EFFECTS OF WEIGHT AND AGE ON CARCASS YIELD AND CONFORMATION OF CATTLE

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Abstract: The aim of this research was to analyse effects of weight and age of dairy cattle breeds and their crossbreeds (423 bulls, 492 heifers and 567 cows) on carcass yield and conformation scores according SEUROP standard data. All animals were divided into groups according to pre-slaughter weight (50 kg interval) and according to age (2 months interval). For research, average ages of the animals were: bulls 19 months, heifers 20 months and cows 38 months. The highest average weight was determined in cows 521.2 kg, followed by heifers 461.7 kg and the least got bulls 456.2 kg however, on the average carcass yield bulls got the highest value of 51.3 percent, 50.1 percent of heifers and the least 47.8 percent of cows. When animals pre-slaughter weight an average increase of 50 kg, the carcass yield of bulls on average increased by 11.1 percent, of heifers - 0.72 and cows – 0.94 percent. In all studied groups of animals were obtained weak correlation links between age of animal and carcass yield. The strongest correlation links were obtained between the animal's weight and carcass weight of bulls (r = 0.93, p <0.001), heifers (r = 0.94, p <0.001) and cows groups (r = 0.91, p <0.01). It was revealed that, if age of cattle moderately increases for 2 months, then there was a moderate increase on carcass yield such as 0.21 percent in heifers (p <0.05) and 0.12 percent in cows groups (p <0.05). This relationship was not statistically significant in the bulls group. Mostly, the O muscularity class of carcasses were evaluated in all analysed animals groups, both depending from pre-slaughter weight and age. In the group of bulls evaluated O muscularity class carcasses were found moderate (76.8 percent), heifers (74.3 percent) and in group of cows (49.7 percent). However, a trend was observed that with animal's weight and age improved carcass yield and arise carcass muscularity class.

Keywords: cattle, carcass yield, muscularity class

Introduction

In many countries of intensive animal husbandry, the cattle breeding carried out considering not only according quantitative but also qualitative indicators of meat production *(Jukna et al., 2006, Jukna et al., 2010)*. The individual scientists maintain that on edible parts of carcass yield (without bones, tendons, and cartilages) with animal age increases *(Crews et al., 2003, Šmiecinska et al., 2006)*. The animal concerning of uneven individual tissue and organ growth intensity of carcass yield increases. Carcass yield and morphological composition of cattle depend on the breed, sex, feeding different growth periods, of the individual animal characteristics, of animal's condition and age *(Aleksic et al., 2001, Berg et al., 2003, Rotta et al., 2009, Huertas et al., 2010)*. Also, carcass morphological composition depends on the individual tissues ratio. The main are muscle, fat and bone tissues. Muscular tissue consists of about 50-65 percent of carcass. The most influence on carcass composition have animal's obesity degree. Between the two sides of the weight and quality of the categories there are a strong relationship, the major carcass weights associated with better body structure and higher animal obesity *(Aleksic et al., 1999, Culioli et al., 2003, Gečienė et al., 2007)*. Cattle carcasses according to age and sex are divided into categories: A - young (not older than two years) uncastrated bulls, B - other (over two years) uncastrated bulls C - oxen (castrated bulls), D - cows (cows that have calved) and E - heifers carcasses *(Jukna et al., 2009)*.

The muscle growth intensive on young cattle are the first 15-18 months of life. When full-fledged feeding in animal offspring muscle growth rate is significantly higher than the skeleton, this consist favourable conditions for the formation of muscular and heavy carcasses with very high valuable soft parts amount. Slaughter age and feeding system are the two main factors, the most influencing the animals' growth and carcass traits *(Matusevičius et. al., 2006, Bendikas et. al., 2009, Hilton et al., 2010, Veselá et al., 2011, Agastin et. al., 2013)*.

The fundamental purpose of beef cattle growing is to produce high-quality beef. Carcass yield and good muscularity and fat class are important factors for beef production profitability. Muscularity classification indicates of carcasses development, structure and quality. Cattle carcass quality are assessed according six SEUROP muscularity standard classes. In Lithuania is grown many dairy cattle, whose carcasses are of inferior quality, therefore mainly carcasses adequate the O and P muscularity classes *(Pečiulaitis et. al., 2007)*. Individual countries are verified subclasses system and muscularity and fat classes. Higher quality

muscularity class means, that there is more meat in the carcass and the slaughterhouse is usually assessed at a higher price *(Jamieson, 2013)*. In order that to get a good carcass yield and higher muscularity class most importantly to slaughter cattle to respective age and weight.

The aim of the study was to determine the pre-slaughter weight and age of cattle, its influence on carcass yield and carcass muscularity class.

Materials and Methods

In order to investigate the cattle weight and age influence on the carcass yield and quality, for the research data of slaughtered cattle in the years 2011-2012 was used from one slaughterhouse in Lithuania. For the study was used a total of 4890 slaughtered different dairy breeds and their crossbreeds with beef breeds cattle data, from the following: 423 bulls, 492 heifers and 567 cows. Cattle pre-slaughter weight was divided for every 50 kg intervals. Animals according to age were divided for every 2 months interval. Bulls, heifers and cows were separately grouped. For study have used different ages of the animals such as bulls 19 months, heifers 20 months and cows 38 months. Carcasses according of muscle development has been classified in accordance with SEUROP standard. Cattle carcasses classified by SEUROP classification with reference of Commission Regulation (EB) Nr. 1249/2008, 2008 on 10 December whereby determinable comprehensive Community of cattle, pig and sheep of carcases classification scale use and the report about the carcass prices instruction. During slaughter was assessed animal pre-slaughter weight, the warm carcass weight, carcass yield and muscularity class.

Carcass yield calculated by the following formula: $H = (S*100) / G$, where H – carcass yield, %; S – warm carcass weight, kg; G – animal pre-slaughter weight, kg.

Statistical analysis were determined using the R statistical package 2:01 (Gentlemen, Ihaka, 1997) and an Excel spreadsheet. The linear correlation coefficients were calculated to evaluate the investigated signs of mutual relations. The differences between the average parameters of groups evaluated Student's criteria. Carcass yield dependence from pre-slaughter weight and age. To evaluate the aforesaid the analysis of variance (ANOVA) was applied and the average trends were calculated. The difference statistically reliable when $p < 0.05$.

Results and Discussion

Studies have shown that pre-slaughter weight of animals has influence on carcass yield till a certain age of the animal. The study used bulls average age was

19 months, heifers 20 months and cows 38 months. The highest average weight of animal was determined on cows 521,2 kg, slightly lesser heifers 461.7 kg and the least of bulls 456.2 kg however, the highest average carcass yield 51.3 percent was of bulls, slightly lower 50.1 percent of heifers and least 47.8 percent of the cows (Table 1).

Table 1. The bulls, heifers and cows of age, weight and carcass yield analysis

	The number of animals, units	Age of the animals, months	Weight of animals, kg	Carcass weight, kg	Carcass yield, percent
Bulls	423	19.18±0.24 [a]	456.19±3.62 [a]	235.21±2.34 [a]	51.34±0.19 [a]
Heifers	492	20.22±0.15 [a]	461.66±3.56 [a]	232.24±2.13 [a]	50.13±0.16 [b]
Cows	567	38.9±0.32 [c]	521.2±3.73 [b]	256.7±2.44 [b]	47.8±0.20 [c]

In column a, b, c letters to mark averages differed statistically significant p <0.001

In all three studied cattle groups were observed a statistically significant (p <0.001) linear relationship between the animal pre-slaughter weight and carcass yield. The linear averages trends obtained suggest that, an animal's pre-slaughter weight for an average increase of 50 kg, the carcass yield of bulls on average increased 11.1 percent, heifers - 0.72 and cows – 0.94 percent (Fig. 1). Our study data of cattle pre-slaughter weight showed considerable influence to carcass yield coincides with the data of other researchers *(Jukna Č. & Jukna V., 2002; Crews et al., 2003; Serra et al., 2004; Jukna et al., 2009).*
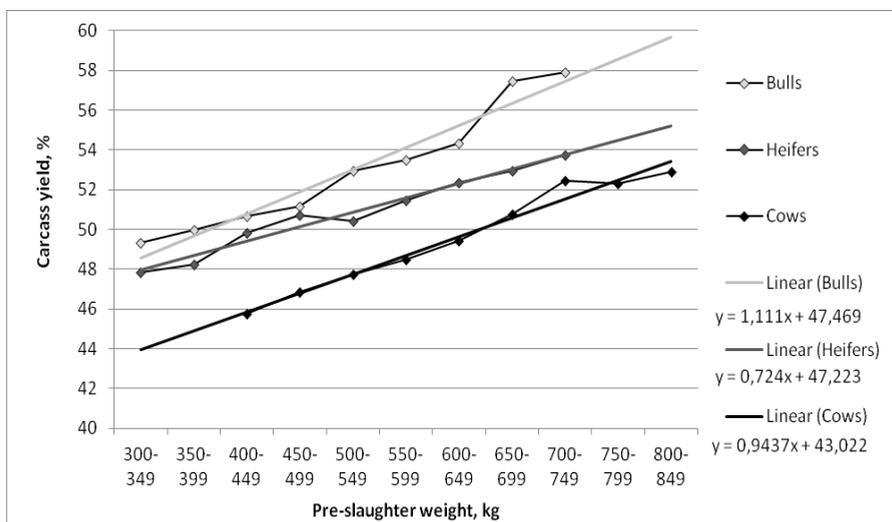
Figure 1. Carcass yield of bulls, heifers and cows depending from pre-slaughter weight

The data in table 2 showed, that correlation link were found stronger between carcass weight and carcass yield in group of bulls (r = 0.65, p <0.001) than between pre-slaughter weight and carcass yield (r = 0.35, p <0.001). The strongest correlation link was found between the animal's weight and carcass weight (r = 0.93, p <0.001). The results obtained show that when weight of animals increased carcass weight and yield also increased. The weakest correlation link was found of bulls group between age of bull and carcass yield (r = 0.11, p <0.05). Similar correlation links has been obtained and in group of heifers, between carcass weight and carcass yield was determined stronger correlation link (r = 0.57, p <0.001) than between of heifers pre-slaughter weight and carcass yield (r = 0.27, p <0.001). The strongest correlation link was obtained between the animal's weight and carcass weight (r = 0.94, p <0.001) and weakest link between heifers age and carcass yield (r = 0.09, p <0.05). After correlation analysis also strong correlation links were determined between carcass weight and carcass yield (r = 0.70, p <0.01) and the animal's weight and carcass weight (r = 0.91, p <0.01) in group of cows. The weakest statistically significant correlation link was established between the age and carcass yield of cows. (r = 0.09, p <0.05). Although, in all studied groups of animals were obtain weak correlation links between age of animal and carcass yield, but the trend shows that with increasing age, carcass yield also increases. Some researchers argue, when animal grows due to uneven growth of individual tissues and organs intensity, carcass yield also increases *(Alberti et al., 2005; Jukna Č., Jukna V., 2005; Jukna et al., 2009)*.

Table 2. The correlation coefficients between the different signs of cattle in groups

Signs	Weight of animals, kg	Carcass weight, kg	Carcass yield, kg
Bulls group			
Age of the animals, months	0.331***	0.307***	0.113*
Weight of animals, kg		0.934***	0.352***
Carcass weight, kg			0.656***
Heifers group			
Age of the animals, months	0.413***	0.381***	0.094*
Weight of animals, kg		0.944***	0.279***
Carcass weight, kg			0.574***
Cows group			
Age of the animals, months	0.365***	0.317***	0.098*
Weight of animals, kg		0.913***	0.365**
Carcass weight, kg			0.705***

* - p<0.05; ** - p<0.01; *** - p<0.001

Analysis have shown that between age and carcass yield linear dependence was expressed slightly. The results presented in figure 2 showed, that this dependence was not statistically significant in the bulls group, while of heifers and cows groups of carcass yield dependence from age describing of linear functions the reliability was evaluated p <0.05. The linear trends averages obtained suggests that, if analysed cattle age moderately increases for 2 months, then moderately carcass yield increased 0.21 percent in heifers group (p <0.05) and 0.12 percent in cows group (p <0.05).
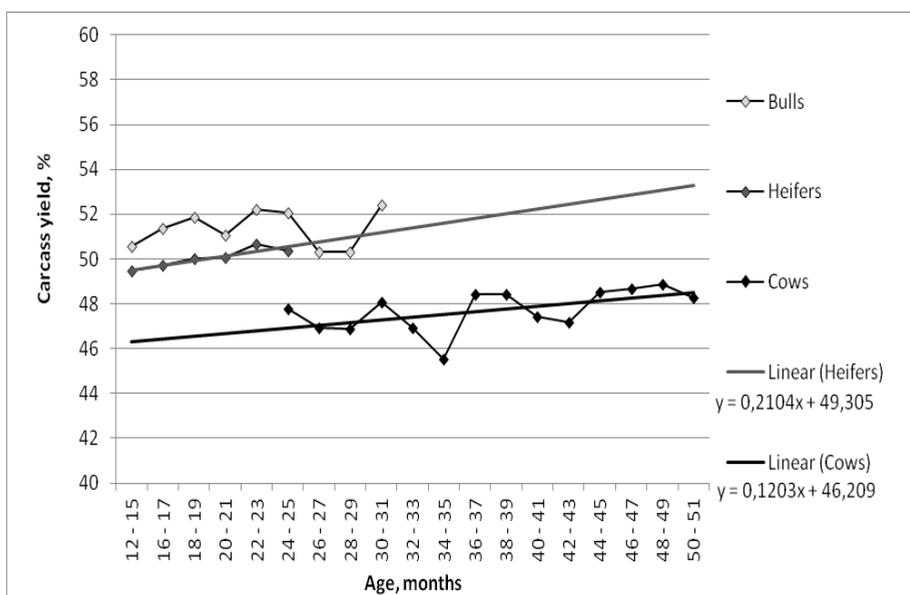

Figure 2. Carcass yield of bulls, heifers and cows depending on the age before slaughter

In figure 3 data show, that increasing pre-slaughter weight of bulls carcass muscularity class also increased. The R muscularity class of bull carcasses assessed moderately accounted 14.4 percent, increasing animal's pre-slaughter weight every 50 kg. The P muscularity class carcasses assessed until 500 kg of bulls pre-slaughter weight was obtained 7.6 percent. Mostly of O muscularity class of bulls carcasses were determined moderately accounted 76.3 percent. The U muscularity class assessed carcasses of bulls appeared only from 500 kg, and they moderately accounted of 1.2 percent. The carcasses muscularity of heifers also increased, when pre-slaughter weight of animals increased. Increasing pre-slaughter weight of heifers every 50 kg from 500 kg weight of heifers carcasses evaluated U muscularity class were obtained moderately of 0.9 percent. It also increased and the R muscularity class evaluated carcasses the increasing pre-slaughter weight of heifers, their were determined moderately of 16.5 percent. From 500 kg of pre-

slaughter heifers' weight P and O muscularity classes evaluated carcass were not observed. Increasing pre-slaughter weight of heifers for every 50 kg until 500 kg on average P muscularity class carcass accounted - 8.3 percent and O class - 74.8 percent. Cows lowest muscularity class of carcass was evaluated which had lowest pre-slaughter weight. When cow's pre-slaughter weight increasing every 50 kg, carcass P muscularity class evaluated declined gradually. Carcass P muscularity class moderately were evaluated 47.4 percent. Similarly as other studied groups, O muscularity class on carcass mainly were evaluated, it accounted of 49.7 percent. From 500 kg pre-slaughter weight of cows emerged 0.4 percent a highest U muscularity class assessed cow carcasses. The R muscularity class obtained 2.5 percent of cows' carcasses. Our research data coincided with the data of other researchers that pre-slaughter weight of animals influenced to carcass quality. Their study found that cattle the larger pre-slaughter weight carcasses were superior quality *(Rios-Utrera et al., 2005; Bendikas et al., 2006; Alberti et al., 2007).*
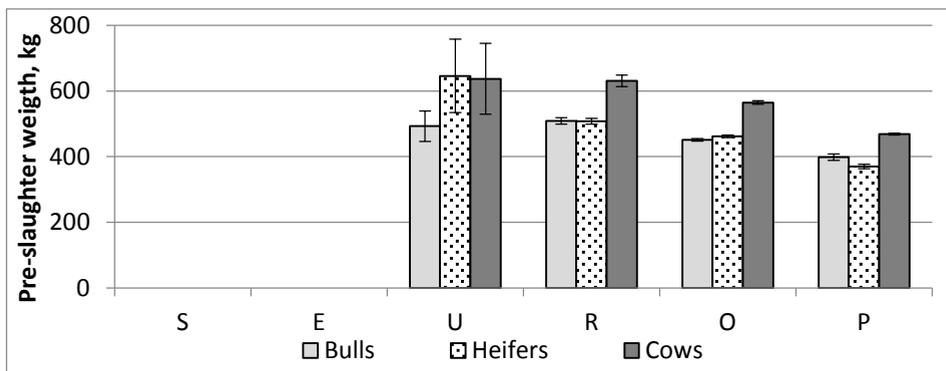
Figure 3. Pre-slaughter weight of cattle distribution according SEUROP of muscularity classes classification

The data presented in Figure 4 showed that with age of the animal carcass muscularity class slightly but rising. The observed, that O muscularity class of carcasses evaluated number increased meanwhile evaluated P class declined. Assessing, every 2 months age bull O muscularity class assessed of bulls carcasses were found moderately 76.8 percent, and carcass P muscularity class moderately accounted of 7.6 percent. The U and R muscularity classes assessed bulls carcasses with age increased. The bulls' carcasses evaluated for R muscularity class moderately accounted of 14.4 percent. The least U muscularity class has been evaluated bulls carcasses (1.2 percent). U muscularity class evaluated heifers were only from 22 months old in heifers group. U class carcass composed of 0.9 percent. The R muscularity class of carcases with age gradually increased and were obtained 16.5 percent. Meanwhile, P muscularity class of heifers' carcases

evaluated with age decreased and accounted moderately of 8.3 percent. The O muscularity class evaluated carcasses were mostly (74.3 percent) in group of heifers. The highest U muscularity class evaluated of cows carcasses, moderately were found 0.4 percent, cows evaluated every 2 age months, R muscularity class obtained 2.5 percent, and P carcass muscularity class accounted of 47.4 percent. At most O muscularity class has been estimated of carcass, and it accounted of 49.7 percent. Other authors also argue, that in order to get a good muscularity class, and thus higher profits, it is best to grow up and realize the animals of a certain age, because muscle tissue later turns into fat tissue *(Berg et al., 2003; Serra et al., 2004; Jukna et al., 2009).*
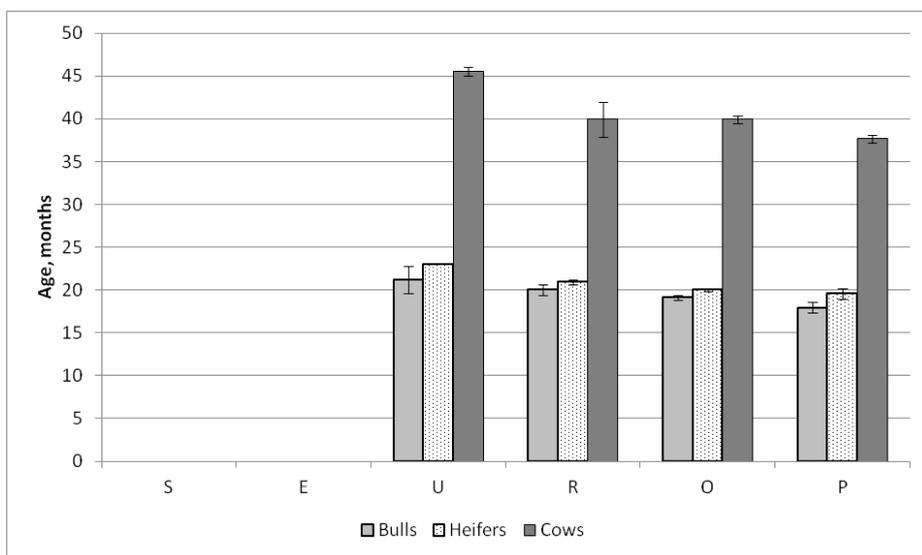

Figure 4. Cattle age distribution according SEUROP of muscularity class classification

Conclusion

Carcass yield of cattle depends on the animal's weight until to a certain age, if increasing mass of animal also increasing carcass yield. The linear averages trends obtained suggest that, an animal's pre-slaughter weight an average increase of 50 kg, carcass yield of bulls on average increased 11.1 percent, of heifers - 0.72 and cows – 0.94 percent.

Although, in all studied groups of animals were obtain weak correlation links between age of animal and carcass yield, of bulls ($r=0.11$; $p<0.05$), heifers ($r=0.09$; $p<0.05$) and cows ($r=0.09$; $p<0.05$), but the trend shows that with increasing age, carcass yield also increases. The strongest correlation links was

identified between the animal's weight and carcass weight of bulls (r = 0.93, p <0.001), heifers (r = 0.94, p <0.001) and cows groups (r = 0.91, p <0.01).

Between age and carcass yield linear dependence was expressed slightly. This dependence was not statistically significant in the bulls group. The linear trends averages obtained suggests that, if analysed cattle age moderately increases for 2 months, then moderately carcass yield increased for 0.21 percent in heifers group (p <0.05) and 0.12 percent in cows group (p <0.05).

Mostly, O muscularity class of carcass were evaluated in all analysed animals groups, both depending from pre-slaughter weight and age, it was apparently, therefore that in a slaughterhouse mostly were slaughtered different dairy breeds cattle and their crossbreeds with beef breeds. In the group of bulls evaluated O muscularity class carcasses were found moderately (76.8 percent), heifers (74.3 percent) and in group of cows (49.7 percent). However, a trend was observed that with animal's weight and age arise muscularity class.

Uticaj telesne mase i godine starosti na randman i konformaciju trupa goveda

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Rezime

Cilj ovog istraživanja bio je da se analiziraju efekti telesne mase i starosti goveda mlečnih rasa i njihovih meleza (423 bika, 492 junice i 567 krava) na prinos trupa i ocenu konformacije prema SEUROP standardnim podacima. Sve životinje su podeljene u grupe prema težini na klanju (interval od 50 kg) i prema uzrastu (interval od 2 meseca). Za istraživanje, prosečne starosti životinja su: bikovi - 19 meseci, junice - 20 meseci i krave - 38 meseci. Najveća prosečna masa je utvrđeno kod krava 521,2 kg, zatim junica 461,7 kg a najmanja prosečna masa je utvrđena kod bikova 456,2 kg međutim, u prosečmi prinos/randman trupova je bio najviši kod bikova - 51,3 %, 50,1% kod junica i najmanje 47,8 % kod krava. Kada prosečna telesna masa životinja na klanju se poveća za 50 kg, prinos trupova bikova u proseku se poveća za 11,1%, kod junica - 0.72 % i krava - 0.94 %. U svih ispitivanim grupama životinja su dobijene slabe korelacije između starosti životinja i prinosa/randmana trupova. Najjače korelacije su dobijene između telesne mase i težine trupova bikova (r = 0,93, p <0,001), junica (r = 0,94, p <0.001) i krava (r = 0,91, p <0,01). Pokazalo se da, ako se starost goveda umereno povećava za 2 meseca, onda dolazi do umerenog povećanja prinosa trupa od 0,21 %, kao što je u junica (p <0,05) i 0,12 % u grupi sa kravama (p <0,05). Ovaj odnos nije bio statistički značajan u grupi bikova. Uglavnom, O klasa mišićavosti trupova su ocenjeni u svim analiziranim grupama životinja, u zavisnosti od težine na klanju,

kao i starosti. Međutim, registrovan je trend da sa telesnom masom i godinama starosti životinje poboljšava se prinos trupa i povećava klasa mišićavosti trupova.

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