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Performance of Straightbred Friesian and Charolais X Friesian Crossbred Males Slaughtered at Three Different Ages

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ABSTRACT

Eighteen 4-month old male calves; 9 straightbred Friesian (FxF) and 9 Charolais x Friesian (CxF) were used in fattening trial. Six were slaughtered at 4 months of age. The rest were fattened and slaughtered at 8 and 12 months of age. Concentrate and Rhodesgrass hay were offered *ad libitum.* Average daily gain (ADG), feed conversion ratio (FCR), slaughter weight (SW), hot carcass weight (HCW) and dressing percentage (DP) were calculated. Ribs (9th, 10th and 11th) were dissected into lean, fat and bone. Also, the *Longissimus dorsi* area (LDA) and fat thickness (FT) were measured over the 9th. Samples of *Longissimus dorsi* muscle were used for chemical analysis of meat.

Charolais crossed (C x F) had higher ADG (P<.01), and better FCR (P<.01) during the period from 4-8 months, resulting in heavier SW (P<.05) at 8 months, higher HCW, DP and percentage lean with less percentages of fat and bone in the rib cut, but differences were nonsignificant. Higher LDA (P < .05) in C x F indicating greater cutability.

Delay of slaughter to 8 or 12 months increased SW, LDA, HCW (P<.0001), improved DP (P<.05) and reduced bone % in ribs cut (P<.0001). This was accompanied by higher fat % and an increase of FT. Results indicated that the use of Charolais and slaughter delay would improve efficiency of dairy beef production in the United Arab Emirates.

Key words : Straightbred, Crossbred, Friesian, Charolais, Slaughtered, U.A.E.

INTRODUCTION

In the last two decades numerous dairy farms have been established in the United Arab Emirates. Replacement heifers are imported almost annually, but very few farms raise small proportion of their own replacements. Male and female progeny are sold for slaughter and with only 20% self sufficiency in red meat, efficient system of dairy beef production is needed.

Use of semen from beef bulls to inseminate dairy cows has been widely practiced in Europe. Beef sires improved significantly body weight, feed conversion efficiency and carcass composition of the crossbred progeny (Berg and Butterfield, 1976; Berg et al., 1978; Kempster et al., 1982 and Kempster et al., 1988). The adoption of a sire breed that meet individual producer requirements should be based on accurate information on the relative performance of breeds in different production systems. The use of semen from beef breeds to inseminate Friesian cows is increasingly practiced in the U.A.E.

As animals grow, the increase in weight gain and changes in carcass composition are used to determine the optimum age (S) at slaughter. The objectives of this study are to compare weight gain, feed efficiency and carcass traits of straightbred Friesian (F x F) with Charolais crosses (C x F) and to study the effect of age at slaughter on performance of the two genotypes under U.A.E. conditions.

MATERIALS AND METHODS

This experiment was carried out at the Faculty of Agricultural Sciences Farm, United Arab Emirates University, for 8 months. Eighteen 4 months old male calves (105.2 $\pm$ 3.4 kg live weight) were bought from a local dairy farm and used in fattening trial. Nine were straightbred Friesian (F x F), from dams of German origin with 75% Holstein blood, and the other nine were Charolais crosses (C x F) from Friesian dams with Charolais semen. Six calves (3 FxF & 3 CxF) were slaughtered at 4mos. of age. The rest were fattened and slaughtered at 8 and 12 months of age.

Animals were housed in individual open shaded pens. Diet consisted of Rhodesgrass (*Chloris gayana*) hay and pelleted concentrates. Animals were fed *ad libitum* and had free access to water and trace mineralized salt blocks. Chemical composition of feed is shown in Table 1.

Table 1: Chemical composition of experimental feed[1] .

	Concentrate	Rhodesgrass
	--------- % of	DM -------------
Crude protein	19.4	5.9
Ether extract	3.6	1.7
Crude fiber	6.1	28.5
Ash	6.9	9.5

[1]Each value is the mean of two observations.

All organs of slaughtered calves were weighed separately. The three rib (9, 10 and 11) cuts were taken from the left side of each carcass. Fat thickness (FT) over the *Longissimus dorsi* of the 9th rib and *Longissimus dorsi* area (LDA) were measured. Rib (9, 10 and 11) cuts were dissected physically into lean, fat and bone. Chemical composition of meat from *L. Dorsi* muscles were analyzed according to AOAC (1984).

The following traits were recorded or calculated: slaughter weight (SW); average daily gain (ADG); dry matter intake (DMI); feed conversion ratio (FCR); hot carcass weight (HCW); empty body weight (EBW); and cold carcass weight (CCW).

Statistical analyses were performed using MSTAT (Michigan State Univ. 1985). Two statistical models were used: the first to analyse BW, ADG, DMI and FCR. Reads $Y_{ij} = U + g_i + e_{ij}$ where Y_{ij} = an individual observation, U = overall mean, g_i = an effect due to the i th genotype (F x F or C x F) and e_{ij} = an error term. The second model was used to analyse carcass charcteristics and reads:

$Y_{ijk} = U + g_i + a_j + (ga)_{ij} + e_{ijk}$ where a_i = an effect due to age at slaughter, (4, 8 or 12 months) and $(ga)_{ij}$ an effect due to the interaction between genotype and age. The other components are the same as defined in the first model.

RESULTS AND DISCUSSION

Means and mean squares of SW, ADG, DMI and FCR for straightbred Friesian (F x F) and Charolais x Friesian (C x F) are shown in Table 2. Charolais crosses had heavier SW at 8 and 12 months but differences were only significant (P<.05) at 8 mos. The higher SW of C x F at 8 mos. is attributed to higher (P<.01) ADG from 4 - 8 mos., CxF had better feed efficiency than FxF (P<.01) during the same period. Several studies indicated that C x F crosses gained weight faster, converted feed more efficiently and reached heavier SW compared to straightbred Friesian (Everitt et al., 1988; Southgate et al., 1982 and 1988, Mostageer et al., 1989 and More O'Ferrall and Keane, 1990).

Delay of slaughter from 4 to 8 or 12 months enhanced ADG, improved feed efficiency and doubled SW. Estimates of ADG were markedly higher from 8-12 mos. when compared to those of 4-8 months for both breed types. This was accompanied by greater feed consumption and better feed conversion. Present results are in agreement with Keane et al. (1990) and More O'Ferrall and Keane (1990).

Genotypic differences in carcass charcteristics were nonsignificant in all traits (Table 3). However, Charolais crosses tended to have higher DP (52.2 vs. 50.2%), yielding relatively heavier carcasses (126.8 vs. 119.5 kg). Numerous studies indicated that the DP of Charolais, was higher than Friesian, (Berg and Butterfield, 1976; Kempster et al., 1982 and 1988; Mostageer et al., 1989 and More O'Ferrall and Keane, 1990). In the present study, the dairy breed, F x F deposited more non-carcass fat (1.34 vs. 1.17%) than CxF. Khalil and Pirchner (1986) mentioned that impaired ADG and FCR of F xF as compared with those of dual purpose may be due to the greater accumulation of non-carcass relative to carcass fat.

Table 2: Means and mean squares of slaughter weight, average daily gain, dry matter intake and feed conversion ratio of straightbred Friesian (FxF) and Friesian x Charolais (FxC)

Trait	N	Mean FxF	Mean CxF	SE	Mean squares Genotype	Mean squares Residual
Sw[1] (kg) :						
4 months	18	106.4	104.0	4.94	27^{NS}	219
8 months	12	196.7^{b}	221.0^{a}	8.41	1176^{*}	425
12 months	6	376.0	392.7	18.59	417	1037
ADG[2] (kg/day) :						
4-8 months	12	0.78^{b}	0.92^{a}	0.03	0.06^{**}	0.01
8-12 months	6	1.48	1.45	0.13	0.01^{NS}	0.05
4-12 months	6	1.13	1.17	0.08	0.01^{NS}	0.02
DMI[3] (kg) :						
4-8 months	12	698	696	14.38	13^{NS}	1240
8-12 months	6	1066	1063	17.67	9^{NS}	936
4-12 months	6	1788	1772	39.85	373^{NS}	4765
FCR[4]						
4-8 months	12	7.48^{a}	6.37^{b}	0.30	3.71^{**}	0.54
8-12 months	6	6.08	6.25	0.60	0.04^{NS}	1.07
4-12 months	6	6.64	6.44	0.57	0.06^{NS}	0.97

[a,b] Means, within rows, followed by different letters differ significantly (P<.05).
[1]SW = slaughter weight.
[2]ADG = average daily gain = (final body weight-initial body weight) / days on feed.
[3]DMI = dry matter intake = The sum of roughage and concentrates on DM basis.
[4]FCR = feed conversion ratio = DMI/Weight gain.
NS, nonsignificant; * = P,.05 and ** = P<.01.

Table 3. Means and mean squares of hot carcass weight, dressing percentage and non-carcass fat percentage of straightbred Friesian (FxF) and Friesian x Charolais (CxF) slaughtered at different ages[1]

Trait	Genotype (G)			Age at slaughter (A)				Mean squares			
	FxF	CxF	SE	4mo	8 mo	12 mo	SE	G	A	GxA	Residual
No. of animals	9	9		6	6	6		1	2	2	12
HCW[2] (Kg)	119.5	126.8	4.45	51.6C	109.8^{b}	208.0^{a}	5.44	240^{NS}	37500^{**}	326^{NS}	178
DP[3]	50.2	52.2	0.75	49.7^{b}	50.7^{ab}	53.4^{a}	0.91	18.2^{NS}	21.5^{*}	5.3^{NS}	5.0
NCFP[4]	1.34	1.17	0.12	NA	1.02^{b}	1.49	0.12	0.09^{NS}	0.69^{*}	0.01^{NS}	0.08
HHL/EBW[5](%)	15.7	16.3	0.25	18.2^{a}	14.8^{b}	15.0^{b}	0.31	1.86^{NS}	21.93^{**}	2.05^{NS}	0.58

[1]Means, within classification within rows, followed by different letters differ significantly (P<.05).
[2]HCW, Hot carcass weight.
[3]DP = cold carcass weight /empty body weight.
[4]NCFP = (kidney + pelvis + channel fat) / EBW.
[5]HHL / EBW = (head + hide + legs) / EBW.
NA. not avaiable; NS, nonsignificant; * = P<.05; ** = P<.0001.

Delay of slaughtering from 4 to 8 or 12 months improved DP significantly (49.7, 50.7 and 53.4%, respectively). This was attributed to the increase in deposition of carcass tissues (HCW) and reduction of non-carcass percentage (P<.0001). Present data of an increasing DP with advance of animal age is in agreement with Berg and Butterfield (1976), and Mostageer et al. (1989). Hot carcass weight at 8 and 12 months was 2 and 4 times that at 4 months (P<.0001). This was accompanied by an increase of 0.4% non-carcass fat from 8 to 12 months.

Physical composition of the carcass represented by traits measured on the 9, 10 and 11 rib cut is shown in Table 4. Breed type affected significantly (P<.05) (LDA). Charolais crosses had larger area compared to straightbred Friesian (57.4 cm^2 vs. 46.5 cm^2, respectively), indicating higher cutability. Eventhough, differences were not significant, Charolais crosses had more lean, less fat and bone in the *L. dorsi* muscles and less fat over the 9th rib. These findings are in agreement with previous studies indicating the superiority of Charolais and their crosses in carcass composition (Berg and Butterfield, 1976; Berg et al., 1978; Kempster et al., 1988 and More O'Ferrall and Keane, 1990).

Age at slaughter affected (P<.0001) all traits. Increasing slaughter age was accompanied by larger LDA. The reduction in bone exceeded 10% with advancement of age, means were 32.8, 21.2 and 22.4% for animals slaughtered at 4, 8 and12 months, respectively. Fatness of carcass, indicated by FT and % ether extract increased progressively with advance of age.

Differences among groups in chemical composition were all nonsignificant (Table 5) except for the effect of age at slaughter on % ether extract in *L. dorsi* muscle (P<.01). However, crossing with Charolais tended to produce meat with more lean and less fat. These findings are confirmed by the data on physical composition of *L. dorsi* muscle and with reports reviewed by Berg and Butterfield (1976).

Table 4. Means and mean squares of physical composition of Longissimus dorsi muscle of straightbred Friesian (FxF) and Friesian x Charolais (CxF) slaughtered at different ages[1]

Trait	Genotype (G)			Age at slaughter (A)				Mean squares			
	FxF	CxF	SE	4mo	8 mo	12 mo	SE	G	A	GxA	Residual
No. of animals	9	9		6	6	6		1	2	2	12
LDA[2] (cm^2)	46.5^b	57.4^a	3.37	31.3^c	41.9^b	82.7^a	4.13	528^*	4411^{**}	166^{NS}	102
FT[3] (mm)	2.14	1.76	0.31	0.80^c	1.47^b	3.58^a	0.39	0.7^{NS}	12.7^{**}	0.3^{NS}	0.9
Lean (%)	64.7	67.6	1.29	64.2^b	73.5^a	60.7^b	1.28	36^{NS}	264^{**}	63^*	15
Fat (%)	9.2	7.5	0.74	2.9^c	5.3^b	16.9^a	0.90	13^{NS}	336^{**}	16^{NS}	5
Bone (%)	26.1	24.9	1.02	32.8^a	21.2^b	22.4^b	1.25	6^{NS}	247^{**}	21^{NS}	9

[1]Mean, within classification, within rows, followed by different letters differ significantly (P<.05).

[2]LDA = Longissimus dorsi area.

[3]FT = fat thickness.

NS, nonsignificant; * = P<.05; ** = P<.0001.

Table 5. Means and mean squares of chemical composition fo Longissimus dorsi muscle of straightbred Friesian (FxF) and Friesian x Charolais (CxF) slaughtered at different ages[1]

Trait	Genotype (G)			Age at slaughter (A)				Mean squares			
	FxF	CxF	SE	4mo	8 mo	12 mo	SE	G	A	GxA	Residual
No. of animals	9	9		6	6	6		1	2	2	12
Moisture(%)	75.9	76.8	0.44	77.0	76.6	75.6	0.54	3.56^{NS}	2.81^{NS}	0.04^{NS}	1.76
Crude protein(%)	20.7	21.1	0.25	21.1	21.1	20.7	0.30	0.83^{NS}	0.25^{NS}	0.30^{NS}	0.54
Ether extract(%)	1.59	0.96	0.24	0.53^{c}	1.31^{b}	1.99^{a}	0.29	1.77^{NS}	3.19^{*}	0.13^{NS}	0.51
Ash (%)	0.99	1.03	2.59	1.00	0.96	1.06	0.03	0.01^{NS}	0.02^{NS}	0.01^{NS}	0.01
NFF (%)	0.78	0.36	0.15	0.45	0.63	0.64	0.18	0.78	0.06	0.09	0.19

[1]Means, within classification within rows, followed by different letters differ significantly (P<.05).
NS, nonsignificant, * = P<.01.

Using Charolais sires on Friesian herds would yield faster gain, better conversion, and enhance dressing percentage. In conclusion, results obtained from the present study recommend the use of Charolais coupled with delay of slaughter up to 12 months would be an effective means to improve efficiency of dairy beef production in the U.A.E. However, further research is required to determine the economic feasibility of using Charolais sires.

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أداء ذكور أبقار الفريزيان وخليط الشاروليه المذبوحه عند ثلاث اعمار مختلفه

علي نجم ، غالب الحضرمي ، عبد القادر خليف و عمر عبدالله
قسم الإنتاج الحيواني - كلية العلوم الزراعية - جامعة الإمارات العربية المتحدة - ص . ب ١٧٥٥٥ - العين - الإمارات العربية المتحدة .

ملخص :

تم استخدام ثمانية عشر عجلاً بعمر اربعة شهور في تجربة تسمين ، تسعه فريزيان والباقى فريزيان خليط مع شاروليه . تم ذبح ستة عجول عند عمر اربعة شهور والباقى تم تسمينه ثم ذبحه عند عمر ثمانيه أو اثنى عشر شهراً قدم العلف المركز ودريس حشيشه الرودس حتى الشبع وقد تم حساب كل من متوسط الزياده اليوميه للوزن ، معدل التحويل الغذائى ، الوزن عند الذبح ، وزن الذبيحه الساخن ونسبة التصافى . فُصل اللحم والدهن والعظم من الضلع التاسع ، العاشر والحادي عشر كما اخذت مساحة العضلة العينيه وسمك الدهن للضلع التاسع ، اجريت التحليلات الكيميائيه للحم على العضلة العينيه .

اعطي خليط الشاروليه اعلى متوسط للزيادة اليوميه في الوزن ($P < .01$) وافضل معدل تحويل للغذاء ($P < .01$) خلال الفترة من ٤ - ٨ شهور. مما نتج عنه اعلي وزن عند الذبح ($P < .05$) عند عمر ٨ شهور واعلى وزن للذبيحه الساخنه واعلي نسبة للتصافى واعلي فى نسبة اللحم الأحمر واقل

في نسبة الدهن والعظم فى منطقه الضلوع ولكن الفروق كانت غير معنويه.
ان زيادة مساحة العضلة العينية (P<.05) في خليط الشاروليه دلالة علي زيادة عدد القطعيات .
تأخير الذبح الي ثمانية أو اثنى عشر شهراً ادى الى زيادة وزن الذبيحه ومساحة العضلة العينيه ووزن الذبيحه الساخن (P<.0001) كما تحسنت نسبة التصافي (P<.05) وانخفضت نسبة العظم في قطعيات الضلوع (P<.0001) وكان ذلك مصحوباً بزيادة فى نسبة وسمك الدهن . وقد اوضحت النتائج ان استخدام الشاروليه وتأخير وقت الذبح سوف يحسن من كفاءه انتاج اللحم من حيوانات الحليب فى دولة الإمارات العربية المتحدة .

كلمات مفتاحيه : ذكور أبقار فريزيان ، شاروليه ، خليط ، الذبيحة .