S2P15.WP

BUFFALO (*Bubalus bubalis*) MEAT QUALITY WHEN SUBMITTED TO THREE FEEDING REGIMENS

L. MÜLLER, L.F. AGUIRRE, G.L. FEIJÓ and Z. PEROBELLI

Universidade de Santa Maria, Departamento de Zootecnia, S. Maria, RS Brasil

INTRODUCTION

Water buffalo was first introduced in Brasil about 150 years ago, (ASCRIBU, 1987). For many years they were raised mainly in the northern portion of Brasil in grounds subjected to flood or in poor quality grass. Differing from the rest of the world, buffaloes are raised mainly for meat production and only less frequently for milk and/or labour.

In the last few years, the ranchers are showing a growing interest in this species all over the Country, due mainly to its ability to digest grass with a high fibre content, adaptation to wet lands where cattle do not perform well and resistance to ecto and endo parasites and diseases that affect cattle.

Another point is the claim from buffalo breeders that meat produces less cholesterol than other mammalian meat which is supported by the work of Yadava and Singh (1974). Few scientific studies have been devoted to test performance, carcass and meat quality, but the findings generally agree that they can produce meat quality comparable to cattle (Valin *et al.*, 1984, Müller *et al.*, 1991). The increased production of buffalo meat could make a great contribution to the growing need for meat in developing countries.

The southern portion of Brasil where this work was conducted, presents temperate to sub-tropical climate with hot summers and cold winters. During winter frosts are frequent that kill or stop the growth of native grass. As a result, cattle lose weight and some die by starvation. Due to this problem, the slaughter age of steers is around 4 to 4.5 years of age (Müller and Primo, 1986). In order to reduce the age of slaughter and achieve a better quality carcass, it is recommended to plant cultivated pasture that grows well during the winter, generally ryegrass or a mixture of it with legumes. The performance of cattle in this system is well established, but is not well defined for buffaloes.

The aim of this experiment was to compare performance and carcass quality of this species when submitted to three different feeding regimens during the winter.

MATERIAL AND METHODS

Twenty-four Mediterranean buffalo steers were randomly distributed into three treatments during the winter (112 days):
T1-8 steers permanently in cultivated pasture of ryegrass;
T2-8 grazed ryegrass for two hours/daily and the rest of the day remained in native pasture; and
T3-8 permanently in native pasture.
During the summer (112 days) all 24 grazed the same native grass until they reached slaughter weight that was fixed in around 450kg.

After a 24-hour chill, the right side was used for objective and subjective determinations. The side was ribbed between the 12 and 13th rib, *longissimus* area was traced, fat thickness measured and marbling, colour and texture of the lean were evaluated. A portion of the loin (9-10-11 rib cut) was used for estimating the physical composition of the carcass following the procedure of Hankins and Howe (1946). The left side was divided into the three major cuts as is used in Brasil: pistol cut (round, rump and loin with eight ribs), fore quarter (five ribs) and side.

A portion of the loin was transported to the Meat Laboratory at the University and stored in a freezer at -20°C until used for palatability studies. From each loin two steaks 2.5cm thick, were removed, thawed and roasted to an internal temperature of 70°C: Steak 1 for the taste panel (five persons) and steak 2 for objective determination of tenderness through the use of the Warner-Bratzler shear device.

RESULTS AND DISCUSSION

The performance of the buffaloes during the winter (fall/winter/spring) and summer (spring/summer/fall) can be seen on Table 1.

T1 animals showed better gain in the cultivated pasture (910g) although the gains made by T2 and T3 can be considered good, mainly T3, because this is the time when cattle loses weight. During the summer when all animals were put in the same native pasture, the inverse was observed. T3 and T2 gained better making compensatory gain that caused the animals to reach slaughter weight at the same age (two years). Johnson and Charles (1975) reported an average gain of 670g for buffaloes fed grain for 200 days and Valin (1984) found an average daily gain of 706g when fed 50% concentrate and 50% straw.

No significant difference was observed in live weight in the Experimental Farm or in the Packing Plant among the three groups. Loses during transportation averaged 3.83%. Hot and cold carcass weight was also similar for the three treatments. The most significant difference was observed in dressing percentage where T1 presented better yield, 52.98%, possibly as a result of the better feeding during the winter what caused a lesser development of the G.I. tract. These values are similar to the ones reported by Valin (1984), Robertson *et al.* (1986) and Arima *et al.* (1990) whose values situated around 50 and 52%.

Evaluation of some carcass parameters are presented in Table 3.
Studying the data, the only significant differences were noticed in fat thickness which averaged 5.32mm for T1, 4.31 for T3 and 2.43 for T2 and physiological maturity where T1 animals were judged more mature by observing cartilagen ossifications. All the other characteristics showed similar values, that could be expected since they were slaughtered at the same age and live weight.

The area of the *longissimus* muscle in relation to live weight is small in comparison to cattle (Müller *et al.*, 1991). This may be explained by the results of Butterfield (1963b) who concluded that buffaloes show a reduction in the proportion of muscles surrounding the spinal column in comparison with steers.

The proportion of the three major cuts, Brazilian style, is presented in Table 4. The pistol cut presented higher values in T1 and T3, average 47.96% whilst T2 had a slightly higher proportion in the forequarter. These values are in close agreement and did not differ a great deal from that found for cattle, Müller *et al.* (1991).

The carcasses were then evaluated in their physical composition, Table 5. The proportion of the tissues were similar for the three treatments. Average values were 59.46, 20.80 and 18.65% for muscle, fat and bone respectively. Charles and Johnson (1972) working with five buffaloes 14-21 months old/177kg carcass weight and one with 48 months/280kg carcass weight, found the following values for muscle, fat and bone: 68.6, 10.6 and 17.3%. In a work conducted by Berg and Butterfield (1966) the values obtained were: muscle 63, fat 13 and bone 20%.

Table 6 presents some characteristics of the meat. The only significant difference was in the amount of marbling where T1 displayed a higher value, although smaller than cattle of similar age and weight (Müller *et al.*, 1991). Tenderness judged by panel and Warner-Bratzler shear presented similar values between treatments. Nascimento *et al.* (1978), Charles (1982) and Valin (1984) reported that buffaloes can produce meat of high quality. The values presented in Table 6, show that tenderness for the three groups was around and above (T1) average score.

Correlation coefficients between loin area and fat thickness with physical composition of the carcasses can be seen in

Table 7. From these results one can conclude that loin area is a poor indicator of muscling, fat and bone in buffaloes. On the other hand, fat thickness measured between the 12 and 13 rib, correlates quite well with the proportion of the three tissues, calculated using the equations of Hankins and Howe (1946).

CONCLUSIONS

It can be concluded from this work that the different feeding regimens during the winter did not influence the majority of parameters studied and that buffalo can produce carcass and meat of acceptable quality.

REFERENCES

ARIMA, A.K., MATTOS, J.C.A., BARBOSA, C., and SILVEIRA, E.T.F. 1990. Carcass Composition of Mediterranean (*Bubalos bubalis*) and Zebu Nelore *Bos indicus* Breeds. *Proc. 36th ICMST.* Havana, Cuba. 1:6-13.

ASCRIBU (Associação Sulina de Criadores de Búfalos). 1987. *O manejo do Búfalo.* Boletim Ascribu. 43pp.

BERG, R.T., and BUTTERFIELD, R.M. 1966. Carcass Composition of Buffalo and Cattle. *Anim. Prod.* 8:1.

BUTTERFIELD, R.M. 1963b. In: tribe, d.e. (ED). *Symposium on Carcase Composition and Appraisal of Meat Animals.* Pap. No.7, p.1 (CSRIO, Aust. Melbourne).

CHARLES, D.D. 1982. Meat Tenderness and Palatability of Swamp Buffalo and Four Breeds of Cattle. *Anim. Prod.* 34:79-84.

CHARLES, D.D., and JOHNSON, E.R. 1972. Carcass Composition of the Water Buffalo (*Bubalus bubalis*). *Aust. J. Agric. Res.* 23:905-911.

HANKINS, O.G., and HOWE, P.E. 1946. Estimation of the Composition of Beef Carcasses and Cuts. *USDA Tech. Bull.* #926. 20pp.

JOHNSON, E.R., and CHARLES, D.D. 1975. Comparisons of Live weight Gain and Changes in Carcass Composition Between Buffalo (*Bubalus bubalis*) and (*Bos taurus*) Steers. *Aust. J. Agric. Res.* 26:415-422.

MÜLLER, L., AGUIRRE, L.F., and RESTLE, J. 1991. Carcass and Meat Quality of Cattle and Buffalo (*Bubalus bubalis*). *Proc. 37th ICMST.* 1:37,165-169.

MÜLLER, L., and PRIMO, A.T. 1986. Influência do Regime Alimentar no Crescimento e Terminação de Bovinos e na Qualidade da Carcaça. *Pesq. agropec. bras. Brasília.* 21(4):445-452.

NASCIMENTO, C.N.B., NETO, M.S., and CARVALHO, L.O.D.M. 1978. Provas de Degustação com Carnes Bovinas e Bubalinas. In: *Anais da 15a Reunião Anual da Soc. Bras. Zootec.* Belém, Brasil. p.149.

ROBERTSON, J., RATCLIFF, D. BOUTON, P.E., HARRIS, P.V., and SHORTHOSE, W.R. 1986. A comparison of Some Properties of Meat from Young Buffalo (*Bubalus bubalis*) and Cattle. *J. Food. Sci.* 51:47-50.

VALIN, C., PINKAS, A., DRAGNEV, H., BOIKOVSLI, S., and POLIKRONOV, D. 1984. Comparative Study of Buffalo and Beef. *Meat Sci.* 10, 69-84.

YADAVA, B.S., and SINGH, L.N. 1974. Chemical Composition of Buffalo Meat Available from the Local Slaughter House. *Indian J. Anim. Sci.* 44(10):746-749.

Table 1. Performance of buffaloes when submitted to three feeding regimens during winter and summer - kg.

Treatments	Winter Initial	Final	ADG	Summer Final	ADG	Final ADG
T1	301	403	0.910[a]	452	0.248[a]	0.674
T2	300	380	0.714[b]	451	0.625[b]	0.674
T3	300	356	0.500[c]	439	0.741[b]	0.620

[a,b,c] Means bearing a different letter in the column differ (P<0.05).
ADG = average daily gain.
[e] The T3 animals were slaughter 13 days later.

Table 2. Yield data of buffaloes submitted to three feeding regimens during the winter and the summer.

Parameters	T1 Mean	SD	T2 Mean	SD	T3 Mean	SD
Weight, in farm, kg	452.75	21.02	451.50	16.82	459.12	21.11
Weight in abattoir	435.00	24.35	437.50	12.25	438.75	18.85
Transport loss, %	3.92	.12	3.10	0.08	4.47	0.17
Hot carcass weight, kg	230.45	11.84	221.90	7.97	220.12	13.12
Cold carcass weight, kg	225.81	11.61	216.60	7.72	213.81	12.85
Chilling loss, %	2.00[a]	.05	2.39[a]	0.07	2.87[b]	0.08
Dressing percentage, %	52.98[a]	1.82	50.71[b]	0.79	50.17[b]	1.01

[a,b] Means bearing a different letter differ (P0<.05).

Table 3. Carcass evaluations of buffaloes submitted to three feeding regimens during the winter and the summer.

Parameters	T1 Mean	SD	T2 Mean	SD	T3 Mean	SD
Longissimus area, cm^2	50.16	3.00	50.80	2.41	47.33	4.51
Fat thickness, mm	5.32[a]	2.20	2.43[b]	0.62	4.31[a]	1.67
Carcass length, cm	123.68	3.12	122.93	2.60	122.00	3.07
Leg length, cm	69.81	2.93	70.31	2.07	70.31	1.03
Arm length, cm	40.87	1.73	41.06	1.32	39.87	0.69
Arm perimeter cm	34.87	0.83	34.62	1.41	35.37	1.42
Thickness of cushion, cm	23.75	0.85	23.12	0.69	22.91	0.79
Conformation[c]	9.00	0.93	8.50	0.53	8.50	1.07
Physiological maturity[d]	11.00[a]	0.53	11.50[ab]	0.76	12.37[b]	0.52

[a,b] Means bearing a different letter differ (P0<.05).
[c] 7 - 9 = Standard.
[d] 10 = B plus; 11 = B average; 12 = B minus.

Table 4. Major cuts in the carcasses of buffaloes submitted to three feeding regimens during the winter and the same in the summer.

Parameters	T1 Mean	SD	T2 Mean	SD	T3 Mean	Sd
Pistol cut[c], %	47.37[a]	1.01	46.66[b]	0.89	48.56[a]	0.52
Forequarter, %	37.94[a]	0.67	38.36[ab]	0.57	37.39[b]	0.71
Side, %	14.66	0.72	14.15	1.18	14.02	0.52

[a,b] Means bearing a different letter differ (P0<.05).
[c] Round, rump and loin with 8 ribs.

Table 5. Physical composition of buffaloes submitted to three feeding regimens during the winter and the same in the summer.

Parameters	T1 Mean	SD	T2 Mean	SD	T3 Mean	SD
Muscle, %	58.28	2.94	60.24	.98	59.86	3.63
Fat, %	22.32	3.25	19.26	1.95	21.10	.18
Bone, %	18.48	1.36	19.25	.95	18.24	.62

Table 6. Qualitative evaluation of the meat of buffaloes submitted to three feeding regimens during the winter and the same in the summer.

Parameters	T1 Mean	SD	T2 Mean	SD	T3 Mean	SD
Marbling[c]	3.12[a]	1.73	1.37[b]	0.52	2.00[b]	0.93
Colour of lean[d]	3.00	0.76	3.62	0.52	3.37	0.92
Texture of lean[d]	2.62	0.52	2.00	0.76	2.37	0.74
Thawing losses (%)	5.62	1.84	6.41	1.69	6.00	2.36
Cooking losses (%)	30.22	3.17	32.85	2.38	31.96	1.62
Panel tenderness[e]	5.90	0.86	5.52	0.70	5.52	0.69
Panel juiciness[e]	5.20	0.54	4.81	0.70	4.80	0.46
Panel flavour[e]	5.27	0.51	4.96	0.46	4.85	0.35
Shear force kg	5.59	0.84	5.76	0.68	6.08	1.20

[a,b] Means bearing a different letter differ (P<.05)
[c] 1-3 = Traces 4-6 = Slight
[d] 1 = Very dark, very coarse 5 = Bright red, very fine
[e] 1 = Ext. tough, dry, undesirable flavour 5 = Average
9 = Ext. tender, juicy, flavourful

Table 7. Simple correlation coefficients among some variables in buffaloes submitted to three feeding regimens during the winter and the same in the summer.

Variable	Loin area	Fat thickness
Muscle, %	0.01	-0.63**
Fat, %	-0.12	0.73**
Bone, %	0.25	-0.43*