# A comparison of carcass proportions in Czech Pied and Montbeliarde bulls with a high carcass weight

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**ABSTRACT**: The aim of the experiment was to compare the carcass composition of 20 Montbeliarde bulls (M) and 20 Czech Pied bulls (C). The carcass weight of the animals in one group varied minimally and was about 380 kg. The Montbeliarde bulls showed a higher growth rate, expressed by a significantly lower ($P < 0.01$) age at slaughter (562.6 vs. 626 days) while the live weight (682.9 vs. 690.6 kg) and carcass weight (380.4 vs. 382.6 kg) were comparable, which resulted in a significantly higher ($P < 0.01$) daily weight gain (1.142 vs. 1.045 kg) and net weight gain (0.676 vs. 0.615 kg). The Montbeliarde bulls showed a greater ($P < 0.05$) height at rump (144.0 vs. 140.2 cm), worse carcass conformation according to SEUROP (3.24 vs. 2.84), lower proportion of forequarter (44.7 vs. 45.7%) and higher proportion of hindquarter (55.3 vs. 54.3%). As for the carcass composition, no significant inter-breed differences were found in weights and proportions of shanks, meat trimmings, separable fat, bones, round, loin, filet, flank with rib, flank, shoulder and chuck. The Montbeliarde bulls had a significantly lower ($P < 0.05$) weight and proportion of neck (10.1 vs. 11.1 kg and 5.4 vs. 5.9%) and weight of brisket and rib (17.6 vs. 18.7 kg) and proportion of brisket and rib (9.4 vs. 9.9%, $P < 0.01$).

**Keywords**: Czech Pied; Montbeliarde; beef; carcass value; carcass composition

Czech Pied breed plays an important role in beef production in the Czech Republic. Lately, the milk performance of Czech Pied cattle has been increased by an improved nutrition (Bartoň *et al.*, 1996a) and immigration of dairy cattle genes into the population. Consequently, these changes had a negative impact on the meat performance of Czech Pied cattle. The aim of breeding is to minimize the depression of meat performance and to ensure satisfactory feedlot performance and good carcass composition. Therefore, the import of breeding bulls and semen of pied breeds of the Simmental origin was renewed (Golda *et al.*, 1988).

French Montbeliarde cattle are one of those breeds. Compared to Czech Pied cattle, the breeding of Montbeliarde cattle focuses more on milk performance. Breeders' attention abroad is also paid to milk performance rather than to meat performance of Montbeliarde cattle; they are supposed to have the best dairy parameters out of the dual-purpose breeds of Simmental origin. Therefore, foreign references concerning their meat production are scarce (Mikšík *et al.*, 1996).

Morisse *et al.* (1990) analysed the internal fat deposition in Montbeliarde bulls of carcass weights 315, 341 and 382 kg, respectively, with daily weight gains 995, 1 107 and 1 193 g, respectively. They found the high internal fat deposition in bulls of the same age (21.7–26.4 kg) that tended to grow with an increasing growth rate.

Warzecha *et al.* (1995) compared the feedlot performance of Fleckvieh and Montbeliarde bulls fattened up to 715 and 698 kg. The daily weight gains exceeded 1 000 g. Both breeds had the same dressing percentage (58.3%). Fleckvieh got a better conformation score in EUROP classification (2.6–3.0) while the fatness score in both groups was 2.7.

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Golda *et al.* (1988) compared the meat performance of Czech Pied bulls and their crosses with Montbeliarde cattle. The crosses reached the slaughter weight of 575.3 kg at the age of 499.8 days. The daily weight gain was 1 081 g, dressing percentage was 58.1% and net weight gain 0.669 kg. The authors found no significant differences between the crosses and pure-bred bulls in the weight of flank with rib (8.2 kg), flank (7.2 kg), round including bones (50.0 kg) bones in hind- and forequarter (12.5 kg and 13.7 kg), separable fat in hind- and forequarter (3.8 kg and 0.7 kg) and loin with filet (17.6 kg). The crosses had a significantly higher ($P < 0.05$) weight of brisket and rib (18.3 kg vs. 17.5 kg) and weight of neck with chuck (33.6 kg vs. 30.9 kg, $P < 0.01$) while the weight of shoulder with shank was significantly lower (24.2 kg vs. 25.7 kg, $P < 0.01$).

Mikšík *et al.* (1996) evaluated the meat performance of Montbeliarde and Czech Pied bulls; subsequent analyses were carried out by Šubrt *et al.* (1997) and Šubrt and Mikšík (2002). No interbreed differences were found in slaughter weight (557 kg and 538 kg), age at slaughter (524 days and 527 days), daily weight gain (1 060 g and 987 g), net weight gain (622 g and 588 g), dressing percentage (58.51% and 57.62%), carcass conformation score (1.9 and 2.0) and fatness score (1.2 and 1.1). No differences were detected in the weight of the right half of carcass, forequarter and hindquarter (164.2 kg and 153.7 kg, 76.1 kg and 71.7 kg and 88.1 kg and 82.0 kg, respectively), round (48.3 kg and 45.6 kg), loin (15.4 kg and 15.7 kg), filet (1.97 kg and 1.82 kg) and shoulder (20.3 kg and 19.0 kg).

Recent reduction in the cattle population and stagnation of prices of slaughter animals resulted (in order to maintain a certain level of income) in the fattening of bulls to higher live weights, i.e. weights exceeding 650 kg (according to Vrchlabský *et al.*, 1988). Therefore it is desirable to compare the meat performance of bulls of both breeds slaughtered at higher live weights.

No detailed information on the carcass composition of bulls slaughtered at such weights is available, however, Župka *et al.* (1985), Vrchlabský *et al.* (1988) and Bartoň *et al.* (1996) studied the meat performance of bulls slaughtered at higher live weights. Župka *et al.* (1985) analysed the meat performance of bulls fattened to 644.3 kg and found out the carcass weight of 366 kg. Vrchlabský *et al.* (1988) compared bulls slaughtered at 706.3 kg and 635.5 kg of live weight. A higher slaughter weight was associated with a higher weight and proportion of kidney fat (13.4 kg and 3.16% vs. 11.6 kg and 3.09%) and a lower proportion of bones (13.85% vs. 14.6%) but the differences were not statistically significant. The total proportion of meat declined in both groups of bulls with a higher slaughter weight; the proportion of leg was lower by 2.6% and 4.4%, respectively. Bartoň *et al.* (1996a) presented meat performance characteristics of bulls slaughtered at the weight of 613.5 kg, at the age of 655.8 days; the daily weight gain was 0.893 kg, dressing percentage 58.9% and net weight gain 0.551 kg. The weight and proportion of prime quality meat were 69.8 kg and 39.6% and of low quality meat 73.4 kg and 41.013%.

In bulls with a slightly lower carcass weight (341.2 kg) Voříšková *et al.* (1998) found out dressing percentage 57.5%, weight of right side 169.46 kg, forequarter 80.27 kg and hindquarter 89.18 kg. The weight and proportion of loin were 5.78 kg and 3.41% and filet 2.04 kg and 1.21%.

Nová and Louda (2000) also analysed the carcass composition of bulls with a lower (307.0 kg) carcass weight and found out the weight and proportion of brisket and rib and flank with rib 42.3 kg and 13.7%, meat trimmings in forequarter and hindquarter 33.7 kg and 11.0% and fore and hind shanks 16.0 kg and 5.2%.

Nová and Louda (1999) presented some body dimensions of Czech Pied bulls at the age of 365 days: height at withers 118.5 cm and at rump 124.1 cm. Bartoň *et al.* (1996b) determined the height at withers 130.7 cm and at rump 138.1 cm in Czech Pied bulls at the age of 594.6 days and live weight of 572.6 kg; the carcass weight of bulls was 337.1 kg.

The aim of the study was to compare carcass proportions of purebred Montbeliarde and Czech Pied bulls with a high carcass weight of 380 kg.

## MATERIAL AND METHODS

The experiment was carried out in two groups: 20 Czech Pied bulls and 20 Montbeliarde bulls. The animals were loose-housed with no bedding and fed an identical diet with the aim of reaching on average 380 kg of carcass weight after slaughter.

The diet consisted of an ad lib amount of maize silage and a limited amount of protein concentrate (containing an adequate amount of minerals and vitamins). The daily ration was calculated in order to achieve predicted daily weight gain 1.25 kg as recommended by Sommer *et al.* (1994).

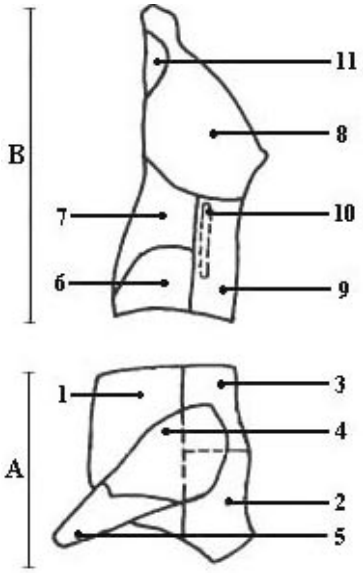


Figure 1. Chart of carcass dissection

A = Forequarter; B = Hindquarter
1 = brisket an rib; 2 = neck; 3 = chuck; 4 = shoulder; 5 = fore shank; 6 = flank with rib; 7 = flank; 8 = round; 9 = loin; 10 = filet; 11 = hind shank

The following meat production parameters were evaluated on the day of slaughter: live weight and age, daily weight gain and net weight gain, carcass weight, dressing percentage, carcass conformation and fatness, height at rump and at withers. On the following day (24 hours) the weight of the right side and the weight and proportion of forequarter and hindquarter were determined. Then the side was dissected (Figure 1) and the weight and proportion of fore and hind shanks, meat trimmings, separable fat, bones, round, loin, filet, flank with rib, flank, neck, shoulder, chuck, brisket and rib were measured and calculated. The data were analysed for the mean values ($\bar{x}$), standard deviations ($s_{\bar{x}}$) and coefficients of variation $V$ (%). GLM method was applied to determine the observed effects of breed.

Values in tables marked with different letters A or B and a or b, respectively, are different on the level of 99% ($P < 0.01$) or on the level of 95% ($P < 0.05$).

## RESULTS

The effect of breed on feedlot performance parameters is described in Table 1. The overall ($n = 40$) mean carcass weight was 381.5 kg, slaughter weight 686.7 kg, age at slaughter 594.3 days, height at withers 137.3 cm, height at rump 142.2 cm, weight of right side 187.2 kg, daily weight gain 1.094 kg, net weight gain 0.645 kg, dressing percentage 55.6%, meat class 3.04 and fat class 2.24 according to SEUROP. While the difference in the carcass weight

Table 1. The effect of breed on some parameters of feedlot performance

| Parameter | Units | $\bar{x}$ ($n = 40$) | $s_{\bar{x}}$ | $V$ (%) | Breed | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Czech Pied ($n = 20$) | $P$ | Montbeliarde ($n = 20$) | $P$ |
| Carcass weight | kg | 381.5 | 26.8 | 7.09 | 382.6 | | 380.4 | |
| Slaughter weight | kg | 686.7 | 38.7 | 5.67 | 690.6 | | 682.9 | |
| Age at slaughter | day | 594.3 | 59.0 | 9.94 | 626.0 | A | 562.6 | B |
| Daily weight gain | kg | 1.094 | 0.096 | 8.82 | 1.045 | A | 1.142 | B |
| Height at withers | cm | 137.3 | 38.7 | 5.67 | 136.3 | | 138.2 | |
| Height at rump | cm | 142.2 | 0.096 | 8.82 | 140.2 | a | 144.0 | b |
| Right side weight | kg | 187.2 | 11.67 | 6.23 | 187.9 | | 186.5 | |
| Daily net gain | kg | 0.645 | 0.054 | 8.44 | 0.615 | A | 0.676 | B |
| Dressing percentage | % | 55.6 | 2.20 | 3.97 | 55.4 | | 55.8 | |
| SEUROP meat class[1] | points | 3.04 | 0.57 | 18.8 | 2.84 | a | 3.24 | b |
| Fat class[2] | points | 2.24 | 0.67 | 29.9 | 2.09 | | 2.38 | |

A, B = $P < 0.01$; a, b = $P < 0.05$
[1]Scale SEUROP (1 = S to 6 = $P$); [2]Scale 1 = (leanest) to 5 = $P$ (fattest)

Table 2. Weight and proportion of the parts of forequarter

| Parameter | Units | $\bar{x}$ ($n$ = 40) | $s_{\bar{x}}$ | $V$ (%) | Breed | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Czech Pied ($n$ = 20) | $P$ | Montbeliarde ($n$ = 20) | $P$ |
| Forequarter | kg | 84.6 | 5.99 | 7.08 | 85.9 | | 83.2 | |
| | % | 45.2 | 1.34 | 2.96 | 45.7 | a | 44.7 | b |
| Brisket and rib | kg | 18.1 | 1.82 | 10.05 | 18.7 | a | 17.6 | b |
| | % | 9.7 | 0.66 | 6.80 | 9.9 | A | 9.4 | B |
| Neck | kg | 10.6 | 1.72 | 16.22 | 11.1 | a | 10.1 | b |
| | % | 5.6 | 0.83 | 14.82 | 5.9 | a | 5.4 | b |
| Chuck | kg | 9.2 | 1.27 | 13.18 | 9.4 | | 9.1 | |
| | % | 4.9 | 0.54 | 11.02 | 5.0 | | 4.9 | |
| Shoulder | kg | 11.6 | 0.95 | 8.19 | 11.9 | | 11.4 | |
| | % | 6.2 | 0.48 | 7.74 | 6.3 | | 6.1 | |
| Fore shank | kg | 6.8 | 0.94 | 11.12 | 6.7 | | 6.9 | |
| | % | 3.6 | 0.45 | 12.50 | 3.6 | | 3.7 | |
| Bones | kg | 12.9 | 0.56 | 4.34 | 13.0 | | 12.9 | |
| | % | 6.9 | 0.32 | 4.64 | 6.9 | | 6.9 | |
| Meat trimmings | kg | 13.2 | 2.56 | 19.39 | 13.1 | | 13.3 | |
| | % | 7.0 | 1.23 | 17.57 | 7.0 | | 7.1 | |
| Separable fat | kg | 2.1 | 0.87 | 41.43 | 2.2 | | 2.0 | |
| | % | 1.1 | 0.45 | 40.91 | 1.2 | | 1.0 | |

A, B = $P < 0.01$; a, b = $P < 0.05$

was minimum (+2.2 kg), the Czech Pied bulls had a significantly higher ($P < 0.01$) age at slaughter (+63.4 days), lower ($P < 0.01$) daily weight gain and net weight gain (–0.097 kg and –0.061 kg, respectively), lower ($P < 0.05$) height at rump (–3.8 cm) and meat class (–0.4) compared to the Montbeliarde bulls. The other differences were not significant – weight at slaughter (+7.7 kg), height at withers (–1.9 cm), weight of right side (+1.4 kg), dressing percentage (–0.4%) and fat class (–0.29).

The weight and proportion of the parts of forequarters are presented in Table 2. The overall ($n$ = 40) mean weights and proportions were as follows: forequarter 84.6 kg and 45.2%, brisket and rib 18.1 kg and 9.7%, neck 10.6 kg and 5.6%, chuck 9.2 kg and 4.9%, shoulder 11.6 kg and 6.2%, fore shank 6.8 kg and 3.6%, bones 12.9 kg and 6.9%, meat trimmings 13.2 kg and 7.0%, separable fat 2.1 kg and 1.1%. The Czech Pied bulls had a significantly higher proportion of brisket and rib (+0.5%, $P < 0.01$) and weight of brisket and rib (+1.1 kg, $P < 0.05$), weight and proportion of neck (+1.0 kg and +0.5%, both $P < 0.05$) and proportion of forequarter (+1.0%, $P < 0.05$). The other differences were not statistically significant: weight of forequarter (+2.7 kg), weight and proportion of chuck (+0.3 kg and +0.1%), shoulder (+0.5 kg and +0.2%), fore shank (–0.2 kg and –0.1%), bones (+0.1 kg and 0.0%), meat trimmings (–0.2 kg and –0.1%) and separable fat (+0.2 kg and +0.2%).

The weight and proportion of the parts of hindquarters are presented in Table 3. The overall ($n$ = 40) mean weights and proportions were as follows: hindquarter 102.6 kg and 54.8%, flank with rib 12.3 kg and 6.6%, flank 8.3 kg and 4.4%, round 32.3 kg and 17.2%, loin 8.3 kg and 4.5%, filet 2.4 kg and 1.3%, hind shank 4.4 kg and 2.4%, bones 15.8 kg and 8.4%, meat trimmings 15.6 kg and 8.3% and separable fat 1.8 kg and 0.9%. The Czech Pied bulls had a significantly lower ($P < 0.05$) proportion of hindquarter (–1.0%). The other differences were not statistically significant: weight of hindquarter (–1.0 kg), weight and proportion of flank with rib (0.0 kg and –0.1%), flank (0.0 kg and –0.1%), round (–0.3 kg and –0.2%), loin (–0.1 kg and –0.1%), filet (0.0 kg and 0.0%), hind shank (–0.1 kg and –0.1%),

Table 3. Weight and proportion of the parts of hindquarter

| Parameter | Units | $\bar{x}$ ($n$ = 40) | $s_{\bar{x}}$ | $V$ (%) | Breed | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Czech Pied ($n$ = 20) | $P$ | Montbeliarde ($n$ = 20) | $P$ |
| Hindquarter | kg | 102.6 | 6.75 | 6.58 | 102.1 | | 103.1 | |
| | % | 54.8 | 1.34 | 2.44 | 54.3 | a | 55.3 | b |
| Flank with rib | kg | 12.3 | 1.91 | 15.53 | 12.3 | | 12.3 | |
| | % | 6.6 | 0.87 | 13.18 | 6.5 | | 6.6 | |
| Flank | kg | 8.3 | 1.18 | 14.22 | 8.3 | | 8.3 | |
| | % | 4.4 | 0.58 | 13.18 | 4.4 | | 4.5 | |
| Round | kg | 32.3 | 2.53 | 7.83 | 32.1 | | 32.4 | |
| | % | 17.2 | 0.84 | 4.88 | 17.1 | | 17.3 | |
| Loin | kg | 8.3 | 0.96 | 11.57 | 8.3 | | 8.4 | |
| | % | 4.5 | 0.47 | 10.44 | 4.4 | | 4.5 | |
| Filet | kg | 2.4 | 0.19 | 7.92 | 2.4 | | 2.4 | |
| | % | 1.3 | 0.08 | 6.25 | 1.3 | | 1.3 | |
| Hind shank | kg | 4.4 | 0.47 | 10.68 | 4.4 | | 4.5 | |
| | % | 2.4 | 0.22 | 10.48 | 2.3 | | 2.4 | |
| Bones | kg | 15.8 | 0.80 | 5.06 | 15.7 | | 15.8 | |
| | % | 8.4 | 0.42 | 5.00 | 8.4 | | 8.5 | |
| Meat trimmings | kg | 15.6 | 2.15 | 13.78 | 15.4 | | 15.9 | |
| | % | 8.3 | 0.90 | 10.84 | 8.2 | | 8.5 | |
| Separable fat | kg | 1.8 | 0.74 | 41.11 | 1.8 | | 1.7 | |
| | % | 0.9 | 0.37 | 42.13 | 0.9 | | 0.9 | |

a, b = $P < 0.05$

bones (–0.1 kg and –0.1%), meat trimmings (–0.5 kg and –0.3%) and separable fat (+0.1 kg and 0.0%).

## DISCUSSION

The bulls of both breeds showed a better-than-average growth capacity in spite of their high slaughter weight. The Czech Pied bulls reached daily weight gains comparable to the values reported by Mikšík *et al.* (1996). However, significantly higher weight gains in the Montbeliarde bulls were in contrast with earlier results of e.g. Golda *et al.* (1988), who investigated Montbeliarde crosses, or Mikšík *et al.* (1996), who studied purebred Montbeliarde bulls. On the contrary, they were comparable with the results of e.g. Morisse *et al.* (1990). This could probably be explained by the greater body frame of Montbeliarde bulls in connection with ad lib feeding of both breeds.

The greater body frame of Montbeliarde bulls was expressed in a greater height at rump and a tendency towards a greater height at withers. The difference between the Montbeliarde and Czech Pied bulls was evident even though the Czech Pied bulls included in the experiment had a great body frame (compared to their breed standard). This finding was supported by the results of Bartoň *et al.* (1996b) or Nová and Louda (1999), despite of the age and weight differences of their experimental animals. While the difference between height at rump and height at withers was only +3.9 cm in the Czech Pied bulls, it was +5.8 cm in the Montbeliarde bulls. The comparison of both values suggested that the further growth potential was higher in the Montbeliarde bulls than in the Czech Pied bulls.

A greater body frame of the Montbeliarde bulls probably impaired their meat class. In animals with the identical carcass weight, a greater height at rump was the main cause of worse roundness of leg which is crucial for meatiness classification. A similar relation was likely to occur between the height at withers and the roundness of shoulder, though expressed to a smaller extent.

Worse carcass conformation and similar carcass fatness of our bulls corresponded with the results of Warzecha *et al*. (1995) despite of the fact that the authors compared Montbeliarde bulls with Fleckvieh.

Our hindquarter: the forequarter ratio was higher than that presented by Golda *et al*. (1989) or Mikšík *et al*. (1996), which was probably caused by a higher slaughter weight (by as much as 150 kg) of our animals.

Župka (1987) reported a tendency towards a caudal-cranial increase in allometric coefficients in growing animals, which means that the animals with a relatively higher proportion of hindquarter did not finish their growth. In our case, where Montbeliarde bulls had a higher proportion of hindquarters, this theory again suggested a hypothesis that the further growth potential of Montbeliarde bulls was higher than in the Czech Pied bulls.

As for the carcass composition, a higher proportion of forequarters in the Czech Pied bulls was mainly affected by higher proportions of brisket and rib and neck. A higher proportion of hindquarters in the Montbeliarde bulls was the result of cumulated non-significant tendencies towards greater proportions of all the parts of hindquarter. The comparison of the weight and proportion of the parts of carcass with literature sources was complicated by the way the carcass was processed. For example, Voříšková *et al*. (1998) presented weights of parts after being boned. On the contrary, Mikšík *et al*. (1996) included bones into the weight of the parts. Golda *et al*. (1989) applied a different way of dissection. Thus our results corresponded with findings of some authors, e.g. the weight and proportion of filet or loin presented by Voříšková *et al*. (1998), or they differed greatly from other authors, e.g. the weight of round presented by Mikšík *et al*. (1996) or loin with filet reported by Golda *et al*. (1989). In spite of some differences between the proportions of some parts of carcass, the carcass proportions in general were identical in both breeds and were not negatively affected by the high carcass weight.

It can be concluded that during fattening up to the carcass weight of 380 kg the Montbeliarde bulls showed a higher growth rate and their further growth potential was higher than in the Czech Pied bulls. In spite of the higher proportion of hindquarters and the lower proportion of forequarters of the Montbeliarde bulls (which resulted in the lower weight and proportion of brisket and rib and neck) carcass proportions in general were basically identical in both breeds and were not negatively affected by the higher weight of carcass.

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