat thickness increased and lean meat content of carcass showed the linear declining tendency. Significant differences appeared in lean meat content of carcass between the live weight groups. In combination A the difference ($P \leq 0.001$) was shown in lean meat content between fatteners slaughtered at 94.9 and 125.3 kg live weight (56.07 vs 53.4%). In combination B the difference ($P \leq 0.001$) in lean meat content of carcass appeared between pigs slaughtered at 106.6 and 125.7 kg live weight (56.3 vs 53.9 %).

Highly significant ($P \leq 0.001$) positive correlation was determined between live weight at slaughter and depth of *Longissimus dorsi* muscle (0.327) or backfat thickness (0.450). High negative correlation (-0.907) was determined between backfat thickness and lean meat content of carcass.

KEY WORDS: backfat / lean meat / *longissimus dorsi* / muscle depth / pigs / slaughter weight

From the point of view of healthy nutrition and under the pressure of consumers, producers of pork are still forced to deliver pigs with higher meat content of carcass. Lean meat per cent of pig carcass depends, among others, on animals' slaughter live weight. According to Pulkrábek [2000] the decrease of slaughter weight by each 10 kg

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leads to increase in lean meat per cent of pig carcass by 1.5 per cent points.

After introducing on April 1, 2001 in the Czech Republic the classification of pig carcasses with ultrasound devices, it appeared necessary to reduce the slaughter weight of pigs to 105-108 kg, what was also recommended by Demo and Poltarský [1997].

One-way oriented selection on high lean meat per cent of pig carcass can decrease the meat quality by appearing of PSE and DFD faults. pH_1 of 5.80 and lower is the best-known, internationally recognized objective criterion for pork PSE determination. According to William *et al.* [1990] slaughter weight is the most important factor influencing the value of pig carcass.

Šašek [1987] reported the slaughter weight of pigs in Czech Republic in the years 1984-1986 to be 117-118 kg. In 2002, an average slaughter weight of pigs was already 111 kg, showing the evident decline by 6-8 kg. Contents of meat and fat of carcass change along with the increase of slaughter weight of pigs, leading obviously to changes in carcass value [Hovorka 1989].

Wide range in pigs' weight at slaughter could be a result of varying environment as well as of using unproper final crosses [Svoboda 2001]. Pulkrábek [2001] reported many crossing schemes used for production of final commercial pig crosses in the Czech Republic. In light of this, polarization of pig breeders is important to create the final crossing combination which would ensure the satisfying value of carcass and bring most profit.

Material and methods

A total of 258 crossbred fatteners were used obtained from two multibreed crossing combinations: [(Czech Large White \times Landrace) \times (Pietrain \times Hampshire)] – combination A, and [(Czech Large White \times Landrace) \times (Duroc \times Hampshire)] – combination B. In both combinations dams were F_1 Czech Large White \times Landrace crosses and were inseminated with the semen of AI F_1 Pietrain \times Hampshire or Pietrain \times Duroc boars. Five boars were used in each combination, 10 sows being inseminated with the semen of each boar.

After birth the piglets were marked with identification number and sex of piglet was introduced into the database Pre-fattening and fattening were conducted separately for each sex in one fattening hall.

After the end of fattening all pigs were slaughtered. After slaughter the modified weight of carcass was obtained and live weight of slaughtered animal calculated using the coefficient of 1.23. Next a per cent of lean meat by two-points method was determined in each tested animal using apparatus IS-D-04. The Gryf 107 device was used to determine pH_1 (45 min post-slaughter) in *longissimus dorsi* muscle in all animals for meat quality evaluation. Moreover, the depth of the muscle was measured 45 min. post-slaughter.

The results obtained were evaluated within each of two combinations and referred to the following slaughter weight groups (kg): 80-89, 90-99.9, 100-109.9, 110-119.9,

120-129.9 and >130.

Significance of differences between slaughter weight groups for individual traits was evaluated using the Student-Newman-Keuls test and variation within combination in slaughter weight was calculated by binate t-test. Pearson correlation was used for determining of relationship between slaughter weight and traits presenting the carcass value. Statistical programme UNISTAT 5.1 was used.

Results and discussion

Tables 1 and 2 present the mean values of traits studied, *i.e.* backfat thickness (mm), *longissimus dorsi* depth (mm), lean meat content of carcass (%) and pH₁ determined in fatteners across their live weight groups when slaughtered.

In combination A the highest share of slaughtered pigs (31.0%) appeared within the slaughter weight interval of 110-119.9 kg with the mean of 114.8 kg (Tab. 1). In combination B the highest share of slaughtered pigs appeared within the weight interval of 100-109.9 kg (26.5%) and 110-119.9 kg (23.3%) with the means of 106.3 and 114.0 kg, respectively (Tab. 2).

The overall mean slaughter weight was 111,6 kg in fatteners of A and 112,7 kg in fatteners of B combination. With increasing slaughter weight the backfat thickness showed the tendency to increase, whereas the lean meat content of carcass had linear tendency to decline.

In pigs from both crossing combinations the thinnest backfat was found in slaughter weight group of 80-89,9 kg (15.0 mm in A and 12.7 mm in B combination). The thickest backfat (20.26 mm in A and 21.2 mm in B) appeared in weight group >130 kg.

Baulain *et al.* [2000] reported the backfat thickness of 23.6 mm in pigs from crossing combination Duroc × German Landrace, with slaughter weight of 107 kg. Their result is higher than 15.5 mm presented here (Tab. 2) for fatteners from combination

Table 1. Means and their standard deviations (SD) for five performance traits of crossbred fatteners from combination A [(Czech Large White × Landrace) × (Pietrain × Hampshire)]

| Weight interval (kg) | n | % | Live slaughter weight (kg) | | Backfat thickness (mm) | | Muscle depth (mm) | | Lean meat content of carcass (%) | | pH ₁ | |
|----------------------|-----|------|----------------------------|-------|------------------------|------|-------------------|------|----------------------------------|------|-----------------|------|
| | | | mean | SD | mean | SD | mean | SD | mean | SD | mean | SD |
| 80-89.9 | 10 | 3.9 | 84.5 | 2.29 | 15.00 | 4.28 | 70.30 | 5.80 | 40.0 | 2.94 | 4.17 | 0.25 |
| 90-99.9 | 45 | 17.4 | 94.9 | 2.64 | 15.10 | 3.87 | 71.58 | 4.22 | 54.1 ^{ab} | 2.95 | 4.27 | 0.30 |
| 100-109.9 | 55 | 21.3 | 105.5 | 2.74 | 16.99 | 4.00 | 72.17 | 4.71 | 54.9 ^a | 3.07 | 4.29 | 0.22 |
| 110-119.9 | 80 | 31.0 | 114.8 | 2.84 | 16.99 | 3.77 | 73.30 | 5.00 | 55.2 ^a | 3.12 | 4.30 | 0.30 |
| 120-129.9 | 51 | 19.8 | 125.3 | 2.41 | 20.35 | 4.11 | 74.42 | 4.74 | 53.4 ^{abcd} | 2.75 | 4.31 | 0.24 |
| ≥130 | 17 | 6.4 | 133.5 | 2.42 | 20.24 | 4.34 | 75.00 | 5.37 | 53.6 ^a | 3.44 | 4.21 | 0.34 |
| Total | 258 | 100 | 111.6 | 12.67 | 17.47 | 4.35 | 72.98 | 4.92 | 54.9 | 3.13 | 4.28 | 0.28 |

^aP≤0.05; ^bP≤0.01; ^cP≤0.001.

Table 2. Means and their standard deviations (SD) for five performance traits of crossbred fatteners from combination B [(Czech Large White × Landrace) × (Duroc × Hampshire)]

| Weight interval (kg) | n | % | Live slaughter weight (kg) | | Backfat thickness (mm) | | Muscle depth (mm) | | Lean meat content of carcass (%) | | pH _i | |
|----------------------|-----|------|----------------------------|-------|------------------------|------|-------------------|------|----------------------------------|------|-----------------|------|
| | | | mean | SD | mean | SD | mean | SD | mean | SD | mean | SD |
| 80-89.9 | 14 | 5.4 | 85.7 | 2.33 | 12.71 | 4.59 | 69.07 | 4.20 | 57.5 ^{***} | 3.42 | 6.19 | 0.24 |
| 90-99.9 | 33 | 13.3 | 96.2 | 2.57 | 14.20 | 4.22 | 69.55 | 4.95 | 55.0 [*] | 3.03 | 6.14 | 0.27 |
| 100-109.9 | 44 | 24.5 | 104.3 | 2.37 | 15.45 | 3.83 | 73.30 | 5.14 | 54.3 ^{**} | 3.49 | 6.23 | 0.28 |
| 110-119.9 | 58 | 23.3 | 114.0 | 2.94 | 17.69 | 4.41 | 72.58 | 4.78 | 54.5 ^{**} | 2.92 | 6.21 | 0.27 |
| 120-129.9 | 32 | 20.9 | 125.3 | 2.87 | 14.69 | 4.23 | 74.54 | 5.44 | 53.9 [†] | 3.03 | 6.24 | 0.27 |
| ≥130 | 24 | 10.4 | 134.5 | 4.01 | 21.23 | 4.40 | 77.58 | 4.24 | 53.8 [†] | 3.10 | 6.21 | 0.24 |
| Total | 249 | 100 | 112.7 | 13.83 | 17.41 | 4.74 | 73.10 | 5.43 | 55.0 | 3.33 | 6.22 | 0.27 |

[†]P≤0.05; ^{**}P≤0.01; ^{***}P≤0.001.

B with mean slaughter weight of 106.3 kg. No significant differences between slaughter weight groups were found.

In fatteners of both combinations the *Longissimus dorsi* depth rose with increasing slaughter weight.

Significant differences were found in lean meat content of carcass between mean slaughter live weights. In combination A the meat per cent of carcass in 94.9 and 105.5 kg fatteners appeared different (P≤0.05) from those found in slaughter weight group of 133.5 and 125.3 kg. (56.1 and 55.0 vs 53.4 and 53.3 %, respectively). Highly significant difference (P≤0.001) was demonstrated in meat content of carcass between fatteners from slaughter weight group of 94.9 kg and 125.3 kg (56.1 vs 53.4%, respectively).

In combination B the meat content of carcass in 85.7 kg fatteners was found different (P≤0.05) from that of 96.2 kg fatteners (57.5 vs 55.0% lean meat). Highly significant difference in meat content of carcass (P≤0.001) appeared between slaughter weight of 106.3 and 125.3 kg (56.3 vs 53.9%).

The overall means for lean meat content of carcass in fatteners from A and B combination were 54.9 and 55.0%, respectively.

Adamec *et al.* [2000] reported 55.10% lean meat in (Large White × Landrace) × Hampshire crosses slaughtered at the live weight of 104 kg, 55.3% in (Large White × Landrace) × Large White crosses slaughtered at 103 kg, and 49.60% lean meat in crosses [(Large White × Landrace) × (Belgian Landrace × Duroc)] slaughtered at 105 kg. In the present study, higher content of lean meat – 56.29% – was found in fatteners from B combination slaughtered when weighing 106.3 kg.

According to Pulkrábek *et al.* [2000] the mean meat content of pig carcass in Czech Republic was 51.97% in animals slaughtered at live weight of 114.60 kg.

The overall mean pH_i was 6.28 and 6.22 in combination A and B, respectively. In

both combinations no significant differences were found between slaughter weights.

In Table 3 shown are means for live weight at slaughter as referred to sex. Between combination A and B significant differences were found within hogs (113.8 vs 115.1 kg) as well as within gilts (109.5 vs 110.1 kg). Pulkrábek and Pavlík [2000] reported the difference in slaughter weight between hogs and gilts to be about 6 kg, when gilts reached 108.4 and hogs 114.3 kg [14].

In Table 4 shown are correlation coefficients between selected carcass traits in crosses considered. Highly significant ($P \leq 0.001$) medium positive correlations were determined between slaughter weight and depth of muscle (0.327) or backfat thickness

Table 3. Means and their standard deviations (SD) for slaughter weight across sexes in fatteners of two combinations of crossing

| Sex | n | Mean | SD | Minimum | Maximum |
|---|-----|--------------------|-------|---------|---------|
| Combination A [(CLW) × (B×H)] | | | | | |
| hogs | 122 | 113.9 ^a | 13.41 | 86.8 | 139.0 |
| gilts | 136 | 109.5 ^a | 11.64 | 81.2 | 135.5 |
| total | 258 | 111.6 | 12.67 | 81.2 | 139.0 |
| Combination B [(CLW×L) × (D×H)] | | | | | |
| hogs | 129 | 115.1 ^b | 14.49 | 81.9 | 151.8 |
| gilts | 120 | 110.1 ^b | 12.63 | 82.2 | 137.0 |
| total | 249 | 112.7 | 13.83 | 81.9 | 151.8 |

^{a,b} $P \leq 0.01$.

Table 4. Correlation coefficients between carcass traits in fatteners (crossing combinations pooled)

| Trait | Muscle depth (mm) | Backfat thickness (mm) | Lean meat content (%) | pH ₄ |
|------------------------|-------------------|------------------------|-----------------------|-----------------|
| Slaughter weight (kg) | 0.327*** | 0.450*** | -0.286*** | 0.046 |
| Muscle depth (mm) | | 0.022 | 0.368*** | -0.039 |
| Backfat thickness (mm) | | | -0.907*** | 0.083* |
| Lean meat content (%) | | | | -0.100* |

* $P \leq 0.05$; ** $P \leq 0.001$.

(0.450). Low and negative correlation (-0,286, $P \leq 0,001$) was found between slaughter weight and lean meat content of carcass. Very high negative correlation (-0,907, $P \leq 0,001$) was determined between lean meat content of carcass and backfat thickness. Mrode and Kennedy [1993] reported such correlation to reach -0,87.

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Zależność między ubojową masą ciała a mięsnością tuszy i jakością mięsa świń mieszańcowych

Streszczenie

Wielorasowe mieszańce przeznaczone na ubój uzyskano z dwóch wersji krzyżowania: [(czeska wielka biała × landrace) × (pietrain × hampshire)] i [(czeska wielka biała × landrace) × (duroc × hampshire)], odpowiednio kombinacja A i B – 258 i 249 tuczników. Zwierzęta podzielono na 6 klas ubojowej masy ciała, od 80 kg, co 10 kg do 130 i ponad 130 kg. Średnia masa ciała tuczników z kombinacji A wynosiła 111,57, a z kombinacji B – 112,69 kg. Ze wzrostem ubojowej masy ciała rosła grubość słoniny na grzbiecie i malała zawartość mięsa w tuszy. W przypadku kombinacji A wysokoistotną różnicę stwierdzono w zawartości mięsa w tuszy między tucznikami ubijanymi przy masie ciała 94,92 a 125,30 kg (odpowiednio 56,07 i 53,44%). W przypadku kombinacji B tusze tuczników ubijanych przy masie ciała 106,25 i 125,6 kg zawierały odpowiednio 56,29 i 53,89% mięsa. Stwierdzono korelacje między ubojową masą ciała a głębokością mięśnia LD i grubością słoniny (odpowiednio $r=0,327$ i $0,450$). Ujemna wysoka korelacja

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wystąpiła między grubością słoniny a zawartością mięsa w tuszy (0,907).

