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CARCASS TRAITS OF FATTENING PIGS IN RESPONSE TO HIGH AMBIENT TEMPERATURE

VPLYV VYSOKEJ TEPLOTY NA JATOČNÉ PARAMETRE VÝKRMOVÝCH OŠÍPANÝCH

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The influence of high ambient temperature on carcass parameters was studied in 13 fattening pigs of Large White breed. The pigs were divided into two groups. The experimental group was housed in a climatic chamber with fixed constant temperature (30 °C), and the control group of pigs was housed in a pen (average temperature 20.25 °C) in standard conditions according to the station of fattening and carcass value. The pigs were slaughtered at about 100 kg body weight. The results showed that higher average body weight during the whole trial was marked in the experimental group of pigs, differences were not statistically significant. The weight of loin was higher (P <0.05) in the group of pigs under long-term heat burden compared with group in standard conditions (5.32 vs. 4.89 kg). The weight of thigh, percentage of lean meat cuts and lean meat from thigh was also higher in the experimental group of pigs compared with the control group. On the contrary, the weight of backfat, thigh fat weight and average backfat thickness was lower in the experimental group of pigs. There were no statistically significant differences. The results indicated that high long-term temperature caused non-significantly lower fat tissue and higher percentage of lean meat in pig carcass. The weight of loin was statistically highly significant.

Keywords: pigs, carcass traits, high ambient temperature

In the summertime in our climatic zone, the extreme increase in temperature occurs more frequently. The ambient temperature is one of the major factors that affect the production of pigs (Sirotkin et al., 2011) and it decreases the performance (Misztal et al., 2006). When the border zone of thermal neutrality is overpassed, it is impossible to achieve maximum performance. Kovalčiková, Kovalčik (1974) suggest that crossing the border zone of thermal neutrality is noticed by organism as a burden. The critical rate for pig is considered at 26 °C and more, depending on a category of pigs (Botto, 2011).

Pigs are animals which are quite sensitive to high temperatures, and the thermoregulation mechanisms represent great expenses in energy (Fagundes et al., 2009). When pigs are exposed to a high ambient temperature, the possibility to dissipate heat to the environment is limited (Le Bellego et al., 2002). Renaudeau et al. (2006) also deals with the influence of high ambient temperature in growing pigs. Myer and Bucklin (2009) show that pigs can reduce their metabolic heat production by eating less feed. Souza (2009) considered the reduction of feed consumption as the primary response of animals when exposing to high temperatures because pigs do not have functional sweat glands like other livestock species. According to Hsia and Lu (2004), when pigs are given very restricted same amounts of feed, they may need less energy to maintain their body temperature under moderately high environmental temperature (30 °C). Pigs were significantly taller (P <0.05) and significantly longer (P <0.05) and the belly was significantly heavier than in pigs kept at 20 °C. Consequently, their performance is better than that of pigs under optimum environmental temperature.

Huynh et al. (2005) indicate that animals respond to increased temperature by decreasing feed intake mainly as a form of reduction of metabolic heat. Quiniou et al. (2000) suggest that thermal stress has a significant negative effect on pigs with higher body weight. Voluntary feed intake depends on temperature and body weight with a marked negative effect of high ambient temperatures in heavier pigs.

Hot weather alters pigs' metabolic system and reduces the production performance and carcass quality. The relationship between growth potential and efficiency in lean meat of pigs is regulated by environmental conditions (Fagundes et al., 2009). Environmental temperature has an influence on the physical appearance and weight of internal organs of pigs (Lefaucheur et al., 1991). Rinaldo et al. (2000) indicate that high temperature had direct effect on fat compared to the cool season, it was also mentioned that in the warm season, fat percentage of the carcass was reduced (P <0.001), whereas less fat was deposited in backfat (P <0.001) and more fat retained in leaf fat (P <0.001). Backfat weight was not modified by indoor temperature or by winter temperature, but it was decreased by summer outdoor rearing (Lebret et al., 2002). Carcass fatness was higher (P <0.01) and lean content was lower (P <0.01) at 22 °C than at 29 °C (Le Bellego et al., 2002). Fagundes et al. (2009) suggest that *longissimus thoracis* muscle thickness was smaller in pigs under heat stress, but lean content was higher in those animals. Farrell (1978) implies that high temperature usually increases the length of pig carcass compared with that at lower temperatures. The degree of fatness tends towards a leaner carcass in a hot environment. According to Renaudeau (2006), the results showed an improved tolerance to heat stress with duration of exposure indicating an acclimation to heat, it was found out that the physiological reactions during heat acclimation are affected by breed. The aim of this work was to evaluate the impact of high temperature on carcass characteristics of fattening pigs.

Material and methods

The experiment was carried out in the laboratory conditions of the Experimental centre of farm animals at Department of Special Animal Husbandry in Nitra, and lasted 3 months, from

October till December. In this study, 13 growing pigs of Large White breed were used. All pigs were from one litter. The control group consisted of 6 growing pigs and the experimental group consisted of 7 growing pigs. The experimental group of pigs (4 gilts, 3 barrows) was housed in a climatic chamber, sized 4 × 3 m, and air temperature was constant 30 ° C ±1.0 degree, depending on the intervention of swineherd for feeding and bedding. The temperature in the climatic chamber and also in the pen was measured every half an hour by temperature datalogger HDL. From the obtained data, average temperature was evaluated by software EHDLog. Space in the climatic chamber was divided into feeding-lying area and dunging area. The pigs were offered wet diet *ad libitum*, feed was humidizing by adjunctive water. In the experiment, a nipple drinker was used. The pigs had unlimited access to water and feed throughout the day. Urine and faeces were mucked out every day. Straw was delivered to lying area every day. The control group consisted of 6 pigs (3 gilts, 3 barrows), which were housed in pens. Floor was made of agro brick. Excrements were removed every day. During the winter, the stall was heated (average temperature 20.25 °C). A wet feeder was situated at the front of the pen on lying area, the pigs were also offered water and feed *ad libitum*. Feeding was controlled by computer program, which provided different mixture of components into each pen. Daylight was provided from 6 a.m. to 6 p.m. The pigs were regularly weighed and they were electrically stunned in the station of fattening and slaughter value when they reached slaughter weight 100 kg according to legislation and standard practises STN 466164.

The carcass indicators were evaluated. Hot and cold carcass weights were taken. Half-carcass length, weight of loin, weight of thigh, weight of backfat, thigh fat weight, lean meat cuts and lean meat from thigh, average backfat thickness, *M. longissimus thoracis* muscle were measured from the right half-carcass. From the data obtained in experiment, mean values and standard deviations were calculated. For comparison of differences between groups with different temperatures, one-way analysis of variance using the F-test with significant level $P \leq 0.05$ was used. Data were analysed by statistical software package SPSS 11.

Results and discussion

High ambient temperature 30 °C which influenced pig performance was used in the experiment; Botto (2011) suggested that critical rate for pigs is considered at 26 °C. Quiniou et al. (2000) found out that thermal burden has a significant negative effect on pigs with higher body weight; heavier pigs receive less food than pigs with less weight. The long term effect of exposure to heat burden on carcass traits of pigs influenced by high ambient temperature and pigs in standard conditions of breed Large White are presented in Table 1 for both groups. The results showed that the weight of right and left half cold carcass was higher in pigs under heat burden. According to experiment of Hsia and Lu (2004) it was found out that in pigs kept at 30 °C, the lean meat of the loin, ham were significantly greater ($P < 0.05$). The obtained results showed that the pigs influenced by heat had longer carcasses than pigs in the pen (99.57 vs. 97.08 cm), which is consistent with the results of Farrell (1978), Lefaucheur et al. (1991) and Hsia and Lu (2004). Significantly lower weight of loin (4.89 vs. 5.32 kg) was observed in the control group of pigs in the pen. The weight of thigh was also higher in pigs housed in the climatic chamber than in the pen (8.88 vs. 8.39 kg). The lower weight of backfat and thigh fat weight showed the pigs influenced by high temperature, but there were no significant differences, as also found out by Hsia and Lu (2004). The carcass parameters of lean meat cuts and lean meat from thigh were higher in the experimental group than in the control group (54.29 vs. 53.16 %, 21.33 vs. 20.95 %), but they did not reach significance, which is consistent with the results of Hsia and Lu (2004) and Le Bellego et al. (2002).

Table 1 Effect of high ambient temperature on carcass traits

Trait (1)	Experiment $x \pm SD$ (2)	Control $x \pm SD$ (3)
Live weight at slaughter in kg (4)	105.79 ± 4.67	102.33 ± 5.44
Cold proportion of left half-carcass weight in kg (5)	41.07 ± 2.13	39.67 ± 2.25
Cold proportion of right half-carcass weight in kg (6)	41.71 ± 1.80	40.08 ± 2.01
Carcass length in cm (7)	99.57 ± 1.88	97.08 ± 2.87
Weight of loin in kg (8)	5.32 ± 0.27a	4.89 ± 0.31b
Weight of thigh in kg (9)	8.88 ± 0.45	8.39 ± 0.33
Weight of backfat in kg (10)	2.99 ± 0.84	3.06 ± 0.60
Thigh fat weigh in kg (11)	1.47 ± 0.39	1.63 ± 0.26
Lean meat cuts in % (12)	54.29 ± 2.38	53.16 ± 2.06
Lean meat from thigh in % (13)	21.33 ± 1.03	20.95 ± 1.08
Average backfat thickness in mm (14)	17.81 ± 6.05	21.33 ± 5.97
Loin eye area in cm^2 (15)	39.86 ± 9.65	40.68 ± 5.33

statistical significance: a, b $P \leq 0.05$; SD – standard deviation
štatistická preukaznosť: a, b $P \leq 0,05$; SD – smerodajná odchýlka

Tabuľka 1 Vplyv vysokej teploty prostredia na jatočné parametre
(1) ukazovateľ (2) pokus, priemer, smerodajná odchýlka, (3) kontrola, priemer, smerodajná odchýlka, (4) živá hmotnosť pred zabitím, (5) hmotnosť ľavej polovičky za studena v kg, (6) hmotnosť pravej polovičky za studena v kg, (7) dĺžka tela v cm (8) hmotnosť karé v kg, (9) hmotnosť stehna v kg, (10) hmotnosť chrbtovej slaniny v kg, (11) hmotnosť slaniny zo stehna v kg, (12) % cenných mäsových častí, (13) % mäsa zo stehna, (14) priemerná hrúbka chrbtovej slaniny v mm, (15) plocha *musculus longissimus thoracis* v cm^2

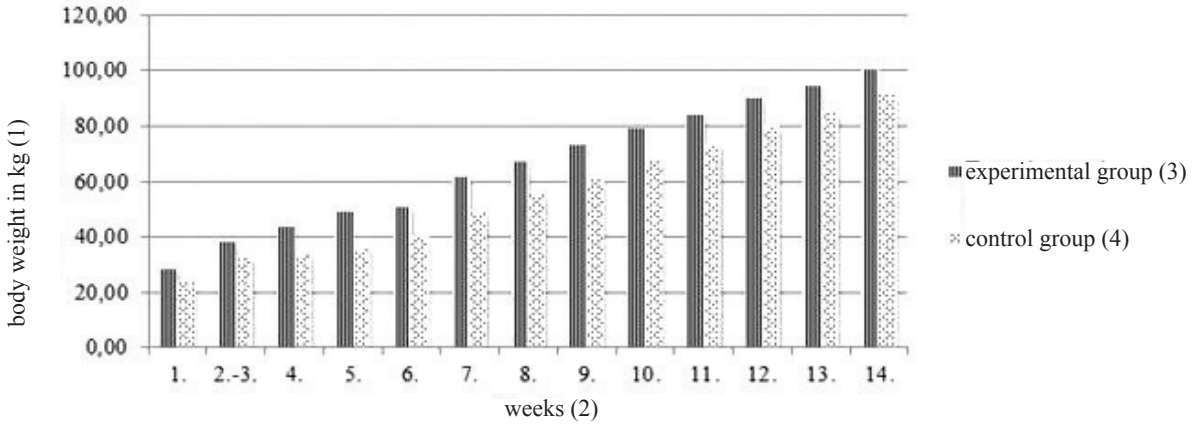

Figure 1 Average body weight of pigs in control and experimental group
Obrázok 1 Priemerná hmotnosť ošípaných v kontrolnej a pokusnej skupine
(1) hmotnosť v kg, (2) týždne, (3) pokusná skupina, (4) kontrolná skupina

The average backfat thickness was lower in the experimental group than in standard conditions (17.81 vs. 21.33 mm) and it decreased with increasing temperature, which was reported also by results of Rinaldo et al. (2000). The area of *M. longissimus thoracis* muscle was lower in pigs under heat burden as showed Fagundes et al. (2009) and Farrell (1978). The pigs fed *ad libitum* showed a significant effect of high temperature in reducing back-fat thickness and eye muscle area.

Figure 1 shows the average body weight of the pigs during the experiment. The pigs in the climatic chamber (experimental group) reached higher body weight than the control group every week during the trial what is in contradiction with the results of Fagundes et al. (2009) and Myer and Bucklin (2009), who pointed out that pigs reared during the summer grew slower and required more feed per unit of weight gain than a group of pigs reared during the autumn. The obtained results showed that the pigs influenced by high temperature had significantly higher average body weight during the 5 weeks at the beginning of the experiment, than in the pen. The pigs had also significantly higher average body weight than in standard conditions during the week 7. – 10. and week 11. – 13.

Conclusion

The presented results indicated that the high constant long term ambient temperature (30 °C) in the climatic chamber compared to standard conditions (20.25 °C) showed that rearing pigs in the high ambient temperature resulted in non-significantly higher average body weight. Higher temperature in the climatic chamber caused non-significantly lower fat tissue and higher percentage of lean meat in carcass. The weight of loin was significantly higher compared to normal conditions.

Súhrn

Vplyv vysokej teploty prostredia na jatočné parametre bol skúmaný na 13 ks výkrmových ošípaných plemena biela ušľachtilá. Ošípané boli rozdelené do dvoch skupín. Experimentálna skupina bola ustajnená v klimatickej komore s konštantnou teplotou (30 °C) a kontrolná skupina ošípaných bola umiestnená v kotercoch (pri priemernej teplote 20,25 °C) v štandardných podmienkach stanice výkrmnosti a jatočnej hodnoty. Ošípané boli zabité pri dosiahnutí 100 kg telesnej hmotnosti. Výsledky poukázali na to, že vyššia priemerná telesná hmotnosť bola dosiahnutá v priebehu celého experimentu v experimentálnej skupine ošípaných, rozdiely neboli štatisticky preukazné. Hmotnosť karé bola vyššia (P <0,05) v skupine ošípaných v dlhodobej tepelnej záťaži v porovnaní so skupinou v štandardných podmienkach (5,32 proti 4,89 kg). Hmotnosť stehna, percentuálny podiel cenných mäsitých častí, podiel mäsa zo stehna boli tiež vyššie v pokusnej skupine ošípaných v porovnaní s kontrolnou skupinou. Naopak, hmotnosť chrbtovej slaniny, hmotnosť slaniny zo stehna a priemerná hrúbka chrbtovej slaniny bola v pokusnej skupine ošípaných nižšia. Rozdiely neboli štatisticky významné. Z výsledkov vyplýva, že dlhodobo vysoká teplota prostredia sa prejavila nepreukazne nižším obsahom tukového tkaniva a vyšším percentuálnym podielom mäsa v jatočne opracovanom tele ošípaných. Štatisticky významne sa zvýšila hmotnosť karé.

Kľúčové slová: ošípané, jatočné parametre, vysoká teplota prostredia

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