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EFFECT OF SOME GROWTH PROMOTERS ADDED TO RATIONS OF FRIESIAN CALVES ON QUALITIES AND COOKING PROPERTIES OF MEAT:

1. PHYSICAL CHARACTERISTICS AND CHEMICAL COMPOSITION OF RAW *Longissimus dorsi* MUSCLE MEAT .

Salama, A.A.*; M.A. Owon*; S.A. El-Kady*; H.A. El-Kousy and A.M. El-Sharkawy*****

*** Dept. of Food Technology, Fac. of Agric., Kafr El-Sheikh Univ., Egypt.**

**** Animal Prod. Res. Institute, ARC, Giza, Egypt.**

***** Animal Prod. Res. Station, Sakha Kafr El-Sheikh, ARC, Giza, Egypt.**

ABSTRACT

This investigation was aimed to study the effect of some commercials growth prometers (fibrozyime, moreyeast and pronifer) added to rations of Friesian calves on physical characteristics and chemical composition of raw longissmus dorsi (LD) muscle meat post-mortem.

The longissimus dorsi muscle area for control grow recorded the lowest value, while it was increased in treated groups. High tenderness of meat (moreyeast group) was explained by high fat contents and conversion of part of tough connective dissues into fatty tissues. It could be noticed that water holding capacity (WHC) was higher in moreyeat group, followed by pronifer and control group, while the lowest value was recorded at fibrozyme group.

The average of crude protein content of meat was slightly higher for calves supplemented groups than that in control group. The highest value was recorded in pronifer group (84.14%), while the lowest value was recorded in control (81.29%). The effect of different growth promoters on the ether extract and ash contents of meat were not pronounced. In general no significant differences between treatments for nitrogenous compounds and pH values, also no significant differences between treatments and control.

All of calve's meat fed on control ration and supplemented groups with growth promoters recorded high concentration for potassium, followed by phosphorus, sodium, calcium, magnesium, iron and zinc, while the lowest amounts were recorded for cadmium, followed by manganese, copper and lead.

The most abundant amino acid, glutamic acid, was averaged between 18.47 and 19.56 g/16 N and followed by aspartic acid, then arginine, lysine, leucine, alanine, valine, glycine, threonine, isoleucine, phenylalanine, serine, tyrosine, proline and histidine. The sulfur containing amino acids (methionine and cystine) and tryptophan were relatively very low in all samples comparing with the other indispensable amino acids.

The computed protein efficiency ratio (C-PER) of meat protein for control ration and supplemented groups with growth promoters (fibrozyme moreyeast and pronifer) was 1.25, 2.62, 2.22 and 2.35, respectively. The high value of C-PER and biological Value (BV) were in fibrozyme, treatment, followed by pronifer, then moreyeast, while it was very low in control group .

The results showed higher percentage of total unsaturated fatty acids (USFA) in calves meat supplemented with fibrozyme, moreyeast and pronifer than control group. The dominant USFA was $C_{18:1}$ followed by $C_{18:2}$, while the dominant saturated fatty acids was $C_{16:0}$ and $C_{18:0}$. The ratio of short chain fatty acids observed were

lower than the long chain fatty acids in all samples. Growth promoters led to increase USFA, especially (Linoleic ω_6 and linolenic ω_3 acids) and reduced the saturated fatty acids.

INTRODUCTION

Meat is very important source of nutrients in human diet. So, several methods have been used to develop and improve the production of meat.

Also, the tenderness, juiciness and flavour compounds are important quality criteria that influence the decision of a consumer to purchase beef (Moloney *et al.*, 2001). Concerns about the safety and quality of food have increased at both governmental and consumer levels (McKean, 2001).It was known that, chemical and physical characteristics of animal fats were important factors that contribute to meat quality (Dawood, 1995).

Enhancing the polyunsaturated fatty acids and decreasing the saturated fatty acids content of beef are important target in terms of improving the nutritional value of this food for the consumer (Scollan *et al.*, 2003).

Many feed additives may contribute to improve animal performance. In animal nutrition, probiotics are viable microorganisms used as a feed supplement, which lead to beneficial effects for the host animal, such as improvement of weight gain and feed conversion (Simon *et al.*, 2001). Also, numerous studies have demonstrated improved performance of cattle by supplementing the diet with fibrolytic enzymes as feed additives (Treacher *et al.*, 1997; Krause *et al.*, 1998 and Zinn and Salinas, 1999).

Fibrozyme is a rumen stable fibrolytic enzyme having both xylanase and cellulase activity, prepared from fermentation of *Aspergillus niger* and *Trichoderma longibachiatum* (Howes, *et at*. 1998).

Moreyeast is a probiotic contains *Saccharomyces cerevisiae* which stimulate the ruminal bacteria, increased protien systhesis and fiber digestion (Nicodemo, 2001).

Pronifer contains lactic acid bacteria (approx.10 CFUL gm)(*Lactobacillus planetarium,L.brevis,L.fermertium,L.casi* and *Pediococcus acidilacticii*), lactic acid fermentation metabolites, enzymes (glucosidase and peptidase), free amino acid and short chain peptidases (Nicodemo, 2001).

This investigation was aimed to study the effect of some commercials growth promoters, namely moreyeast,pronifer and fibrozyme, added to rations of Friesian calves on physical characteristics and chemical composition of raw *Longissimus dorsi* muscle meat.

MATERIALS AND METHODS

This work was carried out at El-Karada Animal Production Research Station and Sakha Animal Production Research Laboratories, Kafr El-Sheikh Governorate, which belong to the Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Cairo, Egypt and Food Technology Department, Faculty of Agriculture, Kafr El-Sheikh, Tanta University.

Materials :

Twelve Friesian calves with average body weight 233.17 kg and 11 months, 20 days of age were used in this study. Concentrate feed mixture consisted of yellow corn 30%, cotton seed cake 20%, wheat bran 12%, rice bran 16%, soya bean cake 16%, sugar cane molasses 3%, lime stone 2% and salt 1% (Factory of Concentrate Feed Mixture, Shosha, Al-Minia Governorate, Egypt).

Experiment:

Animals were divided into four similar groups (three animals for each group) according to their live body weight and age. Average of initial live body weight were 234.67, 232.00, 229.33 and 236.67 kg for groups control, fibrozyme, moreyeast and pronifer, respectively.

The first group (control) was fed on a basal ration which consisted of concentrate feed mixture, rice straw and berseem hay without any feed additives supplementation.

The calves of the other three groups were fed the same basal ration with fibrolytic enzyme (fibrozyme obtained from industrial area, Jdeidet El-metn, Lebanon), yeast (*Saccharomyces cerevisiae*, (moreyeast product of norchem, USA) and lactic acid bacteria (pronifer product of P.G.E., Austria), as follow: 15 gm fibrozyme/head/day, 3-5 gm moreyeast/ kg concentrate feed mixture and 5-10 gm pronifer/100 kg live body weight.

Animals were fed to cover the requirements of dry matter, total digestible nutrients and digestible crude protein for growing calves according to National Research Council (1996) and the rations were adjusted biweekly according to the body weight changes.

Animals of the different main groups were kept during the experimental period in semi-open sheds and fed individually. The concentrate mixture was offered twice daily at 8 am and 3 pm, berseem hay was offered once daily at 11 am and rice straw was offered at 9 am. All feed additives were added to the concentrate feed mixture at the time of feeding daily Animals were allowed to drink water twice daily post-feeding in the morning and in the afternoon.

At the end of the feeding trials (six months), all animals were slaughtered after fasting period of 16 hours at an average weights 405, 446.67, 440 and 445 kg for control, fibrozyme, moreyeast and pronifer groups, respectively. Growth promoters supplementation led to significant in body weigth gain and daily weigth gain. Average relative daily body weigth gain during the experimemtal period (180 days) for calves supplemented with fibrozyme, moreyeast and pronifer increased by 125.26, 123.16 and 122.11%, compared with control group, respectively. Upon the completion of bleeding, animals were skinned, dressed out and the hot carcasses were weighted. Samples of meat were taken from *longissimus dorsi*, muscle for analysis, post-mortem.

Methods :

Physical characteristics :

Longissimus dorsi muscle area was measured with planimeter in square centimeter, and fat thickness was measured using calipers as described by United States Department of Agriculture (1975). Specific gravity was determined on *longissimus dorsi* muscle cuts after chilling for 48 hours at 4°C as described by Sorror (1993). Cooking loss was detected according to Dawood (1995) method. Tenderness and water-holding capacity (WHC) were investigated using the Grau and Hamm method (1957) modified by Volovinskaia and Merkolova (1958). Colour intensity of meat-water extract was tested according to the method described by Husaini *et al.* (1950). pH value was measured using pH meter with glass electrode as described by Aitken *et al.* (1962).

Chemical composition :

Gross Chemical composition :

Moisture content, ash, crude protein and ether extract were determined in the raw *Longissimus dorsi* muscle meat according to the methods of AOAC (1995).

Total soluble nitrogen (TSN) was measured according to the method of El-Gharbawi and Dugan (1965). The extracted nitrogen was used for determination of TSN using microkjeldahl method of the AOAC (1995).

Minerals contents :

Minerals were determined according to Dremina *et al.* (1974) method. Meat samples were digested using concentrated HNO_3 for 2 hours (till the solution became colourless) and diluted to 100 ml distilled water. The solution was used for determination of Ca, Fe, Cu, Mg, Mn, Pb, Zn and Cd using PYE Unicam SP 1900 Atomic Absorption Spectrophotometer, at Central laboratory, Faculty of Agriculture, Alex. Univ. Sodium and potassium were determined in the same solution by the Flame photometer. Total phosphorus was estimated in the digested solution colorimetrically according to the method of Tausky and Shorr (1953).

Amino acids analysis :

Amino acids composition (except tryptophan) of raw muscle meat was determined according to the method of Moore and Stein (1958). Amino acids in hydrolyzate samples were injected into amino acid analyzer Model 119 CL at Central Laboratory, Fac. of Agric., Alex. Univ. Egypt. Tryptophan was colorimetrically determined according to the method described by Kogan and Pojarskaya (1971).

Amino acid score (AAS): were computed according to Pellet and Young (1980).

Computed protein efficiency ratio (C-PER): was calculated according to the following regression equation by Alsmeyer *et al.* (1974).

Biological value (BV): was calculated using equation as given by Block and Mitchell(1946).

Fatty acids composition :

Extraction of fat from raw muscle meat was done according to the method described by Folch *et al.* (1957).The fatty acid are converted to the methyl esters following the procedure adopted by Shehata *et al.* (1970),and injected into the gas liquid chromatography apparatus (PYE Unicam GCV Chromatography) , in the central laboratory Fac. of Agric. Alex. Univ. Egypt.

Statistical analysis :

Data were statistically analyzed using general linear models procedure adapted by SPSS (1997) for user's guide, with one way ANOVA; means were separated using Duncan's multiple range tests (Duncan, 1955).

RESULTS AND DISCUSSION

Physical characteristics :

Data in Table (1) show the physical characteristics of raw meat post-mortem. The *Longissimus dorsi* muscle area for control group recorded the lowest value, while it was increased in treated groups but the differences between all treatment were not significant. The differences among the groups of *Longissimus dorsi* area might be attributed to the variation in carcass weight, edible meat percentage and marbling of carcass. Data show that, the values of subcutaneous fat thickness were not significant and not affected by growth promoters supplementation.

Table (1): Some physical characteristics of *longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters.

Characteristics	Growth Promoters				MSE
	Control	Fibrozyme	Moreyeast	Pronifer	
Longissimus dorsi muscle area (cm^2)	81.57	96.22	97.91	84.81	1.34
Fat thickness (mm)	1.70	1.60	1.80	1.55	0.01
Tenderness (cm^2)	3.06	3.00	3.20	3.10	0.02
Water holding capacity (cm^2)	7.21	7.37	7.12	7.15	0.13
Colour intensity(OD)	0.40	0.42	0.36	0.37	0.005
Specific gravity	1.04	1.06	1.01	1.08	0.004
Cooking loss(%)	43.62ab	42.74ab	41.93a	45.21b	0.01
PH value	5.80	5.70	5.90	5.85	0.01

a, b and c: means in the same row with different superscripts differ significantly ($P < 0.05$).
MSE : Mean of standard error

Data cleared that the differences in tenderness and water holding capacity (WHC) between control and treatments were not significant. The differences in tenderness was explained by high fat contents and conversion of part of tough connective tissues into fatty tissues (Udin, 1967), while Etman (1985) mentioned that, the differences in tenderness might be due to variations in moisture contents in meat, differences of fiber diameter, amount of connective tissues and protein solubility.

The decrease of WHC could be due to the decrease of pH value towards the isoelectric point of muscle proteins as well as the association of actin and myosin leading to decrease of protein solubility and decrease of free chemical groups that are able to bind water (Soloviev, 1966). Also, Rao *et al.* (1989) reported that WHC increased over the pH ranged between 4.0 and 5.1.

The colour intensity decreased in the case of moreyeast and pronifer supplemented groups than those of fibrozyme and control groups. Yamazaki (1981) found that, marbling (intramuscular fat) affected on colour of muscles. Binder *et al.* (1986) reported that a part of darker lean colour is due to higher myoglobin concentration in the eye muscle of steers. There were no significant differences of specific gravity between control and treatments. The increasing of specific gravity may be attributed to increasing the percentage of lean and decreasing the percentage of fat. The highest specific gravity indicates to a leaner carcass. Differences in cooking loss are mostly due to differences in intramuscular fat (marbling). Armbruster *et al.* (1983) has found that marbling and intramuscular fats, were related to cooking loss. Further confirmation of the relationship between cooking loss and fat content was reported by Solomon *et al.* (1980).The values were nearly similar, with no significant differences between treatments and control group. The pH value however reflects the amount of glycogen content of muscle at slaughter.

Chemical composition:

The results in Table (2) indicat that in general there were no significant differences in moisture content, crude protein, ether extract, ash content and nitrogenous compounds of meat between different treatments and control. No significant changes in chemical composition could be ascribed to the effect of the kind of growth promoters used. Sami *et al.*(2004) reported that the amount of subcutanous fat on carcass is generally accompanied by an increase in marbling fat and this can influence the composition of meat and many of its platability characteristics. The results obtained are in good agreement with the results of fat thickness (subcutanous fat) and tenderness. The increase of protein solubility in some treatments could be due to the breakdown and proteolysis of the muscle proteins to other nitrogen forms as well as the dissociation of actomysin into actin and myosin (El-Ashry and El-Dashlouty,1970 and Shehata,1974)

Minerals:

The minerals in meat of *longissimus dorsi* muscle of Friesian calves postmortem as affected by addition of different growth promoters to experimental rations of calves are presented in Table (3).

It is evident that variable contents of minerals were recorded for different treatments and control. The control groups showed the lowest contents of Na, P, Cu, Mg, Mn, Zn, Cd and Pb while the highest content of K was found in control group. On the other hand, fibrozyme groups recorded low contents of K, Ca and Fe, while it was contained high Mn, Cd and Pb.

Table (2): Chemical composition of *longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters.

Chemical components (%)	Growth Promoters				MSE
	Control	Fibrozyme	Moreyeast	Pronifer	
Moisture	75.99	76.42	76.46	76.67	0.06
Dry matter	24.01	23.58	23.54	23.33	0.06
Crude protein*	81.29	83.76	84.07	84.14	0.06
Ether extract*	10.12	9.92	10.83	10.76	0.02
Ash*	4.71	4.75	4.80	4.89	0.01
Total soluble nitrogen**	2.35	2.21	2.62	2.44	0.01
Soluble non protein nitrogen**	0.58	0.62	0.58	0.65	0.04
Soluble protein nitrogen**	1.77	1.59	2.04	1.79	0.01

a,b and c: means in the same row with different superscripts differ significantly ($P < 0.05$).
MSE: Mean of standard error   *(% of dry matter)   **(% of wet matter)

Table (3): Minerals contents of *longissimus dorsi* muscle meat of Freisian calves fed ration supplemented with different growth promoters.(mg/100gm,dry matter)

Minerals	Growth promoters			
	Control	Fibrozyme	Moreyeast	Pronifer
Sodium (Na)	401.25	512.60	584.49	504.50
Potassium (K)	1578.84	1468.74	1473.53	1563.65
Phosphorus (P)	555.64	558.02	599.11	706.30
Calcium (Ca)	135.23	111.66	134.45	143.46
Iron (Fe)	18.45	15.65	18.82	20.19
Copper (Cu)	0.25	0.30	0.30	0.30
Magnesium (Mg)	106.41	111.37	125.91	111.44
Manganese (Mn)	0.15	0.22	0.18	0.21
Zinc (Zn)	11.50	11.83	13.81	13.67
Cadmium (Cd)	0.03	0.07	0.04	0.04
Lead (Pb)	0.50	1.10	1.06	0.73

The moreyeast groups recorded the highest value of Na, Mg and Zn. The pronifer groups showed high contents in P, Ca and Fe.

In general, all meat in control and treatments had highest concentrations of K, followed by P, Na, Ca, Mg, Fe and Zn, while lowest amounts were recorded for Cd, followed by Cu, Mn and Pb.

From the results in Table (3), it was observed that Pb and Cd have non-nutritive value, and their accumulation in the human body cause it's pollution. The presence of these minerals in meat as a result of animals feeding on rice straw and berseem hay contaminated with these minerals because these plants absorb Cd from the soil, and Pb from outside pollution of the air. so, we must be careful of soil contamination with Cd because is believed to be a most serious health risk (El-Sharkawy, 2006).

Protein quality :

Amino acids :

The amino acids composition of *Longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters are presented in Table (4).

The results show that the protein of all meat samples contained 18 amino acids including all the ten indispensable amino acids i.e. the eight amino acids indispensable for adults, besides cystine and tyrosine which are considered semi-indispensable (Davedson *et al.,* 1975).

According to Rice (1978), the amino-acid contents of meat protein is quite constant, regardless of the species or the type of cut from which the meat is obtained.

Data in Table (4) show that, sulfur containing amino acids (methionine and cystine) and tryptophan were relatively very low in all samples compared to the other indispensable amino acids.The most abundant amino acid, glutamic acid, averaged between 18.47 and 19.56 g/16 g N and was followed by aspartic acid, then arginine, lysine, leucine, alanine, valine, glycine, threonine, isoleucine, phenylalanine, serine, tyrosine, proline and histidine.

Table (4): Amino acids composition of *longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters.(gm/16gm N)

Amino acids	Growth promoters				FAO/WHO 1973 standard P. g/16 g N
	Control	Fibrozyme	Moreyeast	Pronifer	
Indispensable amino acids:					
Thereonine	4.95	4.47	4.56	4.26	4.00
Valine	5.70	5.51	4.58	5.48	5.00
Methionine	2.38	2.27	2.19	2.24	3.50 (Methionine + Cystine)
Cystine	0.22	0.43	0.46	0.55	
Isoleucine	4.45	3.78	3.57	3.86	4.00
Leucine	6.51	6.87	6.43	6.04	7.00
Phenyalanine	4.46	4.10	3.86	3.92	6.00 (Phenyalanine + Tyrosine)
Tyrosine	3.38	3.43	3.02	3.21	
Lysine	7.51	6.44	6.28	7.56	5.50
Tryptophan	1.20	1.15	1.10	1.15	1.00
Histidine	3.60	3.22	2.60	3.55	
Arginine	7.79	6.91	6.44	7.68	
Total indispensable	52.15	48.58	45.09	49.50	
Dispensable amino acids:					
Aspartic acid	9.22	9.34	10.18	9.11	
Serine	4.22	3.69	3.56	3.60	
Glutamic acid	19.56	18.98	18.65	18.47	
Proline	4.25	3.66	2.50	3.72	
Glycine	5.58	4.67	5.95	4.97	
Alanine	6.20	5.73	5.99	5.82	
Total dispensable amino acids	49.03	46.07	46.83	45.09	
Total amino acids	101.18	94.65	91.92	95.19	
Indispensable/total amino acids	0.52	0.51	0.49	0.52	

It could be noticed that the indispensable amino acids/total amino acids of calves meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) were 0.40, 0.41, 0.39 and 0.40, respectively.

Amino acid score:

The nutritive value of dietary proteins depends on its indispensable amino acid content and composition. The amino acid scores(AAS) can be considered as an imperfect indicator of protein quality, but it still the best one based on amino acid composition (Woodham and Dean, 1977). This is due to the fact that protein quality as determined by biological procedures depends on the limiting indispensable amino acid. The amino acid scores were calculated to throw light on the quality of meat protein as affected by some different growth promoters. Amino acids composition in meat post-mortem shown in Table (4) were further used to calculate the amino acid score (AAS) and the calculated protein efficiency ratio (C-PER).

The chemical scores of the indispensable amino acids presented in meat as affected by different growth promoters supplemented with experimental ration of Friesian calves (based on the indispensable amino acids pattern of whole egg protein) are illustrated in Table (5).

Table (5): Amino acids score of *Longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters.

Amino acids (indispensable)	FAO/WHO (1973) standard P mg/gm N.	Growth promoters							
		Control		Fibrozyme		Moreyeast		Pronifer	
		A.A. mg/gm N	AAS	A.A. mg/gm N	AAS	A.A. mg/gm N	AAS	A.A. mg/gm N	AAS
Isoleucine	250	278.13	111.25	236.25	94.50	223.13	89.25	241.25	96.50
Leucine	440	406.88	92.47	429.38	97.59	401.88	91.34	377.50	85.80
Lysine	340	531.88	156.44	402.5	118.31	267.50	78.68	472.50	138.97
Methionine + cystine	220	162.50	73.86	168.75	76.70	165.63	75.29	174.38	79.26
Phenylalanine + tyrosine	380	490.00	128.95	470.63	123.85	430.00	113.16	445.63	117.27
Threonine	250	309.38	123.75	279.38	111.75	285.00	114.00	266.25	106.50
Valine	310	418.75	135.08	344.38	111.09	286.25	92.34	342.50	110.48
Tryptophan	60	75.00	125.00	71.88	119.80	68.75	114.58	71.88	119.80

A.A. = Amino acid
AAS = Amino acid score

$$\text{AAS} = \frac{\text{Mg of amino acid per gm. N. in tested protein}}{\text{Mg of amino acid per gm. N. in reference protein (FAO/WHO, 1973)}} \times 100$$

The sulfur-containing amino acids gave the minimal score for control and all treatments, although the AAS in control was lower than those of other treatments. This indicated that the sulfur-containing amino acids are the most limiting in meat, although the AAS of calves meat treated with different growth promoters showed some improvement.

Leucine was the second limiting amino acid in meat for control and treatments, although the AAS of leucine in fibrozyme group showed some improvement, while the AAS of leucine in moreyeast and pronifer groups was lower than control.

Isoleucine was the third limiting amino acid in calves' meat treated with different growth promoters, while the AAS of control was higher than the other treatments. Lysine and valine showed low ASS only in moreyeast group (78.68 and 92.34, respectively).

It is worthy to mention that the AAS of other indispensable amino acids (isoleucine, lysine, phenylalanine + cystine, threonine, valine and tryptophan) were higher in control group comparing with those of the other treatments. This may be attributed to the effect of growth promoters used in the trial.

Protein efficiency ratio (C-PER) and Biological value (BV):

The calculated C-PER originally described by Alsmeyer *et al.* (1974) utilized the indispensable amino acid profile to predict the protein quality.

The results in Table (6) show that different growth promoters had good effect on C-PER. The highest value of C-PER was in fibrozyme group, followed by pronifer group then moreyeast group, while it was very low in control group.

Table (6): Computed protein efficiency ratio(C-PER) and biological value (BV) of *Longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters.

Growth promoters	C-PER	BV
Control	1.25	63.06
Fibrozyme	2.62	77.49
Moreyeast	2.22	73.28
Pronifer	2.35	74.65

C-PER = -1.816 + 0.435 meth. + 0.781 leu. + 0.211 his -0.944 tyr. (Alsmeyer *et al.*, 1974)
BV = 49.9 + 10.53 x PER (Block and Mitchell, 1946)

Fatty acids composition:

Fatty acids composition for intramuscular fat of *longissimus dorsi* muscle meat post-mortem as affected by different growth promoters supplemented with experimental rations of Friesian calves are shown in Table (7). The percentages of total unsaturated fatty acids in calves' meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) were 46.16, 56.90, 56.80 and 52.37, respectively. The corresponding percentages of total saturated fatty aids were 53.86, 43.09, 43.22 and 47.64, respectively. Ratios of polyunsaturated fatty acids to saturated fatty acids in calves' meat fed on control ration and supplemented groups with growth promoters (fibrozyme. moreyeast and pronifer) were 0.86, 1.32, 1.31 and 1.10, respectively.

These results showed higher percentage of total unsaturated fatty acids in calves' meat supplemented with fibrozyme, moreyeast and pronifer than control group and this may attributed to the effect of growth promoters which led to increase unsaturated fatty acids and reduce saturated fatty acids. In the UK, the Department of Health (1994) recommended that ratio of polyunsaturated fatty acid to saturated fatty acids should be increased to above 0.4. So, the results obtained considered to be very good and in agreement with the previous recommendation.

The dominant unsaturated fatty acids were $C_{18:1}$ followed by $C_{18:2}$, while the dominant saturated fatty acids were $C_{16:0}$ and $C_{18:0}$. It was observed that, the unsaturated fatty acids especially ω_6 unsaturated fatty acids were more in calves' meat fed experimental rations supplemented with growth promoters than control group, which increased from 8.93 to 14.34, 14.10 and 11.23% in the case of control, fibrozyme, moreyeast and pronifer, respectively. The results cleared also that ω_3 unsaturated fatty acids were increased from 0.95 in control sample to 1.60, 1.57 and 1.25 for fibrozyme, moreyeast and pronifer, respectively. On the contrary the saturated fatty acids in control group were more than growth promoters groups.

On the other hand, the ratio of short chain fatty acids observed were lower than the long chain fatty acids in all samples.

Table (7): Fatty acids composition of *Longissimus dorsi* muscle meat of Friesian calves fed ration supplemented with different growth promoters.(% of total fatty acids)

Fatty acids (FA)	Growth promoters			
	Control %	Fibrozyme %	Moreyeast %	Pronifer %
Unsaturated fatty acids:				
Palmitoleic acid ($C_{16:1}$)	2.74	4.27	3.46	3.66
Oleic acid ($C_{18:1}$)	33.54	36.69	37.67	36.23
Linoleic acid ω_6 ($C_{18:2}$)	8.93	14.34	14.10	11.23
Linolenic acid ω_3 ($C_{18:3}$)	0.95	1.60	1.57	1.25
Total monoenoic fatty acids %	36.28	40.96	41.13	39.89
Total polyenoic fatty acids %	9.88	15.94	15.67	12.48
Total unsaturated fatty acids %	46.16	56.90	56.80	52.37
Saturated fatty acids:				
Lauric acid ($C_{12:0}$)	0.34	0.34	0.21	0.37
Myristic acid ($C_{14:0}$)	2.06	2.42	2.09	2.49
Palmitic acid ($C_{16:0}$)	24.14	19.03	19.41	24.35
Stearic acid ($C_{18:0}$)	27.05	20.73	21.07	19.93
Behenic acid ($C_{22:0}$)	0.27	0.75	0.44	0.50
Total saturated fatty acids	53.86	43.09	43.22	47.64
Unsaturated FA/saturated FA	0.86	1.32	1.31	1.10

There is an evidence that the diet which predominantly contains relatively saturated fats raises the levels of cholesterol in the blood, thus enhancing the formation of blood clots (Lawrie, 1979), while the unsaturated fatty acids appear to be essential for health. They are necessary constituents of cell walls. Mitochondria and other intensely active metabolic sites.

Ruminant meats are a relatively good source of n-3 polyunsaturated fatty acids due to the presence of $C_{18:3}$ in grass. Long chain n-3 polyunsaturated fatty acids synthesized from $C_{18:3}$. Grass-fed beef and lamb have naturally high levels of $C_{18:3}$ and long chain n-3 poly unsaturated fatty acids. In pork, beef and lamb the melting point of lipid and the hardness of carcass fat is closely related to the concentration of stearic acid (18: 0) (Wood *et al.*, 2003).

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تأثير إضافة بعض محفزات النمو الى علائق عجول الفريزيان على جودة وخواص الطبخ للحم:
١- الخواص الطبيعية والتركيب الكيميائى للحم العضلة الطولية الظهرية بعد الذبح.

عبدالباسط عبدالعزيز سلامة*، مصطفى أحمد عون*، سمير عبدالمعطى القاضى*، هناء عبدالحميد القوصى** و أحمد محمد الشرقاوى***

- * قسم الصناعات الغذائية – كلية الزراعة – جامعة كفرالشيخ – مصر
- ** معهد بحوث الإنتاج الحيوانى – مركز البحوث الزراعية – الجيزة – مصر
- *** محطة بحوث الإنتاج الحيوانى – سخا – كفرالشيخ – مركز البحوث الزراعية – الجيزة – مصر

يهدف هذا البحث الى دراسة تأثير إضافة بعض محفزات النمو (فيبروزيم، موربيست، برونيفير) المستخدمه تجاريا كإضافات غذائيه الى علائق عجول الفريزيان لمدة ١٨٠ يوم على جودة لحم العضلة الطولية الظهرية بعد الذبح وكذلك دراسة الصفات الطبيعية والتركيب الكيميائى للحم حيث أوضحت النتائج ما يلى:

- إضافة محفزات النمو أدى الى تحسن ملحوظ فى الوزن الحى للحيوانات فى نهاية التجربة والى خفض تكلفة التغذية لكل كيلو جرام زيادة يومياً كما حسنت من الكفاءة الإقتصادية مقارنة بالكنترول.
- حدوث تحسن فى الصفات الطبيعية للحم مثل مساحة العضلة الطولية الظهرية والقدرة على الإمساك بالماء وطراوة اللحم.
- لم توجد أى فروق معنوية فى التركيب الكيميائى للحم بين المعاملات والكنترول حيث كانت نسبة البروتين الخام أعلى فى معاملة البرونيفير ٨٤,١٤% وأقل فى الكنترول ٨١,٢٩%.
- أظهرت النتائج الى وجود العناصر المعدنية بمستوى عالى فى جميع المعاملات من البوتاسيوم يليه الفوسفور والصوديوم والكالسيوم والمغنسيوم والحديد والزنك بينما العناصر التالية كانت كميتها أقل بكثير جداً وهى الرصاص يليه النحاس والمنجنيز وأخيراً الكادميوم.
- أحتوت جميع عينات اللحم فى كل المجاميع على الأحماض الأمينية الأساسية والغير اساسية وكانت أقل نسبة فى الأحماض الأمينية الأساسية هى الأحماض الكبريتية والتربتوفان وأعلى نسبة فى الأحماض الأمينية عموماً كانت حمض الجلوتاميك.
- أظهرت محفزات النمو ارتفاع فى نسبة كفاءة البروتين والقيمة الحيوية للبروتين وكذلك أدت الى زيادة الأحماض الدهنية الغير مشبعة الكلية خصوصاً أحماض اللينوليك (أوميجا-٦) واللينولينيك (أوميجا-٣) وإنخفاض الأحماض الدهنية المشبعة فى الحيوانات المعاملة بها مقارنة بحيوانات الكنترول.
- وفى النهاية أوضحت النتائج إمكانية استخدام بعض محفزات النمو لتغذية الحيوانات حيث أدت الى تحسين الصفات الطبيعية والكيميائية للحم حيث أنها أمنه من الناحية الصحية للحيوان ولها تأثير جيد فى التغذية.