1 : 1

PALATABILITY CHARACTERISTICS OF MEAT FROM CULL COWS IMPLANTED WITH TRENBOLONE ACETATE

ADAM, J.J.[1], FABRY, J.[2] and DEROANNE, C.[1]

(1) Centre Agronomique de Recherche sur la Viande, Faculté des Sciences Agronomiques de l'Etat, B-5800-GEMBLOUX, BELGIQUE.

(2) Station de Zootechnie, Liroux, B-5800-GEMBLOUX, BELGIQUE.

I. INTRODUCTION

Consumers have always requested tender, flavorful meat, but because of economic and social concerns over fat intake, they also prefer products which are mostly free of fat (DIKEMAN, 1982). In Belgium, meat from cull cow represents more than 40 % of the total meat production. Anabolic compounds are widely used to improve live weight gain and feed efficiency in bulls (FABRY & al., 1984).

A rather limited number of experiments have been conducted with anabolics in cull cows. But it is known that trenbolone acetate implant is very efficient to increase rate of weight gain in cows (LAMBOT & al., 1984). But relationship between the effects of the implant on main meat characteristics is not well documented in cows. In young bulls, zeranol implant during postweaning feeding period gives quality and palatability characteristics similar to non-implanted bulls (GREGORY & al., 1983). However other have suggested that implanting young bulls from birth to slaughter may improve marbling score, lean texture (GREATHOUSE & al., 1983) and palatability traits of flavor intensity, connective tissue amount, myofibrillar tenderness and (or) WARNER-BRATZLER shear values (GRAY & al., 1984) compared with non-implanted bulls.

The objectives of our study were to determine the effect of implanting cull cows with trenbolone acetate on meat palatability and muscle collagen characteristics. We also intended to compare results from laboratory methods and notes obtained from a sensory panel to assess main meat parameters.

II. MATERIAL AND METHODS

II.1. ANIMALS

Fourteen White-Blue cull cows (dual purpose strain) were assigned randomly by bodyweight and growth rate to either implanted (T, n = 7) or control (C, n = 7) groups. Treated cows were given an anabolic implant, subcutaneously on the upper face of ear flaps containing 300 mg of trenbolone acetate (Finaplix Roussel-Uclaf, France). Initial mean liveweight of each group was 540 ± 38 kg in control and 544 ± 24 kg in implanted cows. The animals were fed pressed wet beet pulp silage ad libitum and an all mash (0.75 kg/100 kg liveweight) containing 15 % crude protein.

Research financed by I.R.S.I.A. (BRUSSELS - BELGIUM).

Feed intake was controlled daily for each animal during the experimental period (52 days, january-february). At the end of the feeding period, cows were slaughtered and yield grades according to EEC scale were evaluated. For C and T groups final weight and yields were respectively 604 ± 50 kg - 56.1 % and 613 ± 41 kg - 59 %. Carcasses were kept 24 hours at 4°C before removing the 7 th rib sections (right and left). Meat samples were frozen immediately (-20°C) and later analysed for meat quality simultaneously by laboratory methods and by a sensory panel.

II.2. METHODS USED FOR MEAT QUALITY ESTIMATION

In order to characterize meat quality, analyses were performed on the 7 th rib sections of each animal according the reference laboratory methods described previously (ADAM & al., 1985).

Additional parameters were also checked : myofiber shortening, stickiness, total protein and juice extraction after cooking.

II.2.1. Myofiber shortening

The measurement of myofiber shortening was used as an instrumental evaluation of tenderness. A sample (section area : 0,10 cm^2, length : 4 cm) was cut off from the iliospinal muscle. Thereafter it was hung up vertically in a test tube containing 18 ml of phosphate buffer (pH 6.1). The tube was maintained at constant temperature (80°C) in a water-bath for 30 minutes (see Figure 1). Difference in fibers length (before and after thermal treatment) expressed as a percentage of initial length was called "shortability ". Final results were the mean value of two consecutive determinations.

II.2.2. Stickiness

Stickiness was considered as an appreciation of the sticky character of meat which is considered as a defect due to ageing. The parameter we have measured was derive from the work of SHERMAN (1977). It was based on the maximal force measurement to unstick a meat sample (iliospinal muscle, section : 36 cm^2; thickness 1 cm; weight : Pg) from a plexiglass plate, with an INSTRON 1140 instrument (linear speed : 50 mm/min.) (see Figure 2).

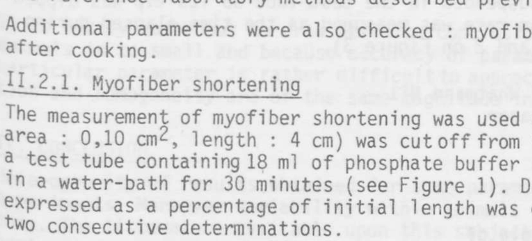
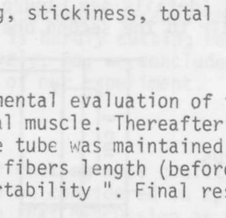


FIGURE 1 - Myofiber shortening measurement apparatus



T = maximum force at the unsticking point

P = sample weight

$$\text{Stickiness} = \frac{T - P}{P}$$

FIGURE 2 - Stickiness test recording general shape

II.2.3. Total protein

The total proteins were determined by Kjeldhal method. Results expressed as nitrogen percent in fresh meat were the mean values of two nitrogen determinations on a 1 g sample cut off the "trapeze" muscle.

II.2.4. Juice extraction by cooking

Three defatted and denerved meat slices from the "grand dentele" muscle (weight : ± 30 g, thick : 0,5 cm) were cooked (1.5 minutes on each side) in a frying-pan heated on an electric hot plate maintained at 165°C. Weight lost during cooking treatment was expressed as a percentage of the initial weight.

II.2.5. Meat color determination (iliospinal muscle)

II.2.5.1. Total pigments

Total pigments were determined according to HORNSEY (1956) method.

II.2.5.2. Metmyoglobin fraction

The method described by BROUMAND (1958) was used to measure the metmyoglobin fraction. Meat sample was minced during 20 seconds in a home mixer at the laboratory temperature.

II.2.5.3. Pigment oxidising level

According to the work of HARRISSON & al. (1980) differences in transmittances were measured at 630 and 580 nm (T 630 - T 580) on intact meat samples. A SHIMADZU UV-240 single beam spectroreflectometer with an integrated sphere was used for transmitance measurements. Results were expressed in percentages of fresh meat (VAN DEN OORD & al., 1971).

II.2.5.4. Tristimuli values

Meat color was also assessed by an HUNTERLAB D25 colorimeter. L, a and b values were calculated.

II.2.6. Juice extracted by centrifugation

II.2.6.1. Quantity

A 120 g sample of lean meat from "iliospinal" muscle was first grinded in a home mixer during 20 seconds at 20°C. The grinded material was divided into 6 centrifugal tubes. The tubes were than centrifugated (35.000 g) during 30 minutes. Juice extracted was separated and weighted. Results were expressed as a percentage of initial fresh meat.

II.2.6.2. Dry matter

One gram of juice was evaporated to dryness in a drying oven heated at 105°C. Dry matter was expressed in percent of initial juice weight.

II.2.6.3. Soluble protein

The Kjeldahl procedure was applied to 2.5 g samples of juice.

II.2.6.4. Viscosity

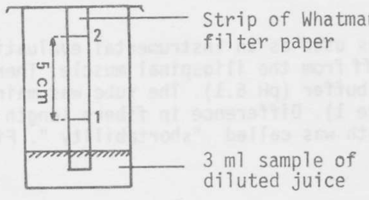
Viscosity was measured on three 3 ml - aliquots of juice in a BROOKFIELD apparatus (plate-cone cell, 60 rpm).

II.2.6.5. Migration

The following procedure was used : centrifugational juice (1 ml) was first diluted in 9 ml of physiological liquid (NaCl 0.85 %). A three ml sample of diluted juice was put in the bottom of a test tube. A strip of Whatmann N°1 filter paper (lenght : 14 cm, breed : 0.5 cm) was suspended in the test tube so its tip was dipped 1 cm below the meat juice level (details see Figure 3). Migration rate was measured as the time elapsed during juice migration from first repair to the second one (noted as 1 and 2 on Figure 3).

FIGURE 3

Migration test apparatus



II.2.7. Sensory assessment

A panel of 8 experts belonging to the laboratory staff was trained to appreciate color, juiciness and tenderness of meat. A 7 points scale was used (1 : low to 7 : high) as mean of classification. The samples cut from iliospinal muscle were assessed during three sessions. Means of the notes obtained from the experts were expressed as a percentage.

III. RESULTS AND DISCUSSION

Main results (mean, standard deviation, variation coefficient) are summarized in the tables given here after.

III.1. PHYSICO-CHEMICAL CHARACTERISTICS

Four out of five physico-chemical parameters (pH, dry matter, total protein and collagen quantity) did not exhibit any significant difference between meats from control or trenbolone acetate anabolised cull cows. Earlier VALIN & al. (1978) failed to detect any difference in pH. However KOPP (1984) observed a decrease in dry matter content but could not distinguish difference in collagen levels. These results might be explained by a difference in anabolic compounds used. More over numerous factors can modify water retention by meat. Meat from anabolised cull cows contains less fat (± 26 %; $P < 0.1$) than meat from control animals. A comparison with results obtained previously (ADAM & al., 1985) indicates that :

1. dry matter of meat from cull cows (CC) was less important than that from heifers (H) control group : 26.70 CC - 25.75 H; treated group : 29.26 CC - 28.86 H). But age, breed and diet composition may greatly influence fat deposition in meat animals,
2. intramuscular fat content was also less important in cull cows than in heifers (control group : 26.30 H - 14.77 CC; treated group : 28.18 H - 10.84 CC),
3. the intramuscular collagen content was of the same magnitude in the two types of animals.

III.2. JUICINESS

As preliminary remark we noted that the quantity of juice extracted was namely method of extraction dependant. When cooking in a microwave oven, we extracted a quantity of juice twice more important than with more classical methods as cooking in humid atmosphere or in a frying-pan. By centrifugation method we separated 15 to 20 % less juice. These results agree with those previously obtained by ADAM & al. (1985). So with the three methods tested no significant difference between treated and untreated meats were found for juiciness. Only juice quantity extracted by centrifugal force was different ($P < 0.01$) between the two groups of animals. On this respect our results were similar to those obtained by VALIN (1984) who observed that anabolised meats lost about 25 % more juice than reference meats.

The sensory panel did not distinguish any significant difference (only 1.3 point). All the parameters measured on centrifugation juices (dry matter, protein, viscosity and migration) were not influenced by anabolic treatments. Nevertheless treated meats were more sticky ($P < 0.1$). That difference might partly be explained by a higher juice viscosity (± 8 %).

III.3. TENDERNESS

Two different approaches of tenderness assessment have been made, on one hand by a sensory panel and on the other hand by a set of instrumental methods based on estimation of shear forces, compression work, elasticity and fiber shortening. All results obtained by the two ways of analysis lead to the same conclusion : the meat is relatively tough. Nevertheless tenderness evaluation by some parameters indicated that the anabolised meat could be less tender. The parameter "A" (increasing of the compression work by increasing of sample thickness) was significant ($P < 0.1$) and the mincing power was also different ($P < 0.01$). Results obtained by the sensory panel were the same for the two types of meat (difference : less than 0.5 point) : no difference could be found in respect of their origin. VALIN (1984) observed a decrease in tenderness when anabolic compounds were used.

III.4. COLOR

The tristimuli values L, a and b were 30 % higher in anabolised meat. That difference was not statistically significant. But that meat contained less oxydised pigments ($P < 0.01$). The determination of this analytical parameter was more sensitive that the eyes of the taste panel who failed to find any difference in meat color (only one point).

III.5. MACROSCOPIC COMPOSITION AND HOMOGENEITY

Comparison of results from this experiment with those obtained earlier (ADAM & al., 1985) indicated that butcher yields (lean meat weight/total weight) in cull cows were lower than in heifers (control : 52.70 H - 48.96 CC; treated : 58.60 H - 56.80 CC).

It is likely hasardous to draw definite conclusion from such experiment because the number of experimental animals is to small and because accuracy of parameters tested is hardly cutting reliability depending. This particular parameter is rather difficult to appreciate objectively. So, we conclude that the macroscopic composition and homogeneity are of the same magnitude in all animals of our experiment.

IV. CONCLUSION

Heterogeneity of results obtained for some parameters used for cheking meat quality was important as in previous experiments. Moreover variability within animals groups was to be considered in spite of care taken to alloted them. The litterature available upon this subject is so scarce that discussion is rather limited. In some cases contradictory results could be explained because numerous factors can influence body composition in farm animals.

With laboratory methods and with a sensory panel we can draw the same conclusion : trenbolone acetate implant in cull cow do no change any main meat qualities as juiciness, tenderness and color.

V. BIBLIOGRAPHY

- ADAM, J.J., FABRY, J., ETTAIB, A. et DEROANNE, C. Effet d'un apport d'hormone de croissance bovine sur la qualité des viandes de génisse Blanc-Bleu-Belge. Recueil de Médecine Vétérinaire, 1985, 161, 8/9, 655-663.
- BROUMAND, H., BALL, C.O. & STIER, E.F. Factors affecting the quality of prepackaged meat. II. E. Determining the proportions of heme derivatives in fresh meat. Food Technology, 1958, 12, 65-77.
- DIKEMAN, M.E. Efficient meat production, consumer demands for nutrition and for palatability. Proc. Int. Symp. Meat Sci. and Techn., 1982, pp. 57-60, Award Printing groups, Chicago.
- FABRY, J., VANDENBYVANG, P., RENAVILLE, R. et BURNY, A. Perspectives nouvelles en vue d'un contrôle in vivo de taurillons anabolisés. Revue de l'Agriculture, 1984, 37, N°1, 99-115.

- GRAY, D.G., UNRUH, J.A., DIKEMAN M.E. & CORAH, L.R. Effects of ralgro implantation periods on masculinity and carcass traits of young bulls and steers. Kansas-Agr. Exp. Sta. Rep. of Prog. 448 : 14, 1984, Kansas State Univ, MANHATTAN.
- GREATHOUSE, J.R., HUNT, M.C., DIKEMAN, M.E., CORAH, L.R., KASTNER, C.L. & KRAPF, D.H. Ralgro implanted bulls. performance, carcass characteristics, longissimus palatability and carcass electrical stimulation. J. Anim. Sci., 1983, 57, 355.
- GREGORY, K.E. & FORD, J.J. Effects of late castration, zeranol and breed group on growth, feed efficiency and carcass characteristics of late maturing bovine male. J. Anim. Sci., 1983, 56, 771.
- HARRISSON, A.R., KROPF, D.H., ALLEN, D.M., HUNT, M.C. & KASTNER, C.L. Relationships of spectrophotometric reflectance measurements to beef muscle visual color. J. Food Science, 1980, 45, 1052-1053.
- HORNSEY, H.C. The colour of cooked cured pork. I. Estimation of the nitric oxide-haem pigments. J. Sci. Food Agric., 1956, 7, 534-540.
- KOPP, J., BONNET, M., ZABARI, M., RENOU, J.P. et VALIN, C. Influences relatives du sexe et d'un traitement anabolisant sur les caractéristiques du muscle long dorsal de veau. 30th European Meeting of Meat Research Workers, 1984, 3 (27), p. 145, BRISTOL.
- LAMBOT, O., VAN EENAEME, C., GIELEN, M., BIENFAIT, J.M. Anabolisants et vaches de réforme. Revue de l'Agriculture 1984, 37, N°3, 599-607.
- SHERMAN, P. Sensory properties of foods. Applied Science Publishers, 1977.
- VALIN, C., RENERRE, M., TOURAILLE, C., KOPP, J. et SORNAY, J., Ann. Nutr. Aliment., 1978, 32, 857.
- VALIN, C., TOURAILLE, C. ZABARI, M. et RENOU, J.P. Influence des anabolisants sur la qualité des carcasses de veau. 30th European Meeting of Meat Research Workers, 1984, 4 (8), p.176, BRISTOL.
- VAN DEN OORD, A.H.A. & WESDORP, J.J. Analysis of pigments in intact beef farm. J. of Food Technology, 1971, 6, 1-8.

SAMPLES	PARTIAL WEIGHTS				pH	DryMat	Fat	Protein	Coll.	WATER HOLDING CAPACITY (cooking)			
	Total	Fat	Bone	Lean						HumAtm	FryPan	MicroW	Stick.
15	1.893,0	586,2	334,0	972,8	5,56	26,66	13,32	23,32	2,94	17,96	24,40	54,90	8,40
16	1.978,0	726,7	361,6	889,7	5,52	26,88	18,68	22,72	2,88	27,53	24,00	59,50	-
17	2.135,6	650,2	334,8	1.150,6	5,53	26,45	15,39	22,91	3,08	25,97	25,90	60,00	8,62
18	2.615,6	710,2	370,2	1.535,2	5,55	26,19	9,13	23,35	2,82	20,15	30,00	54,10	7,88
19	2.363,4	864,2	254,2	1.245,0	5,53	27,28	18,15	22,03	1,84	24,93	26,90	49,30	8,07
20	2 115,6	679,7	258,1	1.177,8	5,53	26,89	12,53	24,25	2,00	33,51	28,80	51,00	-
21	2 263,2	784,2	322,3	1.156,7	5,55	26,52	16,21	23,25	2,93	22,61	32,80	49,30	13,15
$\bar{x}$	2.194,9	714,5	319,3	1.161,1	5,54	26,70	14,77	23,12	2,64	24,67	27,50	54,00	9,22
VC	11,13	12,68	14,48	17,81	0,26	1,33	22,81	2,94	18,99	20,79	11,50	8,29	24,00
22	2.262,0	708,0	389,0	1.165,0	5,62	25,54	7,32	23,02	2,20	21,04	17,60	58,30	18,46
23	2.468,0	631,0	659,6	1.177,4	5,56	24,89	4,86	22,56	2,24	22,84	26,30	45,10	14,29
24	1.738,0	566,7	417,3	784,0	5,57	26,16	7,61	22,49	2,65	23,38	25,90	58,70	10,89
25	1.908,3	866,9	245,4	796,0	5,57	26,84	17,47	22,83	2,44	25,16	23,80	57,10	9,29
26	2.250,1	626,6	368,7	1.254,8	5,53	25,43	16,48	22,58	2,87	23,18	28,70	53,50	7,57
27	2.464,0	654,8	517,2	1.292,0	5,55	24,37	9,11	23,17	2,62	28,23	27,70	51,30	15,68
28	2.207,0	751,0	435,2	1.021,0	5,54	27,04	13,05	23,36	2,59	24,85	28,90	61,50	-
$\bar{x}$	2.185,3	686,4	433,2	1.070,0	5,56	25,75	10,84	22,86	2,52	24,10	25,60	55,10	12,70
VC	12,46	14,47	29,79	19,58	0,53	3,82	44,91	1,47	9,47	13,95	15,40	10,10	32,62

SAMPLES	COLOR DETERMINATION						CENTRIFUGATION JUICE CHARACTERISATION				
	L	a	b	Tot.Pig.	Metmyo %	Pig.Oxi	Viscos.	Mig.	Quantity	Dry mat.	Sol.Prot.
15	36,6	15,0	11,3	163,20	10,93	26,97	3,36	24'16	11,54	13,71	12,52
16	36,9	12,6	10,1	155,04	10,16	19,98	3,20	24'42	12,12	14,38	12,76
17	31,2	14,5	8,7	142,80	16,02	12,46	2,97	22'11	17,00	13,94	12,24
18	30,2	12,7	7,6	148,24	8,49	9,64	3,13	21'39	12,23	14,09	12,87
19	33,8	12,8	9,4	297,16	10,14	1,97	3,02	23'31	16,91	13,96	12,31
20	32,7	11,4	8,8	179,52	9,43	22,09	3,31	22'72	15,86	13,76	12,41
21	26,8	14,3	7,1	212,84	11,23	3,59	2,85	21'53	15,14	14,01	12,67
x̄	32,60	13,33	9,0	185,54	10,91	13,81	3,12	22'81	14,40	13,98	12,54
VC	11,01	9,70	15,95	29,43	22,27	68,93	5,93	5,31	16,49	1,59	1,88
22	31,7	15,6	9,0	133,28	16,96	12,20	2,83	20'80	17,34	13,36	11,39
23	31,4	12,8	8,0	135,32	14,22	15,95	2,76	21'81	17,31	13,28	11,25
24	30,8	18,0	8,9	151,64	15,29	14,82	2,91	22'11	13,86	13,60	11,50
25	30,6	20,3	9,4	191,08	16,66	16,26	4,06	23'58	15,19	14,38	12,69
26	28,8	18,1	8,1	193,80	14,88	10,36	3,58	25'11	19,69	12,48	11,26
27	27,3	17,8	7,6	214,20	13,98	9,94	3,62	26'96	21,09	13,15	11,89
28	29,7	18,0	8,4	227,12	17,41	15,80	3,98	25'86	22,79	13,09	11,62
x̄	30,04	17,23	8,49	178,06	15,63	13,62	3,39	23'75	18,18	13,33	11,66
VC	5,20	13,81	7,52	21,34	8,81	20,04	16,28	9,69	17,55	4,32	4,35

SAMPLES	TENDERNESS PARAMETERS							SENSORY ASSESSMENT		
	Warn.Br.	Tau 5	A	r	LF/Lo	PM	Myo. Sh.	Color	Juiciness	Tenderness
15	3,56	95,24	103,56	0,90	0,496	89	29,93	51,79	45,54	67,86
16	3,65	94,74	87,16	0,87	0,534	109	36,86	42,86	40,19	35,71
17	4,93	57,89	125,28	0,96	0,522	106	32,91	33,93	71,43	66,96
18	6,32	0,00	113,62	0,96	0,520	84	29,92	50,90	34,83	46,43
19	7,97	0,00	119,29	0,94	0,515	86	30,42	62,50	33,93	51,79
20	4,62	76,47	69,80	0,90	0,524	92	28,96	89,29	51,79	42,86
21	7,53	0,00	102,96	0,95	0,507	72	33,12	83,04	51,79	46,43
x̄	5,51	46,33	103,09	0,93	0,517	91,1	31,73	59,19	47,07	51,15
VC	32,50	97,40	18,69	3,82	2,39	14,1	8,68	34,58	27,57	23,69
22	3,97	100,00	124,59	0,93	0,511	83	33,35	35,71	38,39	38,39
23	5,66	30,77	115,83	0,96	0,522	76	32,16	47,32	34,82	52,68
24	4,74	57,69	101,87	0,91	0,492	75	29,85	53,57	51,79	57,14
25	4,87	53,85	141,51	0,96	0,517	98	29,16	51,79	57,14	75,00
26	6,63	12,50	101,36	0,95	0,478	80	30,17	62,50	50,90	44,64
27	8,37	0,00	149,53	0,96	0,559	82	28,23	79,47	47,33	31,26
28	5,68	40,00	123,02	0,95	0,560	70	26,30	77,69	40,19	55,36
x̄	5,70	42,12	122,53	0,95	0,520	80,6	29,89	58,29	45,79	50,60
VC	25,40	78,23	14,95	2,00	5,96	11,1	7,89	27,46	17,83	28,20