

Some carcass traits and physicochemical composition of White Improved breed goat kids slaughtered at 90 and 180 days of age (Short Communication)

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Abstract

The research aimed at analysing the slaughter value and physicochemical attributes of goat kids slaughtered at 90 and 180 days of age. After weaning at 60 days of age, a balanced mixture containing 18.2% of protein and 5.63 MJ of net energy was applied as a feed. Some traits of live and slaughtered animal weight attributes were analysed. Moreover, tissue composition of the half carcass and meat physicochemical properties of meat were determined. The carcass of older male kid goats was by 5.08 kg ($P \leq 0.05$) heavier and the weight of primal cuts ($P \leq 0.05$) including high-priced cuts was by 0.87 kg higher than the young kids. Half carcass tissue composition of older and younger kids was similar: 60.13-60.50% of meat, 25.48-25.37% of bones, and 14.39-14.13% of fat. Significant differences ($P \leq 0.05$) in fat and bone contents were only found in the leg. Furthermore, physicochemical properties indicated that the meat of older animals was darker and had higher values of chemical parameters.

Keywords: goat kids, meat performance, valuable cuts, meat quality, chemical traits, physical properties

Zusammenfassung

Schlachtmerkmale von Kitzen der Veredelten Weißen Ziege geschlachtet am 90. und 180. Lebenstag (Kurzmitteilung)

Ziel der Untersuchung waren die Ermittlung des Schlachtwertes und physikochemischer Merkmale bei Ziegenkitzen der veredelten Weißen Ziege im Alter von 90 und 180 Tagen. Nach dem Absetzen der Kitzen am 60. Tag erhielten die Tiere ein Mischfutter mit 18,2% Eiweiß und 5,63 MJ Nettoenergie. Erfasst wurden das Schlacht- und Hälfengewicht, die Gewebezusammensetzung, die Teilstückanteile sowie physiochemische Merkmale des Fleisches. Die älteren Kitzen waren um 5,08 kg schwerer unterschieden sich jedoch sowohl in den Anteilen wertvoller Fleischteile als auch den Anteilen der einzelnen Teilstücke nicht. Während bei den pH-Werten keine Unterschiede zwischen den Gruppen auftraten, war das Fleisch der älteren Tiere dunkler und wies einen höheren Trockensubstanz-, Rohprotein-, Fett- und Ascheanteil auf.

Schlüsselwörter: Ziege, Kitz, Fleischleistung, wertvolle Teilstücke, Fleischqualität, chemische Eigenschaften

Introduction

Meat of young goats is a material of full value, which can be utilised in the production of healthy meat. It is characterised by a low intramuscular fat content and a high level of protein and mineral elements (KĘDZIOR *et al.* 1997, KESAVA RAO *et al.* 2003, PIENIAK-LENDZION *et al.* 2003, SEN *et al.* 2004, SIKORA and BORYS 2006, BRZOSTOWSKI *et al.* 2008).

Research on goat kids slaughtered at various body weights showed different results. They presented that the content of high-priced cuts and meat tissue in animals slaughtered at higher body weights was higher and the meat was characterised by more favourable physicochemical parameters (KASPRZYK and KRUPA 2000, MIOČ *et al.* 2001, TSHABALALA *et al.* 2003).

Intensive feeding increases the slaughter performance of goat kids, therefore it is profitable to fatten them more intensively to obtain heavier animals, cheap food is available and the demand for goat meat is high. The only exception to this is that the goat kids are destined to obtain the so-called (white meat). They are slaughtered at lower body weight and fed mainly on goat milk (KRUPA *et al.* 1995, KALINOWSKA *et al.* 1997, LUO *et al.* 2000, PIENIAK-LENDZION *et al.* 2005, STANISZ *et al.* 2005). Kids reared on this feeding system displayed higher growth rates (RINGDORFER 2001), better carcass conformation and fatness than smaller kids (DHANDA *et al.* 2003, PALA *et al.* 2005, PEÑA *et al.* 2007).

The research is aimed to analyse the slaughter value and physicochemical traits of castrated goat kids slaughtered at 90 and 180 days of age.

Material and methods

The experiment was carried out on White Improved breed goat kids, which were raised in tie-stall barns and fattened up to the age of 90 ($n=10$) and 180 ($n=10$) days.

After weaning at 60 days of age, a balanced mixture, containing 18.2% of protein, 88.6% of dry matter, 5.46% of fibre and 5.63 MJ of net energy (NE), was applied as a feed. The feeding was supplemented by an addition of meadow hay. The animals were fed *ad libitum*, castrated and raised in tie-stall barns on deep litter. The slaughtering and analyses were performed in accordance with the methodology for small ruminants used by the Institute of Animal Husbandry (NAWARA *et al.* 1963). After 24 h cooling at the temperature of 4°C the division into cuts was carried out. Next the cuts were dissected into meat, fat and bone tissues.

Meat samples of the broadest back (*m. longissimus dorsi*) were subjected to chemical analyses, including to the contents of dry matter (drier method, 105°C), protein (Kjeldahl's method) and fat (Soxhelt's method). The muscle was also used to test water-holding capacity by the Grau-Hamm's method, the values of pH were measured after 4 min and 24 h of the slaughter (CP-315 integrated electrode pH-meter), and muscle fibre darkening was analysed (*m. semimembranosus*) with the Minolta ChromaMeter CR-300.

Statistical analyses of variance were conducted using ANOVA test, and significance of differences between means and groups (90 days and 180 days) were compared by Tuckey's test.

The results were verified statistically by t-test using STATISTICA 6.0 PL software (2002).

Results

The average body weight (Table 1) of the goat kids slaughtered at 180 days of age was significantly higher by 9.86 kg compared with the weight of younger goat kids. Moreover, the weight of cooled carcass obtained from older animals was significantly higher by 5.08 kg and amounted to 14.64 kg in the present study. Carcass weight losses were similar and ranged from 1.64 to 2.17%. However, the percentage of high-priced cuts in the half carcass was similar in both examined groups and ranged from 36.53 to 36.58%.

Table 1
Body weight goat kids, slaughter value and tissue composition in half-carcass
Körpergewicht der Kitzen, Schlachtwert und Gewebezusammensetzung der Schlachthälften

Traits	90 days, mean±SE,	180 days, mean±SE,
Body weight at the slaughter, kg	20.57±2.99 ^A	30.43±3.41 ^B
Carcass weight chilled, kg	9.56±1.53 ^a	14.64±1.89 ^b
Loss during cooling, %	1.64±0.08	2.17±0.15
Body right half-carcass, kg	4.92±0.82 ^a	7.31±0.95 ^b
Valuable cuts in half-carcass, %	36.58±5.34	36.53±4.67
<i>Tissue composition, %</i>		
Leg		
Meat	69.08±4.76	69.54±6.41
Fat	10.49±2.31 ^a	11.53±8.05 ^b
Bones	20.43±2.00 ^a	18.93±3.12 ^b
Half-carcass		
Meat	60.13±5.80	60.50±6.00
Fat	14.39±1.10	14.13±7.10
Bones	25.48±1.15	25.37±1.28

^{a,b} $P \leq 0.05$, ^{A,B} $P \leq 0.01$, SE standard deviation

It indicates that age did not influence significantly their content in the half carcasses. There were found statistically significant differences ($P \leq 0.05$) in the weights of the following primal cuts: chuck, neck, rib, loin, leg, fore shank and shin, in favour of older goat kids, which is an obvious phenomenon due to higher carcass weight (Table 2). High-priced cut weights in older goat kids were larger by 0.87 kg. The weights of leg, rib and loin were larger by 0.58, 0.14 and 0.15 kg, respectively. The leg content in the half carcass was similar in both groups and it ranged from 24.35 to 24.39%. Kid carcasses slaughtered at the age of 180 days of life contained significantly ($P \leq 0.05$) more kidney fat (3.28 vs. 2.64%).

Dissection results (Table 1) revealed that the fat tissue content in older goat kids was larger by 1.04% and the bone tissue content was lower by 1.5% lower. It is an indicator of fat accumulation in legs of older goat kids aged 180 days, which may indicate the slaughter period. No significant differences in the content of individual tissues were found in relation to the whole half carcass. Meat content slightly exceeded 60% and it was similar in both examined groups. The analysis of tissue composition showed that the culinary meat content in the leg was over 69%.

Physicochemical traits of meat are shown in Table 3. The contents of dry matter, protein, fat and mineral compounds in meat of goat kids slaughtered at 180 days of age were significantly larger by 1.55, 0.93, 0.69 and 0.04%, respectively. The W/P (water-

protein) index indicates meat maturity and it was significantly higher in the group of goat kids slaughtered at 90 days of age and amounted to 3.98.

Table 2
The composition of cuts half-carcass
Anteile der Teilstücke

Traits	90 days		180 days	
	Mean±SE, kg	Mean±SE, %	Mean±SE, kg	Mean±SE, %
Neck	0.34±0.07 ^a	6.91±1.41	0.47±0.08 ^b	6.43±1.10
Middle neck	0.48±0.09 ^a	9.76±1.81	0.72±0.10 ^b	9.85±1.37
Shoulder	0.76±0.11 ^a	15.45±2.22	1.15±0.15 ^b	15.73±2.05
Tlank with ribs	0.65±0.09 ^a	13.21±1.81	0.97±0.12 ^b	13.27±1.65
Cutlet	0.31±0.05 ^a	6.30±0.99	0.45±0.06 ^b	6.16±0.81
Leg	1.20±0.16 ^a	24.39±3.18	1.78±0.24 ^b	24.35±3.29
Loin	0.29±0.05 ^a	5.89±1.10	0.44±0.05 ^b	6.02±0.69
Sternum	0.22±0.04	4.47±0.81	0.29±0.03	3.97±0.40
Fore shank	0.23±0.03 ^a	4.67±0.65	0.36±0.04 ^b	4.92±0.54
Hind shank	0.25±0.03 ^a	5.08±0.60	0.39±0.04 ^b	5.34±0.55
Kidneys	0.06±0.01	1.23±0.21 ^a	0.05±0.01	0.68±0.09 ^b
Fat kidney's	0.13±0.02 ^A	2.64±0.42 ^a	0.24±0.03 ^A	3.28±0.54 ^b

^{a,b} $P \leq 0.05$, ^{A,B} $P \leq 0.01$, SE standard deviation

Table 3
Chemical composition and physical properties of muscles
Physiochemische Fleischmerkmale

Items	90 days, mean±SE	180 days, mean±SE
pH ₁	6.00±0.14	6.03±0.11
pH ₂	5.66±0.13	5.66±0.18
Colour L*	42.46±3.09 ^A	37.34±1.66 ^B
Water-holding capacity, %	24.34±1.43	24.01±0.95
Dry matter, %	21.62±0.24 ^A	23.17±0.24 ^B
Crude protein, %	19.71±0.41 ^A	20.64±0.15 ^B
Fat, %	1.30±0.15 ^A	1.99±0.07 ^B
Ash, %	1.05±0.02 ^a	1.09±0.01 ^b
Index W/P	3.98±0.13 ^a	3.72±0.16 ^b

^{a,b} $P \leq 0.05$, ^{A,B} $P \leq 0.01$, SE standard deviation

Among the analysed physical meat traits, significant differences were found only in the case of colour darkness. The values of L* reading for tissue indicate a lighter colour of meat obtained in younger goat kids and the differences between them were highly significant. As far as pH₁ measurement is concerned, after 45 min pH₁ was higher in the meat of older animals and amounted to 6.03, whereas after 24 h pH₂ decreased to 5.66. This phenomenon is a symptom of glycolysis – the process which contributes to meat acidity.

Discussion

The average body weight of the kids slaughtered was similar to the results obtained in earlier studies by the authors (PIENIAK-LENDZION *et al.* 2005) and the research results, concerning different period of goat kid slaughter, by other researchers (SEN *et al.* 2004, STANISZ and GUT 2005, KOYUNCU *et al.* 2007). In the studies carried out on 5-month goat

kids with the Boer breed genes, STANISZ and GUT (2005) obtained the content of high-priced cuts and leg amounting to 35.63 and 23.14%, respectively. A higher percentage of leg and lion in the half carcass was found by SEN *et al.* (2004), the respective values were 28.19% and 13.43%.

TSHABALALA *et al.* (2003) obtained congruent results in relation to the meat tissue content in half carcasses of the goat kids. They obtained larger values of meat tissue (76.19-78.06%) and bone tissue (20.16-22.74%) in legs of castrated kids in relation to the breed than in the presented study. On the other hand, LUO *et al.* (2000) recorded a lower content of meat tissue (57.1%) and higher fat and bone fibre percentage (20.2 and 20.6%, respectively) in goat kids slaughtered at 50 weeks of age. Kid carcasses of Florida breed were characterized by different content of cuts according to the slaughtering weight (PEÑA *et al.* 2007). The slaughtering weight did not significantly affect the long leg content (30-33%), back content (18-19%) and neck content (8-10%); however, it affected rib content (23-25%). The carcasses contained 57-58% of muscles, 20-25% of bone, 5-6% subcutaneous fat and 9-12% of intramuscular fat.

The effect of castration of Turkish hair kids (weaning at 160-216 days) had no significant effect on the content of primal cuts in the whole carcasses (57.29-57.42%), excluding the long leg and ribs. The bone (9.56 vs. 7.09%) and muscle (52.05 vs. 56.50%) contents of carcasses differed significantly between intact males and castrated (KOYUNCU *et al.* 2007). The content of culinary meat in the leg was similar to the values obtained by KĘDZIOR *et al.* (1997) as well as earlier studies by PIENIAK-LENDZION *et al.* (2003). On the contrary, SEN *et al.* (2004) recorded 76.77% of meat tissue and 6.93% of fat tissue in the leg.

The results obtained in relation to dry matter and protein contents, were similar to the earlier studies on the Polish White Improved breed (23.53 and 20.21%, respectively) (PIENIAK-LENDZION *et al.* 2005) and the research on the Alpine and Saan breeds (23.74 and 19.64%; 21.96 and 20.65%, respectively) (MIOČ *et al.* 2001). The higher fat content in meat at the age of 180 days (1.99%) was also reported by GRUSZECKI *et al.* (2006) in lambs of 35 kg of body weight. The value of the W/B index calculated by KESAVA RAO *et al.* (2003) was within the limits of 3.10-3.87 according to the protein content in the ration. The higher the protein content was the higher value of W/B index obtained. Meat of French Alpine kids compared to meat of French Alpine × Boer crossbreed contained higher ($P \leq 0.05$) index W/P (4.18), and lower dry matter content (22.21%) and crude protein content (19.44%) (BRZOSTOWSKI *et al.* 2008).

The mean values of pH₁ at the age of 90 and 180 days of life (6.00 vs. 6.03) and pH₂ (5.66) were within a range (5.5-5.9) considered optimal for high-quality goat meat (STANISZ and GUT 2005, HEROLD *et al.* 2007, BRZOSTOWSKI *et al.* 2008). KESAVA RAO *et al.* (2003) observed a decrease of pH₂ to 5.71 after 24 h, whereas SEN *et al.* (2003) obtained even lower pH₂ value (5.48) in 5-to-6-month old goat kids.

In conclusion, the current study had confirmed that prolonged fattening of goat kids up to 180 days of age with the same balance mixture enabled the authors to obtain higher values of parameters for most analysed slaughtering traits. In spite of the fact that the weight of high-priced cuts was higher, their contents in the half carcass were similar in both analysed groups (36.53-36.58%). Significantly higher percentage of fat and bone

tissue were recorded in the group of older goat kids but the meat tissue content in the whole half carcass was alike. The adequate physicochemical composition of goat kid meat determined its dietary as well as culinary value. It should be stressed that the meat of goat kids slaughtered at 180 days of age contained more dry matter, protein, fat and mineral compounds and it was of a darker colour.

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Received 21 May 2008, accepted 5 May 2009.

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