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Growth and Meat Quality of Friesian and Buffalo Calves Fed Different Planes of Nutrition. II. The Quality of Lean

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FIFTY two bull calves (26 animals of each Friesian and buffaloes) were used in this study on diifferent planes of nutrition. This study was carried out to investigate the effect of age, breed and nutrition on the meat quality. Moisture percentage decreased significantly, while protein and intramuscular fat increased by advancing age. However, breed and plane of nutrition applied did not affect significantly the previous characters. Friesian, seems to be less than buffaloes at the majority of slaughtering ages in intramuscular fat.

Expressible fluid increased significantly by increasing protein percentage, water/protein ratio and advancing age.pH values and cooking loss were not affected by advancing age.

The quality of lean from cattle and buffaloes is important of learning more about the growth and development of meat animals. The quality factors are measured by colour, texture, marbling, fat distribution and some others. These quality factors are influenced by age, weight, breed, nutrition and sex as well as some other variables.

This study was carried out to investigate the effect of age, breed and nutrition on the chemical changes and physical characters of Friesian and buffaloes meat.

This experiment was carried out at the Anim. Prod. Exp. Farm. Fac. Agric., Assiut Univ. and extended from weaning till animals reached 2 years of age.

Material and Methods

Twenty six male calves from each Friesian and buffaloes were used in this study. Animals of each breed were divided into two equal groups on age and body weight basis. Friesian groups were asigned as A and B, while buffalo ones were asigned as C and D.

Group A and C were fed according to Kellner and Becker (1966) standard for fattening Friesian breed.

Group B and D were fed on 80% of the previous level. All animals were fed on the Egyptian clover and wheat straw only during winter time. In summer season (May-November), animals were fed on darawa (green maize fodder), concentrate mixture and maize.

Concentrates were given to adjust the starch value and digestible protein requirements. The ingredient of concentrate mixture as well as the chemical composition and feeding values of feed stuffs as shown in the previous paper(Abd El-Hafiz *et al.* 1981).

At the starting of the experiment, 2 animals from each breed were slaughtered. Therefore, 2 animals from each group were slaughtered at 8, 12, 15, 18, 21 and 24 months of age. Before slaughtering, calves were fasted for 14 hr for reducing the differences in digestive tract content and minimizing the resk of contaminating the carcass with different micro-organisms.

Physical characters and chemical analysis of the eye muscle were carried out to judge the quality of the meat, after the chilling period.

Chemical analysis

Moisture, protein, ash and intramuscular fat percentages were determined according to A.O.A.C. Methods (1975). Samples of Longissmus dorsi from 9, 10, 11*th* rib portion were used to determine the chemical composition for the whole carcass as recommended by O' Mary *et al.* (1979).

Physical characters

1- pH: Was determined by Beckman pH meter.

2-*Cooking loss*: a sample of about 100-200 g from the muscle was taken and put in boiling water for 45 min. from boiling again, then left to be at the room temperature then weighed to calculate the cooking loss percentage.

3- *Expressible fluid*: It was determined by weighing abut 0·3 g and was put on filter paper under pressure equal to 1000 g for 10 min and weighed according to Backer *et al.* (1972).

4- *Fiber diameter*: A sample from the longissmus dorsi muscle was fixed in formaldhyde solution (5%) for 24*hr*, then washed, dehydrated, cleared included in paraffin and sectioned by rotary microtome at thickness of 10 microne. Hematoxylin and eosin were used for staining according to the techinque describd by Carleton and Drury (1957).

Sataistical analysis was carried out according to Snedecor and Cochram (1968).

Results and Discussion

Chemical composition

The data of chemical composition are presented in Table 1 & 2. Generally, the moisture percentage in the carcass lean meat of both breeds decreased significantly with advancing in age under the two treatments. Mahyuddin (1977) fonnd that with increasing weight accompanied by decreasing the carcass moisture percentage.

On the other hand, the differeences between breeds and treatments were not significant Table 3. This is mainly explained on the basis that the intramuscular fat was not affected signiflcantly by either breed or treatment, since water and fat are inversely related Kauffman *et al*; 1964 and Carpenter *et al.*, 1965).

Protein rercentage increased significantly ($P < 0.01$) with advancing in age for the two breeds and at the two treatments. The same trend was reported by Ragab *et al.* (1966a). However, there was no signiffcant differences between two breeds. Griffiths (1978) concluded that the protein percentage in the carcass was little influenced by nutritional factors.

TABLE 1 Chemical and physical characteters of L. Dorsi muscle in Friesian.

Age month	moisture %	Protein %	Fat %	Ash %	Expereс-sible fluid	Water protein ratio	pH	cooking loss %	Fiber dia-meter
				Standard (A)					
5	77.86	19.34	1.76	1.05	25.42	4.03	5.73	45.20	27.4
8	78.99	17.78	2.18	1.05	26.17	4.46	5.60	44.05	24.5
12	73.56	24.36	1.07	1.01	24.69	3.02	5.64	48.05	30.3
15	79.44	17.98	1.63	0.96	23.52	5.45	5.88	46.03	33.0
18	75.30	21.92	1.56	1.23	26.50	3.45	5.30	45.13	33.9
21	74.76	23.01	1.23	1.01	27.28	4.36	5.63	41.53	34.6
24	74.71	23.86	0.04	1.07	27.20	3.14	5.25	45.20	39.9
				Low (B)					
5	77.86	19.34	1.76	1.05	25.42	4.03	5.73	45.20	27.4
8	77.52	20.12	1.45	0.92	29.72	3.87	6.20	43.44	27.7
12	75.61	22.51	0.96	0.96	25.43	3.41	5.47	46.35	31.6
15	79.83	17.15	1.96	1.07	23.27	5.31	5.00	44.13	32.1
18	76.30	21.08	0.96	1.02	26.72	3.68	5.13	42.15	31.6
21	74.63	22.99	1.09	1.30	28.08	3.25	5.93	43.68	36.6
24	78.10	19.68	1.13	1.04	26.13	3.97	6.19	42.35	34.5

TABLE 2. Chemical and Physical charatcers of L.Dorsi muscle in buffaloes.

Age month	monistu-re%	Protein %	Fat %	Ash %	Expres-sible fluid	Water/ protein ratio	pH	cooking loss %	Fiber Diamter
				Standard (A)					
5	77.10	19.91	1.90	1.09	16.83	3.87	5.25	44.90	27.2
8	80.63	17.15	1.33	0.90	24.07	4.77	5.52	44.44	23.7
12	76.53	20.36	2.01	0.62	22.17	3.77	5.55	46.84	33.9
15	78.63	19.51	0.90	0.37	19.65	4.03	5.45	50.06	29.6
18	77.49	20.55	1.12	0.85	21.99	3.77	5.87	50.75	38.8
21	78.42	19.17	1.31	1.12	21.56	4.13	6.30	46.42	36.8
24	73.66	23.55	2.03	0.77	21.52	3.17	6.55	47.48	40.4
				Low (B)					
5	77.10	19.91	1.90	1.09	16.83	3.87	5.25	44.90	27.2
8	76.80	20.79	1.36	1.06	22.42	3.77	5.98	46.83	23.5
12	75.25	21.66	2.03	1.07	20.26	3.48	5.98	45.07	29.0
15	79.08	18.54	1.47	0.92	23.38	4.27	6.21	46.52	31.9
18	77.40	19.97	1.64	1.00	25.09	3.88	6.02	47.00	35.5
21	75.59	22.21	1.20	1.13	23.98	3.43	6.80	41.78	37.6
24	73.94	22.70	2.29	1.08	22.78	3.30	6.75	42.56	39.6

TABLE 3, The analysis of variance for tne two breeds and treatments.

Source of variancc	d.f	M.S								
		Moisture %	Protein %	Fat %	Ash %	Expres-sible fluid %	Water/ protein	pH	Cooking loss %	Fiber diameter
Treatment (T)	1	0.29	0.01	0.08	0.08	17.00	0.77	1.39	83.14	9.47
Breed (B)	1	0.88	3.71	1.59	0.16	567.45**	0 76	3.31**	76.00**	13.22
Period . .	6	41.24**	44.24**	0.63	0.09	44.33**	3.67*	1.27	25.39	387.5**
T X B . .	1	24.70	17.14	0.47	0.09	1.24	0.07	0.50	9.94	2.53
Error . . .	18	7.36	8.61	0.93	0.06	10.64	0.92	0.64	13.17	17.72

** Significant at the 1% level.
* Significant at the 5% level.

The ether extract values increased but not significantly with advancing age from 1·9% at 5 months of age to reach 2·03 % and 2·29% at 24 months for C and D buffaloe groups, respectively. Similar trend was found by Ragab *et al.* (1966a). Also there were no significant differences in the intramuscular fat percentage between breeds, due to that the differences in carcass fat distribution between breeds is a miner factor and that fat growth patterns are similar among breeds when compared relative to total fat growth (Kempester *et al.*, 1976 and Berg *et al.*, 1978).

On the other hand, Friesians were slightly less in ether extract than buffaloes at the majority of slaughter ages. This is mainly due to that Friesian have smaller adipose cells than the other breeds (Hood and Allen, 1973).

Plane of nutrition had no significant effect on the intramuscular fat in both breeds. In this connection, Griffiths (1978)) found that by increasing energy level, there was no significant effect on the fatty tissues.

Ash percentages, especially for buffaloes, decreased but not significantly with advancing age. Ragab *et al.* (1966 *b*) reported similar results. On the other hand, Frisean breed had the higher ash value than buffaloes.

Physical characters

It can be noticed from the data in Table 1 & 2 that the fiber diameter increased significantly ($P<0.01$) with advancing in age in both breeds and under the two levels of feeding. These data are in full agreement with the findings of other investigators (Tuma *et al.*, 1962 and Ragab *et al.*, 1966 c).

The average fiber diameter for buffaloes ranged from 27·2 μ at 5 months to 39·62 — 40·43 μ at 24 months of age. Ragab *et al.* (1966 *c*) found that the fiber diameter was 18 μ at the age of 50 days and 41.6 μ at the age of 24 months.

The differences in fiber diameter between breeds were scarce and not significant. On the other hand, Ragab *et al.* (1966 *c*) concluded that cattle having muscles with larger fiber diameter that buffaloes. This differences may be due to that his comparison was based on the comparison between buffaloes and beef cattle and not with dairy cattle like Friesian.

It can be noticed also that both breeds fed on the high level of energy tended to have the high values at some slaughtering ages, but this increase was not significantly. This may be due to the shrinkage of cross-section area of the muscles and was accounted by reduction in diameter of individual muscle fiber by decreasing the feeding value as reported by Yeates (1964) on the starvation of adult animals.

The expressible fluid increased significantly with advancing age. Some investigators found that expressible fluid is significantly less in veal than in beef. There is a positive relationship between protein percent and expressible fluid percentage. It is increased as protein percentages increased. These results confirmed Hamm (1960) and El-Gammal (1977) conclusion that proteins are the principle water binding constituent in meat.

Not only protein that affects the expressible fluid percentages, but also water/protein ratio has a similar effect. This can be noticed from data in Tables 1 & 2 that by increasing this ratio, the expressible fluid increased. Froning and Norman (1966) found that the higher moisture/protein ratio, the lower the ability of muscle in question to retain water.

From the data of expressible fluid, there was a significant difference between the two breeds. This may be due to the pH difference between breeds (Lawrie, 1974).

From the data presented in Tables 1 and 2, it is clearly seen that there was no change in pH with advancing in age for the two breeds on the two feeding levels. Similar results were reported by Breidenstein *et al* (1965) that no change in pH with advancing maturity. Also Schiefer and Scharner (1977) jound that the pH values were not affected by age.

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كميـة ونـوع اللحم الناتج من العجـول الناميـة المغذاه على مستويات مختلفة من التغذيه ٣ ـ جودة

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اشـتملت هـذه الدراسـة على ٥٢ عجـلا ناميـا (٢٦ حيـرن من كل من الفريزيان ، والجاموس) وغذيت على مستويات مختلفة من التغذية • وقد أجريت هذه الدراسة لبحث تأثير العمر والنوع والتغذية على جودة اللحوم •

وجد أنه بالتقدم فى العمر تناقصت نسبة الرطوبة المئوية بدرجـة معنوية بينما نسبتى البروتين ومستخلص دهن العضلات المئوية قد تزايدت ، ولم يؤثر كلا من النوع ونظام التغذية المتبع على هذه الصفات •

وبالنسبة لمستخلص دهن العضلات لوحـظ أن الفريزيان كان يقـل بدرجة طفيفة عن الجاموس فى معظم الأعمار •

أما نسبة المـاء المضغوط المئوية قد زادت زيادة معنوية بزيادة كـل من نسبة البروتين ونسبة المـاء الى البروتين وبالتقدم فى العمر • بينمـا لم تتأثر كل من درجة الحموضة والفقد بالطبخ بالتقدم فى العمر •