ESSMENT OF EGYPTIAN BEEF AND BUFFALO NUTRITIVE MEAT QUALITY

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SUMMARY:

Both male beef and buffalo longissmus dorsi muscles (sirloin), Psoas major & Psoas minor muscles (Fillet) Extensor & Flexor muscles (leg) of a marketable age (1.5 years) were used to asses the nutritive meat quality. gross chemical composition of such muscle was assessed using the official method of analysis. The amino acid position, fatty acid composition, mineral composition were determined applying Amino acid analyzer, GLC and ic absorption, respectively. The electrophoretic pattern of beef and buffalo muscle extracts were performed ng PAGE electrophoresis. The data revealed that 17 amino acids were detected in all studied beef and buffalo cles in rather variable levels. Meanwhile, 9 fatty acids were present in all studied muscles. The most pre-inant saturated fatty acids were palmitic and stearic, while oleic acid was the major unsaturated acid. 8 mineral elements were evaluated among which sodium and phosphorus were the major element, while cupper and n were the least element in all studied muscles.

Moreover, the PAGE electrophoretic pattern of the above-mentioned studied muscles revealed rather variable ific fractionation for both beef and buffalo muscles.

INTRODUCTION:

The main source of red meat in Egypt is mainly beef and buffalo meat followed by mutton and goat meat.

The factors affecting the chemical composition of meat were investigated by many authors i.e., Ramsbottom al. (1954), Hedrick (1968) and El-lraqi (1970) who reported that the variation in the chemical composition of meats was due to type of mal sex, cut, quality of the cut, age of animal and degree of fatness.

ce (1978), Skelley et al. (1978), Elgasim and Kennick (1980), Kenawy (1984) and Moharram et al. (1987) stating that meat contained atively high percentage of essential amino acids found that the essential amino acids and non essential amino acids composition of meat tein was quite constant, regardless of the species or the cut or organ of the meat. A notable exception was that of meat containing large ounts of connective tissue and relatively large amounts of proline, hydroxyproline and glycine, along with low levels of tryptophane d tyrosine.

bbard and Pocklington (1968) showed that major differences in composition was detected fats from various locations on the carcass. nerally, external fats were considerably more unsaturated than internal fats. According to Sinclair et al. (1982) meat from cattle, sheep, at and buffalo was rich in saturated fatty acids and low in p<Jlyunsaturated such as linoleic acid. Marmer et al. (1985) indicated that creased amount of total unsaturated fatty acids was demonstrated in rumen animals. This was attributed to the biohydrogenati0n which s a bacterial process occurring in the rumen.

rtog (1980) studying the meat proteins of various animals (beef, pork, chicken, horse) using SDS-PA6E, found that the ctropherograms of the extracts from the vari0us species were similar. Hofmann (1986) reported that SDS-PAGE gave characteristic tein bands for different meat species, however, bands appeared in the same position and were therefore of little help in determining mal species.

e present investigation was carried out in at attempt to assess Egyptian beef and buffalo nutritive meat quality.

TERIALS AND METHODS:

aterials:

th male beef and buffalo longissmus dorsi muscles (LD), Psoas major & Psoas minor (PM & PMI) and Extensor ~ Flexor muscles (E F) of a marketable age (1.5 years) were removed 24 h post-mortem from each carcass and trimmed of outside fat and epimysium. Each scle from each animal slaughtered at Assiut Governorate slaughterhouse was divided into 150-200 9 portions and stored at -20°C until alyzed.

ethods:

isture, total protein, crude ether extract and total ash were determined according to A.O.A.C. (1980).

dium and potassium were determined by Flame-photometer (Corning 400). Meanwhile, phosphorus, calcium, magnesium, cupper and n were determined using atomic absorption apparatus (PERKIN-ELMER) as described in A.O.A.C. (1980).

ino acids: The total amino acids in samples were determined according to Mbore et al. (1958) using Beckman Amino Acid Analyzer

Model l19 CL.

Lipid extraction: The cold extraction method of Floch et al. (1957) was used to extract the total lipids from ground meat with a mixture of cold chloroform and methanol (2:1 V/V).

Esterification of the fatty acids: The procedure of Tahoun and Ali (1981) was followed to prepare the methyl esters of meat lipids.

Fatty acids determination: The esterified fatty acids mixture was injected directly in the GLC apparatus, Pye Unicom-104 with a flame ionization detector and a dual glass column (8 feet x l/8 inch).

Drip separation (Sarcoplasmic proteins): The drip resulted from thawing of frozen ground meat tissue was directly used for electrophoresis (using as electrophoretic apparatus "100 v and 45 mA" PANTA-PHOR or MONO-PHOR (Labor-Muller, D-3540 Hann. Munden W. Germany) analysis by standard PAGE or loaded first with SDS/ME before applying in SDS-PAGE.

Sample preparation for SDS-PAGE: Samples for polyacrylamide gel electrophoresis in the presence of sodium dodecyl sulphate (SDS-PAGE) were prepared by mixing 1 ml of the sample extract of meat and 1 ml of a solution mixture consisting of 4 percent sodium dodecyl sulphate (SDS) and 2 percent mercaptoethanol (ME) in a test tube and the mixture was heated in boiling water bath for 3 min. The gel for SDS-PAGE was prepared according to Stegmann et al. (1980).

Preparation of the discontinuous gel for Disc-PAGE: Disc gels of 3 mm thick were poured between two glass plates using the "bag technique", by using monomer solution in the required volumes. After polymerization of the "separation gel" the stacking gel was poured and the comb inserted, as described in the laboratory manual of Stegmann et al. (1987).

RESULTS AND DISCUSSION:

A- Chemical composition of beef and buffalo muscles:

The data on gross chemical composition of the three studied beef and buffalo muscles are presented in table 1. The protein content of E & F was higher than that of PM & PMI in both beef and buffalo. Meanwhile, the fat content of PM & PMI in beef and LD in buffalo recorded the highest levels, while E & F of beef and buffalo rated the lowest levels. These data are in accordance with those reported by Babiker & Yousif (1990) for camel meat and Babiker et al. (1990) for goat meat and lamb. Moreover, the data revealed that the total ash content of both PM B PMI and LD in beef and E & F and LD in buffalo were almost similar, while buffalo PM ~ PMI recorded the highest ash content. These results are in agreement with those reported by Babiker & Yousif (1990) and Babiker et al. (1990). The nitrogen free extract of both beef and buffalo studied muscles was nearly equal except that of PM & PMI in beef which recorded the lowest levels. Such data coincide with Lawrie (1979).

B- Mineral composition of beef and buffalo muscles:

Mineral components in the three studied beef and buffalo muscles are shown in table 2. Of these sodium was quantitatively the most important in beef E & F and PM & PMI followed by phosphorus in beef LD and buffalo PM & PMI. In respect of muscles differences the high content of iron in both beef and buffalo E b F as well as in buffalo LD no doubt reflected the greater concentration of myoglobin in these muscles than that in the other studied muscles. Such data is in a reasonable agreement with Lawrie (1979). From the nutritional stand point the iron exist in meat muscles is highly available form; and enhances the uptake of iron from concomitantly eaten vegetable sources (Bender, 1975). Although the beef PM & PMI contained two fold the calcium percentage of the buffalo PM & PMI, the beef LD contained half the calcium content of the buffalo LD. However, from the nutritional viewpoint, meat muscles are not regarded as the principal source of this element.

C- Fatty acids composition of beef and buffalo muscles:

The data on fatty acid composition in the total extracted lipids of three beef and buffalo muscles are presented in table 3. Muscles taken from the three different locations differed significantly in their fatty acid composition. Oleic, palmitic stearic and myristic acids were the four predominant fatty acids in all three studied muscles, through in variable levels. While, arachidic, behemic and linole nic acids were the least. On the other hand significant differences between the three studied muscles in their total saturated and total unsaturated fatty acids percentages were recorded. However PM & PMI and LD muscles had almost equal levels of total saturated and unsaturated fatty acids in both beef and buffalo meat. Meanwhile, E & F had higher total saturated fatty acids and lower total unsaturated fatty acids as well in beef and buffalo meat. Such differences are in good agreement with those previously reported by Yadava and Singh (1974) and Sharma et al. (1986) for Indian buffaloes. The reason for such high total fatty acid's contents of buffalo might be attributed to marbling phenomenon. The observed variation in total fatty acids of the three studied muscles could be explained on the basis of their metabolic activity and functional properties. These results are in conformity with the findings of Igene et al. (1980) in buffalo and Gokalp et al. 1983) in beef. It is interesting to note that the fatty acid composition also was similar among the three studied muscles, except that the percentage of total monounsaturated fatty acids was highest for PM & PMI and lowest for E & F in both beef and buffalo. Rather similar fatty acid pattern for LD in beef was reported by Rhee et al. (1988)

D- Amino acid composition of beef and buffalo muscles:

The amino acid composition of the proteins of the three studied muscle is shown in table 4. Regarded nutritionally, muscles are very good source of essential amino acids. In respect of the latter, beef E & F and buffalo LD and PM & PMI would appear to have a somewhat higher content of valine, lecuine, tyrosine and lysine for the first and leucine, valine, isoleucine, phenylalanine and tyrosine for the second

...certainly feasible that more significant differences may exist between specific muscle locations have important nutritional effect. ...ilar data were outlined by Lawrie (1979) for beef muscles.

...thermore, the non-essential amino acid pattern revealed that gluatmic acid, proline and alanine were quantitately the most predominant ...buffalo PM & PMI and E & F and beef E & Fmuscles. Noticeable the high levels of alanine and arginine in beef E & F and buffalo LD ...scles. The data are in good accord with Gruhn (1965) and Lawrie (1979).

SDS-PAGE patterns:

...g. (1) illustrates the electrophoretic SDS-PAGE patterns of sarcoplasmic proteins in both three studied beef and buffalo muscles. The ...onic separation gave 6,5and 5 specified protein peaks and 8, 6 and 7 peaks for PM & PMI, E & F and LD in beef and buffalo muscles; ...spectively. The data indicated that the number of protein fractions was lower than that reported by McCormick et al. (1988) for procine ...coplasmic proteins.

CONCLUSION:

...conclusion, regarded nutritionally, beef and buffalo muscles are very good source of essential amino acids, and, to a lesser extent of ...tain minerals. Although essentially fatty acids are also present, beef and buffalo meat is not usually relied upon for these components in a ...ll-balanced diet.

Table (1): The gross chemical composition and caloric value of three beef and buffalo muscles (% dry matter).

Constituents	Beef meat			Buffalo meat		
	PM & PMI	E & F	LD	PM & PMI	E & F	LD
Moisture	68.86	76.31	72.11	74.24	76.21	74.46
Fat	32.03	9.86	23.07	12.96	10.69	14.39
Crude protein	63.55	83.62	70.68	80.12	82.52	79.18
Total ash	3.34	4.38	3.87	4.86	4.32	4.33
Nitrogen free extract*	1.08	2.14	2.38	2.06	2.47	2.10
Caloric value (Cal/100g)	546.79	431.78	499.87	445.36	436.17	454.63

PM & PMI = Psoas major & psoas minor muscles.
E & F = Extensor & flexor muscles.
LD = Longismmus dorsi muscles.
* By differences.

Table (2): The mineral composition of three beef and buffalo muscles (ppm).

Minerals	Beef meat			Buffalo meat		
	PM & PMI	E & F	LD	PM & PMI	E & F	LD
Sodium	579.60	644.00	193.20	128.80	322.00	257.60
Potassium	62.40	117.00	120.90	120.90	85.80	85.80
Iron	3.17	4.22	2.11	2.11	4.22	5.28
Copper	0.89	1.11	0.89	0.67	0.67	0.99
Magnesium	20.01	21.19	23.54	23.54	10.59	11.72
Calcium	48.00	52.80	22.40	24.60	48.00	44.80
Phosphorus	323.27	313.47	636.74	666.13	293.88	303.68

Table (3): Fatty acids composition in total extracted lipids of three beef and buffalo muscles (% of the total).

Fatty acids %	Carbon chain	Beef muscles			Buffalo muscles		
		PM & PMI	E & F	LD	PM & PMI	E & F	LD
Myristic	$C_{14:0}$	12.68	29.63	17.68	15.55	12.17	N.D.*
Myristoleic	$C_{14:1}$	2.25	N.D.*	4.42	3.77	2.25	N.D.*
Palmitic	$C_{16:0}$	29.30	25.31	23.68	19.73	23.70	36.65
Palmitoleic	$C_{16:1}$	3.94	9.26	3.79	1.97	1.13	5.18
Stearic	$C_{18:0}$	12.68	9.26	9.26	14.63	19.23	16.73
Oleic	$C_{18:1}$	33.80	13.27	28.63	29.89	16.08	27.89
Linoleic	$C_{18:2}$	1.69	4.94	5.16	2.90	15.48	6.37
Linolenic	$C_{18:3}$	3.38	6.48	4.84	6.15	2.40	3.98
Arachidic	$C_{20:0}$	0.28	1.85	0.84	2.15	2.55	1.59
Behenic	$C_{22:0}$	N.D.*	N.D.*	1.68	3.25	N.D.*	1.59
Total saturated FA		54.94	66.05	53.14	55.31	62.65	56.56
Total unsaturated FA		45.06	33.95	46.84	44.68	37.34	43.42

* N.D. = Not detected.

Table (4): Amino acids content of three beef and buffalo muscles compared with whole hen's egg (g/16 g N).

Amino acids	Beef muscles			Buffalo muscles			Whole hen's egg
	PM & PMI	E & F	LD	PM & PMI	E & F	LD	
Essential:							
Threonine	5.31	4.73	4.62	4.55	4.27	4.20	5.12
Cystine	1.66	1.38	1.65	1.57	1.59	1.84	2.43
Valine	7.05	6.63	6.71	7.34	5.25	7.98	6.85
Methionine	3.67	3.74	3.03	3.61	3.73	3.48	3.46
Isoleucine	4.61	4.30	4.02	5.09	4.03	5.17	6.32
Leucine	6.03	7.14	7.92	8.79	7.10	8.49	8.79
Tyrosine	5.02	6.76	5.62	5.01	5.96	5.99	4.16
Phenylalanine	5.64	4.44	4.97	5.64	6.52	6.02	5.63
Lysine	7.09	6.01	6.96	6.07	6.96	6.52	6.49
Total EAA	46.08	45.13	45.50	48.57	45.41	49.69	49.75
Non-Essential:							
Aspartic acid	6.85	5.73	5.82	5.61	5.72	4.29	9.02
Serine	5.32	5.08	5.25	4.83	4.75	4.47	7.65
Glutamic acid	14.01	14.66	14.34	14.15	14.68	12.01	12.74
Proline	7.43	8.09	7.66	8.78	8.23	7.14	4.16
Glycine	4.03	6.36	4.51	4.15	5.80	4.55	3.31
Alanine	7.04	8.47	6.99	5.81	7.31	7.64	5.92
Histidine	2.92	3.06	3.21	3.77	3.34	5.24	2.43
Arginine	6.38	5.17	6.72	5.06	5.11	5.78	6.24
Total Non. EAA	53.98	56.62	54.50	52.16	54.94	51.12	51.47
E./N.	0.85	0.80	0.83	0.93	0.83	0.97	0.97

PM & PMI = Psoas major & psoas minor muscles.
E & F = Extensor & flexor muscles.
LD = Longissmus dorsi muscles.

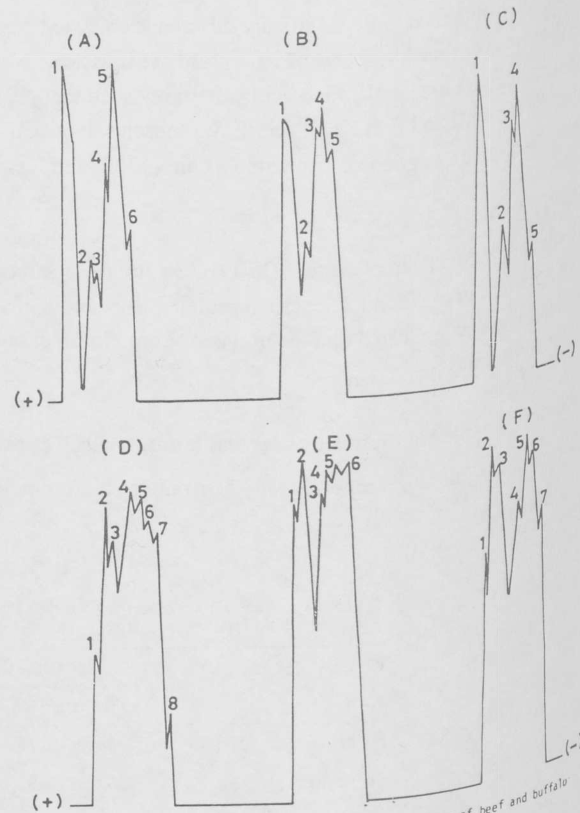

Fig. (1): Densitometric scanning of electrophoretic patterns of beef and buffalo muscles.
A = Psoas major & psoas minor beef muscles.
B = Extensor & Flexor beef muscles
C = Longismmus dorsi beef muscles.
D = Psoas major & psoas minor buffalo muscles.
E = Extensor & Flexor buffalo muscles.
F = Longismmus dorsi buffalo muscles.

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