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

4. Chemical composition and nutritive value of drip loss from frozen stored *Longissimus dorsi* muscle meat.

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ABSTRACT

The object of this study aimed to investigate the effect of using some commercial growth promoters (fibrozyme, moreyeast and pronifer) as feed additives supplementation with the experimental ration of Friesian calves on some chemical composition and nutritive value of drip loss from frozen stored *Longissimus dorsi* meat (at -20°C for 3 and 6 months).

The results showed that the drip loss from thawed calves' meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) after 3 and 6 months of frozen storage at -20°C were 7.48, 9.18; 6.60, 7.88; 8.70, 10.55, 7.65 and 9.54%, respectively. There were increasing amounts of drip as storage time prolonged. The drip loss varied considerably between control and treatments. Total solids, total nitrogen ether extract and ash content in drip increased as the time of frozen storage increased. Total nitrogen in drip of thawed calve's meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) for 3 and 6 months of frozen storage were 1.49, 1.55; 1.36, 1.52; 1.21, 1.49 and 1.35, 1.54% (as wet matter), respectively. Nitrogen content in the drip progressively increased as the time of frozen storage increased. The progressive decreases found in total nitrogen of meat during frozen storage followed the continuous increase of total nitrogen in drip. The drip contained appreciable amounts of minerals, which indicated the loss of the nutritive value of frozen meat. No marked changes noticed in mineral content due to using growth promoters. The highest mineral concentration in meat drip were recorded for K, followed by P, and then came Na, Ca, Mg, Fe.

The presence of all amino acids (indispensable and dispensable) in drip reduce the nutritive value of frozen meat. Drip loss from frozen stored meat of control group had more unsaturated fatty acids than those feed

ration supplemented with growth promoters (fibrozyme, moreyeast and pronifer) were 53.97, 46.21, 48.01 and 49.98%, respectively.

The obtained results revealed that, drip separated from frozen stored meat had high nutritive value and contained very important soluble nutrients such as soluble nitrogen, ether extract, minerals, amino acids and fatty acids, and which had harmful effect on the nutritive value of frozen meat. So, frozen meat should cooked before thawing.

INTRODUCTION

The excessive loss of the proteinaceous fluid drip or exudate from frozen meat upon thawing is the most important factor reducing its quality (**Lundstorm *et al.*, 1979**). Over the years, there has been an increasing focus on drip loss as a quality parameter in meat (**Forrest *et al.*, 2000**). Drip loss is of high importance in meat production due to its financial implication, which meat with high drip loss has an unattractive appearance and therefore has a low consumer acceptance leading to loss of sales (**Otto *et al.*, 2004**). Investigators have attributed drip losses to many factors; these include pH of meat, storage temperature time that meat spends in the range of -1°C to -5°C and time of freezing post-mortem (**El-Sharkawy, 1984**).

Abd El-Gawwad *et al.* (1990) found that volume of drip collected from *Longissimus dorsi* muscle of buffalo meat frozen at -10°C and -20°C for 3 months increased as frozen time increased and extended frozen storage increase nutrients loss in drip on thawing.

Contents of nitrogen in the drip was increased with increasing of frozen storage time (**Miller *et al.* (1980)**.

The fatty acids composition of the lipids in the separated drip was largely affected by frozen storage period (**Fahmy *et al.* (1981)**.

The aim of this investigation is to determine chemical composition and nutritive value of drip separated after thawing of frozen stored meat at -20°C for 6 months of calve's fed on ration supplemented with some commercial growth promoters (fibrozyme, moreyeast and pronifer).

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 of 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

increase in body weight gain and daily weight gain. Average relative daily body weight gain during the experimental 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 and packed in polyethylene bags, each containing 1 kg meat to frozen stored at -20°C for 6 months. The end of freezing period, the samples were thawed at room temperature (at 25°C) and drip was taken for chemical analysis.

Methods :

Chemical composition :

The drip loss from frozen meat after thawing was determined according to the methods described by **Awad (1967)**.

Gross chemical composition of drip (total solids, total nitrogen, ether extract and ash) was determined in the drip loss according to the methods of **AOAC (1995).**

Minerals contents :

Minerals were determined according to **Dremina *et al.* (1974)** method. Drip loss 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 drip loss 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 drip loss 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

Drip losses:

Data presented in Table (1) show that there were increasing amounts of drip as storage time progressed. The drip loss varied considerably between control and other treatments. The averages of the drip loss percentages of thawed of calves' meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) after 3 and 6 months of frozen storage were 7.48, 9.18; 6.60, 7.88; 8.70, 10.55 and 7.65, 9.54; respectively.

Table (1) : Drip loss (%) during thawing of frozen stored *Longissimus dorsi* muscle meat (at -20°C for 3 and 6 months) of friesian calves fed ration supplemented with different growth promoters.

Growth promoters	Storage time at –20°C	
	3 months	6 months
Control	7.48 [a]	9.18
Fibrozyme	6.60 [b]	7.88
Moreyeast	8.70 [a]	10.55
Pronifer	7.65 [a]	9.54
MSE	0.40	0.49

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

The increase of the drip amount noticed as the time of frozen storage increased could be attributed to different degrees of denaturation of the protein muscles which caused by the rate and extent of acidification in the muscle after death as indicated by the decrease of total soluble nitrogen

(Penny, 1977). The temperature fluctuation during frozen storage enhanced the water migration from the cells, therefore the salt concentration increased inside the fibers causing more denaturation and insolubility of protein **(Dyer and Dingle, 1967)**. The increase of fat oxidation with advancing of frozen storage time also decreased solubility of protein **(Awad, 1967)**.

Many investigators attributed drip losses to many other factors. These include time of freezing post-mortem **(Rahelic *et al.*, 1974)**, sample surface area/weight ratio may influence the drip loss with a positive correlation **(Van Moeseke and De Smet, 1999)**, and variation in methods used for measurements of drip losses **(Otto *et al.*, 2004)**.

Chemical composition of drip:

Data in Table (2) show that the total solids,total nitrogen,ether exctract and ash content of drip separated from thawed meat of *longissimus dorsi* muscle as affected by frozen storage at -20°C for 3 and 6 months increased as the time of frozen storage increased in all samples.

Table (2): Chemical composition of drip loss during thawing of frozen stored *Longissimus dorsi* muscle meat (at –20°C for 3 and 6 months) of Friesian calves fed ration supplemented with different growth promoters (% of wet matter).

Growth promoters	Total solids		Total nitrogen		Ether extract		Ash	
	Months							
	3	6	3	6	3	6	3	6
Control	10.52	10.65	1.49^{a}	1.55	0.16^{ab}	0.21^{b}	1.08	1.19
Fibrozyme	9.07^{B}	11.04^{A}	1.36^{ab}	1.52	0.13^{Bb}	0.21^{Ab}	1.18	1.24
Moreyeast	9.13	11.29	1.21^{b}	1.49	0.20^{a}	0.26^{a}	1.10	1.24
Pronifer	9.39	10.85	1.35^{ab}	1.54	0.19^{Bab}	0.24^{Aab}	1.04	1.18
MSE	0.35	0.21	0.04	0.02	0.01	0.007	0.04	0.04

a, b and c: means in the same row with different superscripts differ significantly ($P < 0.05$).
A, B significance between months
MSE: Means of standard error.

The increase of total solids could be explained on the basis that tissue breakdown and solids escape increased in the drip with advancing of frozen storage.

The progressive decrease in total nitrogen of meat during frozen storage explained the continuous increase of total nitrogen in the drip **(El-Sharkawy, 2006)**. Total nitrogen in drip of thawed calves' meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) for 3 and 6 months of frozen storage were 1.49, 1.36, 1.21 and 1.35; 1.55, 1.52, 1.49 and 1.54% (as wet matter), respectively. From previous results, it could be observed that, the

differences in total nitrogen between treatments were slightly and not marked at the end of frozen storage time.

According to **Lawrie (1979)**, the solubilized nitrogenous compounds in drip are sarcoplasmic proteins, creatine and creatinine, free amino acids, peptides, nitrogenous basis, purine and pyrimidine degradation products, porphyrin containing compounds and metabolic cofactors.

The increases of ether extract in the drip may be ascribed to the increasing damage of tissues as the time of frozen storage increased.

The increasing of ash content were also due to increases in the damage of tissues occurred during frozen storage which lead to escape the minerals with the separated drip.

Minerals:

Data in Table (3) showed that the drip contained appreciable amounts of minerals which indicated the loss of the nutritional values of frozen stored meat upon thawing. Such loss increased as the time of frozen storage increased in most minerals with exception the heavy metals Cd and Pb, they decreased as the time of frozen storage increased indicating to reservation of these metals in frozen meat tissue. The increase of minerals in drip were in accordance of the findings of **Fahmy *et al.* (1981)**, who reported that the concentration of minerals in drip raised as the time of frozen storage increased. It was observed that the highest minerals concentration in the drip were recorded for control followed by pronifer, moreyeast and fibrozyme treatments (Table 3).

Table (3): Minerals contents of drip loss during thawing of frozen stored *Longissimus dorsi* muscle meat (at –20°C for 3 and 6 months) of Friesian calves feed ration supplemented with different growth promoters (mg/100 gm, wet matter).

Minerals	Treatments							
	Control		Fibrozyme		Moreyeast		Pronifer	
	Months							
	3	6	3	6	3	6	3	6
Na	57.28	82.28	50.12	68.33	47.08	84.64	39.31	70.84
K	134.74	190.26	130.75	140.23	107.67	135.83	53.35	120.95
P	79.88	123.68	58.20	116.53	88.35	116.09	91.03	188.78
Ca	30.28	31.61	28.22	30.27	20.69	26.13	23.02	25.18
Fe	1.75	1.87	1.39	2.42	1.41	1.66	1.40	2.11
Cu	0.03	0.03	0.02	0.04	0.01	0.03	0.01	0.06
Mg	12.59	13.82	11.60	13.18	10.89	13.72	11.87	12.91
Mn	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Zn	1.36	1.61	1.44	1.49	1.44	1.73	1.41	1.46
Cd	0.03	0.02	0.23	0.01	0.03	0.01	0.03	0.01
Pb	0.17	0.01	0.16	0.12	0.12	0.02	0.14	0.05

The concentration of minerals in drip was influenced by frozen storage time and kind of mineral. The results indicated that, the highest minerals concentration in the drip were recorded for K followed by P, then came Na, Ca, Mg, Fe and Zn.

Amino acids:

The amino acids in drip loss of frozen meat of *longissimus dorsi* muscle as affected by frozen storage time at -20°C for 6 months and by growth promoters supplemented with the experimental rations of Friesian calves are presented in Table (4). The amino acids of different samples expressed as g/16 g N.

Table (4): Amino acids composition of drip loss during thawing of frozen stored *Longissimus dorsi* muscle meat (at –20°C for 6 months) of Friesian calves feed ration supplemented with different growth promoders (g/16 g N).

Amino acids	Control	Fibrozyme	Moreyeast	Pronifer	FAO/WHO 1973 standard P. g/16g N
Indispensable amino acids					
Thereonine	2.91	4.76	3.82	3.63	4.00
Valine	4.40	6.39	4.83	4.26	5.00
Methionine	1.68	2.47	1.95	1.52	3.50
Cystine	0.43	0.44	0.24	0.01	
Isoleucine	3.03	4.86	3.89	3.44	4.00
Leucine	5.36	7.58	5.91	4.69	7.00
Phenyalanine	3.74	4.85	3.86	3.23	6.00
Tyrosine	2.45	3.62	2.65	2.41	
Lysine	8.16	10.53	6.95	6.52	5.50
Tryptophan	1.00	0.95	1.10	1.10	1.00
Histidine	6.40	6.50	5.89	5.04	
Arginine	4.99	5.58	4.78	4.19	
Total indispensable amino acids	44.55	58.53	45.87	40.04	
Dispensable amino acids					
Aspartic acid	6.66	8.91	7.71	7.99	
Serine	2.39	3.86	2.69	2.93	
Glutamic acid	10.94	13.40	10.98	11.55	
Proline	2.03	3.34	2.02	2.29	
Glycine	3.46	5.25	3.99	3.52	
Alanine	4.99	6.94	5.23	4.77	
Total dispensable amino acids	30.47	45.70	32.62	33.05	
Total amino acids	75.02	104.23	78.49	73.09	
Indispensable/total amino acids ratio	0.59	0.56	0.58	0.55	

The results reported that, the drip of all samples contained all amino acids (indispensable and dispensable) which present in meat with high concentrations because of high quantity of soluble nitrogenous compounds escape from frozen meat during thawing to separated drip. The presence of these amino acids in drip reduce the nutritive values of frozen meat.

The indispensable amino acids/total amino acids ratio of drip calves' meat fed on control ration and supplemented groups with growth promoters (fibrozyme, moreyeast and pronifer) were 0.59, 0.56, 0.58 and 0.55, respectively. These ratios were more than the ratios of meat post-mortem and frozen meat (**El-Sharkawy, 2006**).

The results also, revealed that the indispensable amino acids in drip were more than the dispensable amino acids, consequently the nutritive value of frozen meat becomes less than the fresh meat.

Amino acid score:

Indispensable amino acids presented in the drip separated from frozen meat during thawing (Table 4) were used to calculate the amino acid score.

Data in Table (5) showed that the amino acid score (AAS) of drip of fibrozyme treatment was the highest, followed by moreyeast treatment then pronifer treatment, while the control group recorded the lowest amino acid score.

Table (5): Amino acid score of drip loss during thawing of frozen stored *Longissimus dorsi* muscle meat (at –20°C for 6 months) of Friesian calves fed ration supplemented with different growth promoters.

Amino acids (indispensable)	FAO/WHO (1973) standard P mg/gm N.	Control		Fibrozyme		Moreyeast		Pronifer	
		A.A. mg/gm N	A.A.S.	A.A. mg/gm N	A.A.S.	A.A. mg/gm N	A.A.S.	A.A. mg/gm N	A.A.S.
Threonine	250	181.88	72.75	297.50	119.00	238.75	95.50	226.88	90.75
Valine	310	275.00	88.71	399.38	128.83	301.88	97.38	266.25	85.89
Methionine + cystine	220	131.88	59.94	181.88	82.67	136.88	62.22	95.63	43.47
Isoleucine	250	189.38	75.75	303.75	121.50	243.13	97.25	215.00	86.00
Leucine	440	335.00	76.14	473.75	107.67	369.38	83.95	293.13	66.62
Phenylalanine + tyrosine	380	386.88	101.81	529.38	139.31	406.88	107.07	352.50	92.76
Lysine	340	510.00	150.29	658.13	193.57	434.38	127.76	407.50	119.85
Tryptophan	60	62.50	104.17	59.38	98.96	68.75	114.58	68.75	114.58

A.A. Amino acid
A.A.S. Chemical score

$$A.A.S. = \frac{\text{Mg of amino acid per gm. N. in tested protein}}{\text{Mg of amino acid per gm. N. in reference}}$$

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

The data in Table (6) cleared that the C-PER and BV of drip of calves' meat fed on control ration and supplemented groups with growth promoters

(fibrozyme, moreyeast and pronifer) were 2.14, 72.43; 3.13, 82.86; 2.39, 75.07 and 1.30, 63.59, respectively.

The highest value of C-PER was detected in fibrozyme treatment followed by moreyeast treatment, then came control group, while the lowest value of C-PER was had in pronifer treatment.

On the other hand, the BV of drip protein of control and treatments had the same trend of C-PER whereas the highest value was in fibrozyme treatment, followed by moreyeast treatment, then came control group, while the lowest value of BV was in pronifer treatment.

Fatty acids composition:

Data in Table (7) represent that the drip had more total saturated fatty acids in intramuscular fat in the case of calves' meat fed on the experimental ration supplemented with growth promoters, while they were less in control group.

It was also noticed that $C_{18:1}$ constituted the major portion of the total unsaturated fatty acids, followed by $C_{18:2}$, then $C_{18:3}$, while $C_{16:1}$ constituted the lowest portion of unsaturated fatty acids in all treatments.

Table (6): Computed protein efficiency ratio (C-PER) and biological value (BV) of drip loss during thawing of frozen stored *Longissimus dorsi* muscle meat (at –20°C for 6 months) of friesian calves feed ration supplemented with growth promoters.

Growth promoters	C-PER	BV
Control	2.14	72.43
Fibrozyme	3.13	82.86
Moreyeast	2.39	75.07
Pronifer	1.30	63.59

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

On the other hand, $C_{16:0}$ constituted the dominant saturated fatty acids, followed by $C_{18:0}$, then $C_{14:0}$, while the other fatty acids, their portions in the different treatments were scattered.

The presence of the fatty acids in drip of different treatments may be due to the damage of the muscle by ice crystals and escape of the fatty acids with the separated fluids.

From previous results, it could be concluded that, drip had high nutritive value and contained very important nutrients and affect the nutritive value of frozen meat. So, we don't have to neglect it during thawing and cooking of frozen meat.

Table (7): Fatty acid composition of drip loss during thawing of frozen stored *Longissimus drosi* muscle meat (at –20°C for 6 months) of friesian calves feed ration supplemented with different growth promoters (% of total fatty acids).

Fatty acids	Control %	Fibrozyme %	Moreyeast %	Pronifer %
Unsaturated fatty acids:				
Palmitoleic acid ($C_{16:1}$)	0.39	2.96	1.33	2.12
Oleic acid ($C_{18:1}$)	39.27	31.83	33.09	31.52
Linoleic acid ($C_{18:2}$)	10.47	8.87	8.86	14.15
Linolenic acid ($C_{18:3}$)	3.84	2.55	4.73	2.19
Total monoenoic fatty acids %	39.66	34.79	34.42	33.64
Total polyenoic fatty acids %	14.31	11.42	13.59	16.34
Total unsaturated fatty acids %	53.97	46.21	48.01	49.98
Saturated fatty acids:				
Capric acid ($C_{10:0}$)	1.75	1.36	1.18	0.43
Lauric acid ($C_{12:0}$)	1.75	2.73	1.42	0.60
Myristic acid ($C_{14:0}$)	3.14	3.46	2.36	2.57
Palmitic acid ($C_{16:0}$)	22.69	27.29	26.00	24.53
Heptadecnoic acid ($C_{17:0}$)	2.18	4.09	1.60	1.18
Stearic acid ($C_{18:0}$)	11.91	14.19	17.67	20.05
Arachidic acid ($C_{20:0}$)	2.62	0.68	1.77	0.64
Total saturated fatty acids%	46.04	53.80	52.00	50.00
Unsaturated FA/saturated FA	1.17	0.86	0.92	1.00

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الملخص العربى

تأثير إضافة بعض محفزات النمو الى علائق عجول الفريزيان على جودة وخواص الطبخ للحم

٤- التركيب الكيميائى والقيمة الغذائية للسائل المنفصل من لحم العضلة الطولية الظهرية المخزن بالتجميد.

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يهدف هذا البحث الى تقدير التركيب الكيميائى والقيمة الغذائية للسائل المنفصل من لحم العضلة الطولية الظهرية لعجول الفريزيان المخزن بالتجميد على -٢٠°م لمدة ٣ و ٦ شهور والتى تم تغذيتها على علائق مضاف لها بعض محفزات النمو (الفيبروزيم، الموريست، البرونيفير) المستخدمة تجاريا كإضافات غذائية لتحسين خواص وجودة اللحم.

أوضحت النتائج أن هناك زيادة فى كمية السائل المنفصل من اللحم بزيادة مدة التخزين بالتجميد حيث كانت متوسط النسبة المئوية لهذا السائل المنفصل عن اللحم بعد التسييح فى المعاملات الأربعة (الكنترول والفيروزيم والموريست والبرونيفير) بعد ٣ و ٦ شهور من التخزين بالتجميد كانت ٧,٤٨: ٩,١٨، ٦,٦٠ : ٧,٨٨، ٨,٧٠ : ١٠,٥٥ و ٧,٦٥ : ٩,٥٤%) على التوالى. كما حدث زيادة فى محتوى السائل المنفصل لبعض العناصر الغذائية (المواد الصلبة الكلية – المواد النتروجينية – المستخلص الإيثيرى – الرماد – المعادن) بزيادة مدة تخزين اللحم بالتجميد.

إشارت النتائج الى زيادة نسبة المواد النتروجينية فى السائل المنفصل على اللحم المخزن بالتجميد لمدة ٣، ٦ شهور حيث كانت ١,٤٩ : ١,٥٥ ، ١,٣٦ : ١,٥٢ ، ١,٢١ : ١,٤٩ و١,٣٥ : ١,٥٤ (على أساس مادة طازجه) فى المعاملات الأربعة على التوالى. كما اشارت النتائج أن السائل المنفصل يحتوى على نسبة من العناصر المعدنية كان أعلاها البوتاسيوم يلية الفوسفور والصوديوم والكالسيوم والمغنسيوم والحديد وهذه النسبة تزداد بزيادة مدة تخزين اللحم بالتجميد. كما أحتوى السائل المنفصل على جميع الأحماض الأمينية الأساسية والغير اساسيه كما وجد أن السائل المنفصل من لحم معاملة الكنترول المخزن بالتجميد يحتوى على نسبة مرتفعة من الأحماض الدهنية الغير مشبعة (٥٣,٩٧%) بينما تنخفض هذه النسبة به نتيجة معاملة اللحم بمحفزات النمو (الفيبروزيم، الموريست، البرونيفير) حيث كانت ٤٦,٢١، ٤٨,٠١، ٤٩,٩٨% على التوالى مما يؤدى الى نقص القيمة الغذائية للحم المجمد.

النتائج السابقة أشارت الى ارتفاع القيمة الغذائية للسائل المنفصل من اللحوم المجمدة أثناء التسييح لإحتوائة على نسب يجب وضعها فى الإعتبار من العناصر الغذائية لذلك يجب إلا نهمل هذا السائل المنفصل للمحافظة على القيمة الغذائية للحوم المجمدة عند طبخها.