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Comparative Growth Performance and Some Carcass Traits of Calves of Different Cattle Breeds Fed Pasture and Concentration

ABSTRACT

The aim of the current study was to explore growth performance and carcass traits using ultrasound measurements of calves of different cattle breeds under pasture and concentration feeding system. A total of 25 male cattle calves between the ages of 6 to 7 months with an average body weight of 162.37 ± 7.7 kg were fed two separate fattening trials for seven months (pasture and finishing period). Animals were divided into five groups (five of each breed): Kurdi, Rustaki, Jenoubi, Herford and Friesian crossbred. The average daily weight gain was similar ($P > 0.05$) for calves of different cattle breeds during growth (pasture) period, while these values were significantly higher in Kurdi, Rustaki and Friesian crossbred calves during finishing period. The body size measurements were similar among calves of different cattle breeds. The highest increase in Longissimus muscle area and subcutaneous fat thickness was observed in Kurdi, Rustaki and Friesian crossbred calves. In conclusion, Kurdi, Rustaki and Friesian crossbred calves possess the promising potential for beef production under the barn rearing or finishing period.

INTRODUCTION

Breeds of cattle are distributed in the world and are much vital farm animals in Kurdistan Region-Iraq as well as other parts of the world. In this species, a significant attention has been received in growth performance and carcass characteristics studies since last two decades because of their high economic and social values (Sutarno and Setyawan, 2015). On the other hand, there is still incomplete information regarding understanding of the quality of beef meat, body size measurements and weight gain in different species as well as in different rearing periods.

Carcass characteristics, weight gains are of much important economics to cattle producers. There are widely differences between types of cattle breeds in slaughter age and weights based on how sharply they mature that is characterized by fat lying down at a finishing fattening period (Phillips, 2018). Generally, da Costa et al. (2019) stated beef, which produces longer carcasses lead to a poorer conformation as well as a higher fat level in their carcass. On the other hand, it is not case for some small breeds. Differentiations in the carcass yields which are connected to the composition of genetic and the differences of body size that is inherent variations and these are attributed to sex, nutrition and slaughter endpoints (Bureš and Bartoň, 2012).

Body measurements might serve as vital chosen considerations; the production of calves could be better estimated compared to other production properties (Bene et al., 2007). The high

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heritability can be relatively observed in body size measurements (Kamprasert et al., 2019). Nian et al. (2017) reported that weight gain is positively related to beef body weight, which has a high growth rate, produce more size of muscle with a more glycolytic activity that is probably to favour meat ageing as well as thus, tenderness that is the main reason in the consumer's meat preferences. In order to be successful in maximizing the amount of beef production, breed selection is necessary to be considered in cattle.

The major local cattle breeds in Iraq are the Rustaqi, Sharabi, Kurdi and Jenubi and there are some commercial cross breeds have been introduced over the years, including Holstein-Friesian and Hereford and Jersey (Alshawi et al., 2019). Sharabi breed is one of the varieties of domestic cattle in south and north of Iraq. In general, this species lives in Tigris valley and in North of Mosul. The average live body weight and wither height of Sharabi males is about 400 kg and 119 cm, respectively. Sharabi breed is black color. Its male has small horns. Rustaqi breed lives around Hillah and Bagdad. The average live body weight of males is about 450 kg and its average daily gain is about 688 g. Rustaqi breed is brown color and light tan. Male Rustaqi has small horns. Karadi or Kurdi breed lives around Kurdistan region. The average live body weight of males is about 300 kg and its average daily gain is about 379 g. Kurdi breed is black color and light markings and its main use is meat. Jenubi breed lives in south eastern and central Iraq. The average live body weight of males and wither height is about 325 kg and 125 cm, respectively and its average daily gain is about 557 g (Magid et al., 2003). Hereford is one of the oldest British native breeds of cattle. Hereford is colored dark red with a white face, crest, dewlap and underline. It has short thick horns that typically curve down at the sides of the head. Its mature males may weigh up to 850 kg, while mature females may weigh around 550 kg. Hereford is a beef cattle breed, widely used both in intemperate areas and temperate areas, mainly for meat production. Friesian is black and white color. It is the most widespread cattle breed in the world and has been bred for many years as a dual-purpose. Friesian bull calves are characterized by different growth rate and fattening ability (Purwin et al., 2019).

In a marketing system, the viability of the beef cattle industry depends on the ability to produce a high quality, consistent end product. This can be achieved through a clear understanding of lean and fat growth in various breeds of feedlot cattle. Thus far, there is a dearth of information on this topic, not only in number but also in scope, because they have involved a single Iraqi breed. Consequently, the aim of this study was to compare growth performance and carcass traits of calves of five different cattle breeds at two different rearing periods.

MATERIALS AND METHODS

Animals and rearing conditions

The investigation was conducted on 25 calves of different cattle breeds bred purchased from different farms in Erbil city, Kurdistan Region-Iraq after weaning at approximately 6 to 7 months of age. The animals were assigned into five groups: Group A, five calves from the Kurdi breed; Group B, five calves from Rustaki breed; Group C, five calves from Jenoubi breed; Group D, five calves from Herford crossbred and Group E, five calves from Friesian crossbred. Before the trial all calves were weighed, properly tagged, and treated for internal and external parasites. Two separate fattening trials were conducted in seven months (three and four months for pasture rearing (growth period) and barn rearing (finishing period), respectively). In the pasture period, calves were reared on cereal crop residue and were offered concentrates daily for maintenance to consider the animal welfare regulations. All the experimental calves were gone out and fed ad libitum twice daily at 06:00 to 09:30 and 16:00-19:30 h by cereal crop residue. All the experimental calves rotationally grazed a separate area (12 ha) of cereal crop residue which included the straw of barley and wheat as well as some seeds of wheat and barley left after harvesting. Concentrates were offered in one feed each night in linear stainless troughs (0.5 m feed space per animal). In the finishing period, calves were housed together in a proper free-stall house (8 m x 23 m x 2.8 m) with a big stable (17 m x 27 m x 1.7 m). Throughout the second period of fattening, the calves were fed a mixed diet available *ad libitum* composed of 15% soya bean, 50% barley, 33% wheat bran, 1% salt and 1%

limestone. The animals were subjected to seven days of adaptation to the experimental diet. Animals had ad libitum access to water during the whole experiment.

Weight and body size measurements

Data for each animal included initial weight (kg), average daily gain (g/day), slaughter weight (kg), and body measurements (cm) which were recorded systematically. Individual calves weights were measured using a heavy duty scale with accuracy ±0.5 kg (initial weight) at the beginning and continued in each 15 days throughout the study. A daily gain during growth period was calculated between the initial weight at the beginning of study and weight at final periods of feeding on cereal crop residue while average daily gain of finishing period was calculated between initial weight of fattening and final weight of slaughter. An estimated total gain during the fattening period was calculated between the initial weight and at slaughter weight. Body measurements such as body length, height at withers, heart girth, chest depth and paunch girth were recorded at the beginning of the experimental and at 10 months of age and prior to slaughter using measuring stick and tape (Hauptner, Germany) when animals were standing as described in Ozkaya and Bozkurt (2008).

Carcass evaluation using ultrasound as a modern tool

Calves were ultrasonically scanned between the12th and 13th ribs two to three times for external fat thickness and longissimus muscle area using the Pie Medical Scanner 200 (PieMedical Equipment BV, Maastricht, The Netherlands) equipped with an animal science probe (ASP-18) and with a frequency of 3•5 MHz, 17.2 cm linear array transducer Gupta et al., 2013). The transducer was located laterally between the 12th and 13th ribs on the right side of the animal after the scanning site was determined by palpation. To establish good acoustical contact and avoid the presence of air bubbles between the probe and skin surface, the palpated area was cleaned, oiled using vegetable oil and curried until free from dirt and then re-oiled for optimum image quality.

Statistical analysis

The experiment followed a completely randomized design. Data obtained for all parameters were subjected to the generalized linear model (GLM) procedure using Statistical Analysis System package (SAS) version 9.1 software (SAS, 2007). Duncan multiple range test was used to test the significance of variance between the means of the studied parameters at significant level of $p<0.05$.The data in the tables are presented as mean ± standard errors of the mean (SEM).

RESULTS AND DISCUSSION

Growth characteristics

Growth as an important economic feature should be included in either breeding or finished cattle program (Hozáková et al., 2020). In this study, weights were recorded at the beginning and at the end of each fattening period. Despite the fact that calves came from deferent fields, there were no significant differences between breed groups in initial weight at the start of the fattening periods which is presented in Table 1. Furthermore, there was no difference between breed groups in the live body weight and average daily gains of the pasture group over the growing period. The lack of statistical differences might be due to a less stable growth rate of pasture calves which could be explained by that animal on pasture are exposed to changing climatic conditions influencing feed intake and feed conversion efficiency (Velik et al., 2013). Inversely, the average daily gains over the finishing period and slaughter weight were significantly higher in Rustaki, Friesian crossbred and Kurdi calves compared to Jenoubi and Herford crossbred calves. The better performance of Rustaki, Friesian crossbred and Kurdi calves could be due to their comparatively better acclimatization to the area. Over the whole experiment, average daily gain differ ($p<0.05$) among different breeds of calves. The higher average daily gain was observed in Rustaki, Friesian crossbred and Kurdi calves. These results coincide with those of average daily gain through feedlot fattening period.

Table (1): Growth performance of calves of different cattle breeds at different rearing periods

Parameter	Period	Treatments groups					SEM	P value
		Kurdi	Rustaki	Jenoubi	Herford crossbred	Friesian crossbred		
live weight (kg)	Initial	169.69	162.10	156.45	160.00	163.60	7.70	0.547
	End of growing[1]	211.31	198.20	197.20	196.67	205.80	9.34	0.121
	End of finishing [2]	303.85[a]	304.40[a]	276.80[b]	279.00[b]	310.00[a]	16.61	0.041
ADG (g/day)	End of growing[1]	462.44	401.11	452.78	407.44	468.89	31.87	0.144
	End of finishing [2]	771.17[ab]	885.00[a]	663.33[b]	686.08[b]	868.33[a]	74.49	0.017
	Whole experiment	638.86[a]	677.62[a]	573.10[b]	566.67[b]	697.14[a]	59.37	0.039

[1]Pasture group was on cereal crop residue (growing period).
[2]Barn group was on concentration diet (finishing period).ئ
[a,b]Means within the same row with different superscripts are significantly different at p<0.05.
ADG = average daily gain.
SEM = standard error of the mean.

Table (2): Body size measurements of calves of different cattle breeds at different rearing periods

Parameter	Period	Treatments groups					SEM	P value
		Kurdi	Rustaki	Jenoubi	Herford crossbred	Friesian crossbred		
Body length (cm)	Initial	87.14	86.00	80.00	86.50	90.00	3.03	0.32
	End of growth[1]	91.57	91.43	86.00	91.50	96.67	2.76	0.22
	End of Finishing[2]	107.14	108.14	96.00	105.50	109.67	3.76	0.11
Height at withers (cm)	Initial	98.57	99.71	96.00	99.00	104.67	2.49	0.27
	End of growth[1]	103.43	104.86	98.00	100.00	109.67	2.98	0.19
	End of Finishing[2]	109.14	109.86	106.33	107.50	116.00	3.20	0.37
Heart girth (cm)	Initial	128.57	126.43	123.00	127.00	128.33	3.16	0.72
	End of growth[1]	148.00	150.29	145.67	150.00	156.00	3.03	0.25
	End of Finishing[2]	164.86	164.29	152.67	162.50	169.33	7.90	0.18
Chest depth (cm)	Initial	49.71	50.57	48.00	51.50	51.67	1.30	0.37
	End of growth[1]	53.29	53.14	51.33	54.00	58.00	1.87	0.24
	End of Finishing[2]	59.86	59.57	56.33	58.50	63.67	2.44	0.43
Paunch girth (cm)	Initial	144.71	142.86	141.00	147.50	149.33	4.21	0.42
	End of growth[1]	167.71	170.43	166.33	161.00	171.00	4.25	0.14
	End of Finishing[2]	183.71	186.57	181.33	182.50	194.33	4.78	0.19

[1]Pasture group was on cereal crop residue (growing period).
[2]Barn group was on concentration diet (finishing period).
[a,b]Means within the same row with different superscripts are significantly different at p<0.05.
SEM = standard error of the mean.

Body measurements are important characteristics in beef cattle (Bene et al., 2007). They are often using to estimate animals' maturity and additional characteristics including live body weight. Furthermore, body dimensions can also serve as significant selective factors with a relatively high level of heritability (Hozáková et al., 2020). Details on body size measurements, body length, height at withers, heart girth, chest depth and paunch girth, at the beginning of the experiment, at the end of the growing period and at slaughter are given in Table 2. Calves of Rustaki, Friesian crossbred and Kurdi cattle breeds presented higher values of body size measurements than those from calves of Jenoubi and Herford crossbred cattle breeds although the values were not significant.

Namely, the breed with the highest body size measurements was calves of Friesian crossbred. In this respect, the Rustaki and the Kurdi came second alternately which could be expected, as from the examined breeds, these three breeds can be ranked among the large-sized beef cattle. The greater body measurements of Rustaki, Friesian crossbred and Kurdi cattle breeds compared with Jenoubi and Herford crossbred cattle breeds were related to differences in live body weight at end of the rearing experimental period as all variables were highly correlated with live body weight ($r = 0.56 - 0.83$; $p<0.01$). The examination of the relationship between the live body weight and the various body size measurements presented by various authors (Albertí et al.,2008; Bene et al., 2007).

Muscle area and subcutaneous fat thickness

Ultrasound technology is a modern tool that can be utilized to accurately estimate carcass measurements in live animals such as subcutaneous fat thickness and longissimus muscle area (Gupta et al., 2013). Consequently, the evaluation of subcutaneous fat thickness and muscle depth by ultrasonography could be shown differences in the deposition of subcutaneous fat and muscle throughout the production cycle. Therefore, this kind of data is mostly handy for breeding animals that will not drive for slaughtering (Blanco et al., 2014). Muscle area and subcutaneous fat thickness were different at the end of the calves housing period, when Kurdi, Rustaki and Friesian crossbreds had significantly greater muscle area than Jenoubi and Herford crossbred calves, while Kurdi, Jenoubi and Friesian crossbreds had significantly greater subcutaneous fat thickness than Rustaki and Herford crossbred calves (Table 3) but did not differ at the growing of the calves' rearing period. The differences between calves groups in muscle depth and subcutaneous fat thickness at the end of the finishing period were related to differences in the live body weight, as both variables were highly correlated ($r=0.68$ and 0.67 for muscle area and subcutaneous fat thickness, respectively; $p<0.01$).

Table (3): *Longissimus* muscle area and subcutaneous fat thickness of calves of different cattle breeds at different rearing periods

Parameter	Period	Treatments groups					SEM	P value
		Kurdi	Rustaki	Jenoubi	Herford crossbred	Friesian crossbred		
Longissimus muscle area (cm^2)	Initial	42.49	42.34	42.81	42.01	43.90	2.86	0..65
	End of growth[1]	47.70	47.55	46.88	46.92	48.01	1.24	0.12
	End of Finishing[2]	53.65[a]	54.22[a]	51.01[b]	52.21[b]	55.97[a]	1.90	0.02
12th Rib fat thickness (cm)	Initial	0.35	0.34	0.35	0.36	0.34	0.01	0.37
	End of growth[1]	0.49	0.46	0.48	0.47	0.46	0.01	0.09
	End of Finishing[2]	0.82[a]	0.76[b]	0.82[a]	0.76[b]	0.80[a]	0.04	0.03

[1]Pasture group was on cereal crop residue (growing period).

[2]Barn group was on concentration diet (finishing period).

[a,b]Means within the same row with different superscripts are significantly different at $p<0.05$.

SEM = standard error of the mean.

CONCLUSION

The results of present study show that the Kurdi, Rustaki and Friesian crossbred calves had higher growth performance and carcass traits ($p<0.05$) during the fattening period than Jenoubi, Herford crossbred calves. With these results, calves of cattle Kurdi, Rustaki and Friesian crossbred breeds could be preferred for beef production purposes under the environmental conditions of Kurdistan Region-Iraq.

Disclosure statement

The authors declare that they have no conflicts of interest.

REFERENCES

Albertí P., B. Panea, C. Sañudo, J. Olleta, G. Ripoll, P. Ertbjerg, M. Christensen, S. Gigli, S. Failla, S. Concetti and J. Hocquette, (2008). Live weight, body size and carcass characteristics of young bulls of fifteen European breeds. Livest. Sci., 114(1):19-30.

Alshawi A., A. Essa, S. Al-Bayatti and O. Hanotte, (2019). Genome analysis reveals genetic admixture and signature of selection for productivity and environmental traits in Iraqi cattle. Front. Genet., 16:10:609 .

Bene S, B. Nagy, L. Nagy, B. Kiss, J. Polgár and F. Szabo, (2007). Comparison of body measurements of beef cows of different breeds. Arch. Anim. Breed., 50(4):363-73 .

Blanco M., M. Joy, P. Albertí, G. Ripoll and I. Casasús, (2014). Casasús Performance and carcass quality of forage-fed steers as an alternative to concentrate-based beef production. Ital. J. Anim. Sci., 13(4):3384.

Bureš D., and L. Bartoň, (2012). Growth performance, carcass traits and meat quality of bulls and heifers slaughtered at different ages. Czech J. Anim. Sci., 57(1):34-43 .

da Costa R., L. Corbellini, E. Castro-Janer and F. Riet-Correa, (2019) Evaluation of losses in carcasses of cattle naturally infected with Fasciola hepatica: effects on weight by age range and on carcass quality parameters. Int. J. Parasitol., 49(11):867-72 .

Gupta S., A. Kumar, S. Kumar, Z. Bhat, H. Hakeem and A. Abrol, (2013). Recent trends in carcass evaluation techniques-a review. J. Meat Sci., 1:50-5 .

Hozáková K., K. Vavrišínová, P. Neirurerová and J. Bujko, (2020). Growth of beef cattle as prediction for meat production: A review. Acta Fytotech. Zootech., 23(2):58-69 .

Kamprasert N., N. Duijvesteijn and J. Van der, (2019). Werf Estimation of genetic parameters for BW and body measurements in Brahman cattle. Animal., 13(8):1576-82 .

Magid S., W. Al-Murrani and J. Alkas, (2003). Country report animal genetic resources. Ministry of Agriculture: Baghdad-Iraq. https://www.cbd.int/doc/case-studies/inc/cs-inc-FAO-farmanimal-en.pdf

Nian Y., J. Kerry, R. Prendiville and P. Allen, (2017). The eating quality of beef from young dairy bulls derived from two breed types at three ages from two different production systems. Irish J. Agric. Food Res., 56(1):31-44 .

Ozkaya S. and Y. Bozkurt, (2008). The relationship of parameters of body measures and body weight by using digital image analysis in pre-slaughter cattle. Arch. Anim. Breed., 51(2):120-8 .

Phillips, C.J., (2018). Principles of cattle production. CABI.

Purwin, C., I. Wyzlic, Z. Wielgosz-Groth, M. Sobczuk-Szul, J.P. Michalski and Z. Nogalski, (2016). Fattening performance of crossbred (Polish Holstein-Friesian x Hereford, Limousin or Charolais) bulls and steers offered high-wilted grass silage-based rations. Chil. J. Agric. Res., 76(3): 337-342 .

SAS, (2007). User's Guide. 9.2 edn. SAS Inst. Inc, Cary, NC, . USA.

Sutarno S. and A. Setyawan, (2015). Genetic diversity of local and exotic cattle and their crossbreeding impact on the quality of Indonesian cattle. Biodivers. J. Biol. Divers., 16(2): 327-354.

Velik M., I. Gangnat, R. Kitzer, E. Finotti and A. Steinwidder, (2013). Fattening heifers on continuous pasture in mountainous regions–implications for productivity and meat quality. Czech J. Anim. Sci., 58(8):360-8.

مقارنة أداء النمو وبعض صفات الذبيحة لعجول الابقار من سلالات مختلفة التي تغذت على المراعي والعلف المركز

مهابات ابراهيم سعيد أزاد بهنان سبو ارام احمد محمد هاني ناصر هرمز

قسم الثروة الحيوانية- كلية علوم الهندسة الزراعة/ جامعة صلاح الدين- أربيل أقليم كوردستان- العراق

الخلاصة

كان الهدف من الدراسة الحالية هو تقيم أداء النمو وسمات الذبيحة باستخدام قياسات الموجات فوق الصوتية للعجول من سلالات ابقار المختلفة تحت نظام تغذية المراعي

الكلمات المفتاحية: ابقار اللحم، الذبيحة ، اعلاف

مالئة والحبوب ، الموجات فوق الصوتية ، زيادة الوزنية

والعلف المركز. تم تغذية 25 عجل ابقار التي تتراوح أعمارهم بين 6 إلى 7 أشهر وبمتوسط وزن جسم يبلغ 162.37 ± 7.7 كغم في تجربتي تسمين منفصلتين لمدة سبعة أشهر (فترة المراعي والعلف المركز). تم تقسيم الحيوانات إلى خمس مجموعات (خمسة من كل سلالة): كردي، رستكي، جنوبي، هرفورد الهجين وفريزيان الهجين. كان متوسط زيادة الوزن اليومي متشابهًا للعجول من سلالات ابقار المختلفة خلال فترة النمو (المراعي) بينما كانت هذه القيم أعلى معنويًا للعجول الكردي والرستكي والفريزيان الهجين خلال فترة العلف المركز. كانت قياسات الجسم متشابهة بين العجول من سلالات الابقار المختلفة. لوحظت أعلى زيادة في منطقة عضلة العينية وسمك الدهون تحت الجلد في عجول الكردي والرستاكي والفريزيان الهجين. في الختام ، تمتلك العجول كردي، رستكي وفريزيان الهجين إمكانات جيدة لإنتاج لحم تحت نظام تربية داخل الحظائر او التسمسن على العلف المركز.