DIE KATALYTISCHE WIRKUNG DES NITROSYLHÄMOGLOBINS BEI DER LIPIDOXYDATION

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Mechanisch entbeintes Fleisch /MEF/ enthält einen Knochenmarkanteil mit einem verhältnismässig hohen Gehalt an Hämpigmenten und an hochungesättigten Fettsäuren. Diese beiden Inhaltsstoffe können, verglichen mit Fleisch, eine schnellere Lipidautoxydation bewirken.
Der Pökelprozess führt u.a. zur Bildung der Nitrosylpigmente, deren Rolle in der katalytischen Lipidoxydation in den Fleischerzeugnissen noch nicht eindeutig aufgeklärt worden ist. Ausserdem sind die Veränderungen der Knochenmarklipide unter dem Einfluss von Nitrosylhämoglobin bzw. -myoglobin noch nicht untersucht worden. Die Bestimmung der oxydativen Veränderungen der Knochenmarklipide unter dem Einfluss von Nitrosylhämoglobin könnte die Haltbarkeitsprobleme des gepökelten MEF zum Teil erklären.

Untersuchungsmaterial.
Myoglobin, als Metmyoglobin /MMb/, wurde nach der Methode von Bünnig und Hamm /1969/ mit geringen Modifikationen aus Schweineschinkenmuskel /M. quadriceps femoris/ gewonnen. Hämoglobin, als Methämoglobin /MHb/, wurde nach der Methode von Bünnig und Hamm /1974/ aus Schweineblut gewonnen. Lipide von Schweinespeck und -knochenmark wurden mittels der Methode von Kates /1972/ extrahiert. Nitrosylhämoglobin /HbNO/ wurde durch Nitrosylierung des Hämoglobins mit Natriumnitrit in Anwesenheit von Ascorbinsäure /AS/ bei einem Molverhältnis von 1:6:800 /Hb:$NaNO_2$:AS/ und durch Gefriertrocknung der dialysierten Lösung gewonnen.

Untersuchungsverfahren.
Es wurden Modellemulsionen vom Typ "Öl-in-Wasser" hergestellt, die 40% Lipide /aus Knochenmark bzw. Speck/ und 0; 0,1; 0,3; 0,5 und 1,0% in der Wasserphase /pH 6,0 - Phosphatpuffer/ verdünnten Farbstoffs enthielten. Der Emulgierungsprozess wurde bei einer Temperatur von 45°C während 10 Minuten in Anwesenheit von 5% Emulgator Empiwax SK durchgeführt. Die Emulsionen wurden 7 Tage bei einer Temperatur von 4°C aufbewahrt. Es wurden drei Untersuchungsserien vorbereitet.
In den aus den gelagerten Emulsionen extrahierten Lipiden wurde die Peroxydzahl /PZ/, Thiobarbitursäurezahl /TBSZ/ und Säurezahl /SZ/ bestimmt.

Disskusion der Ergebnisse.
Unter den Bedingungen, in denen die Experimente durchgeführt wurden, konnten keine hydrolytischen Veränderungen der Lipide nachgewiesen werden, unabhängig von ihrer Herkunft, ihrer Aufbewahrungszeit sowie Gehalt und Art der Farbstoffe im Emulsionssystem. Lipide aus Speck und aus Knochenmark waren ähnlichen oxydativen Veränderungen unter dem Einfluss von Hämpigmenten in den Emulsionen unterworfen /Abb. 1/. Die beobachteten Tendenzen in den Veränderungen von PZ und TBSZ waren einander ähnlich.
Auf die oxydativen Veränderungen der Lipide hatten die Aufbewahrungszeit sowie der Gehalt an in die Emulsionen eingeführten Farbstoffen Einfluss. Das wurde statistisch durch die Varianzanalyse bestätigt. Der Anstieg der Konzentration des MHb /und des MMb/ vergrösserte den Oxydationsgrad der Lipide. Dagegen nahmen mit der Zunahme der HbNO-Konzentration in der Emulsion seine katalytische Eigenschaften deutlich ab, und es wurden keine katalytischen Wirkungen des HbNO bei einer Konzentration von 1% in der Emulsion nachgewiesen /Abb. 2/.
Die Nitrosylierung beeinflusste die prooxydativen katalytischen Eigenschaften der Hämpigmente. HbNO bei niedriger Konzentration /von 0,1%/ zeigte stärkere Eigenschaften bezüglich der katalytischen Oxydation der Knochenmarklipide in der Emulsion im Vergleich zu MHb bei derselben Konzentration. Dagegen bewirkte die Zunahme des Gehaltes an HbNO bis zu 1,0% stufenweise eine Senkung der prooxydativen Eigenschaften /Abb. 3/. Da z.B. im Rinder-MEF der Gehalt an Hämpigmenten ca. 1% beträgt, bedeutet das, dass für die bei einem 50%-igen Umrötungsgrad des MEF erreichte Menge an Nitrosylpigmenten /ca. 0,5% im MEF/ keine katalytische Aktivität im Lipidoxydationsprozess zu erwarten ist. Das MEF stellt natürlich ein komplexeres System dar als die verwendeten Emulsionen, trotzdem können die beobachteten Tendenzen verglichen werden.

Schlussfolgerungen.

1. Es wurde kein statistisch signifikanter Unterschied in der Oxydationsempfindlichkeit der untersuchten Lipide /aus Schweinespeck und -knochenmark/ festgestellt, jedoch ein statistisch hochsignifikanter Einfluss der Hämpigmente-Konzentration auf die Lipidoxydation in den Emulsionen.
2. Nitrosylhämoglobin war bei niedriger Konzentration /von 0,1%/ im Vergleich zu Methämoglobin katalytisch aktiver bei der Lipidoxydation, dagegen mit dem Anstieg der Konzentration des HbNO nahm seine Aktivität deutlich ab und bei einer Konzentration von 1,0% in der Emulsion war sie nicht mehr nachweisbar.
3. Die erhaltenen Ergebnisse zeigen, dass das Pökeln des mechanisch entbeinten Fleisches der Lipidoxydation im MEF vorbeugt.

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Abb. 1. Abhängigkeit der Peroxydzahl /PZ/ der Knochenmarklipide o—o—o und der Specklipide •—•—• in den kühlgelagerten Emulsionen von Menge des in die Emulsion eingeführten Methämoglobins /MHb/.

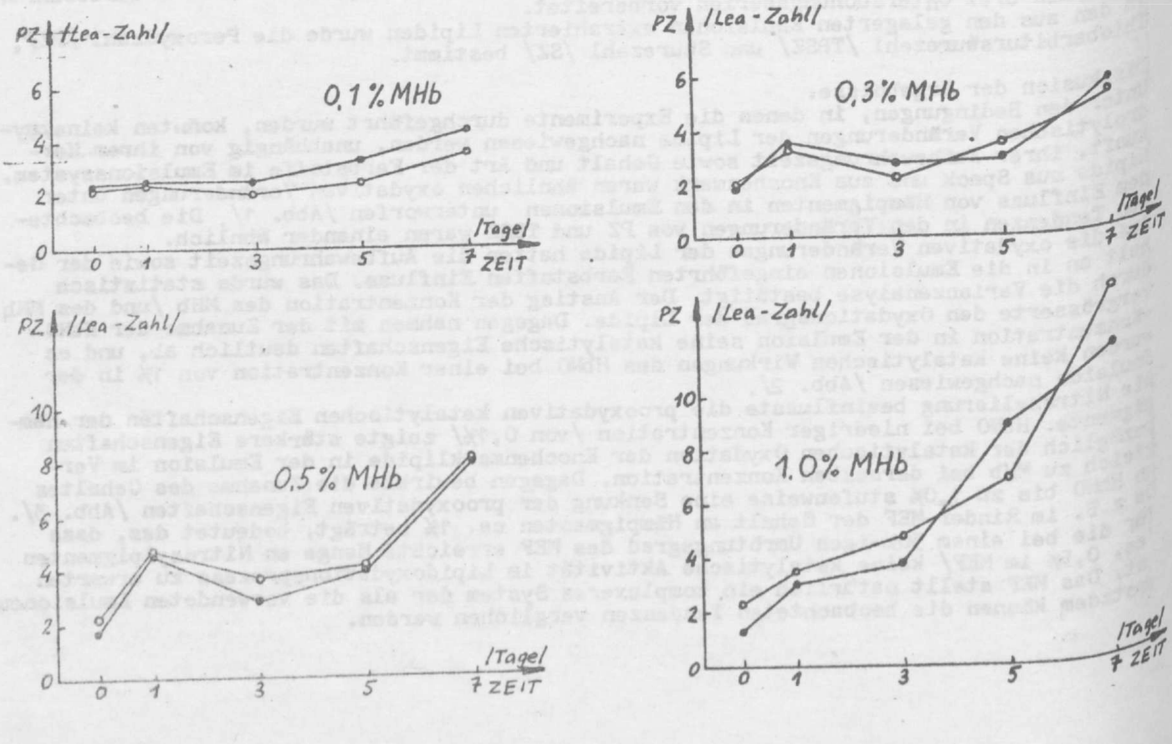


Abb. 2. Abhängigkeit der Peroxydzahl der Knochenmarklipide in den kühlgelagerten Emulsionen von Art des in die Emulsion eingeführten Farbstoffs /Methämoglobin MHb und Nitrosylhämoglobin HbNO/.

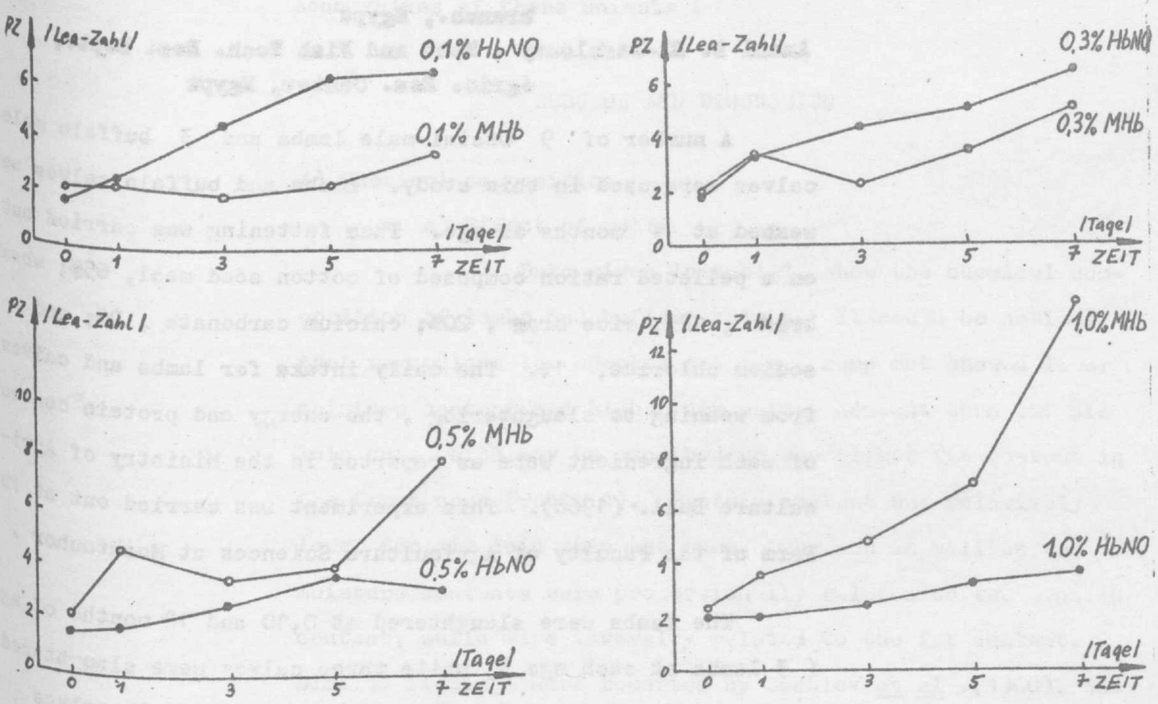
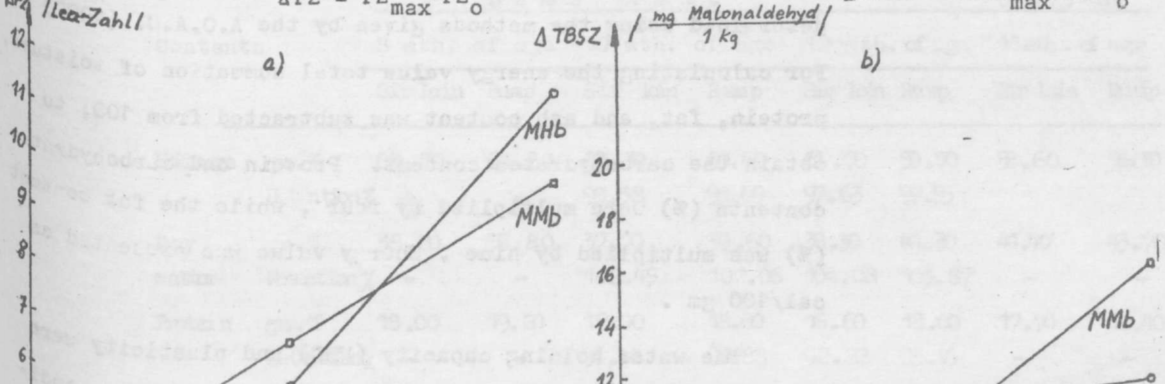


Abb. 3. Einfluss der Methämoglobin /MHb/-, Metmyoglobin /MMb/- und Nitrosylhämoglobin /HbNO/-Konzentration auf die Zunahme a/ der Peroxydzahl /ΔPZ/ und b/ der Thiobarbitursäurezahl /ΔTBSZ/ der Knochenmarklipide in den Emulsionen.

$\Delta PZ = PZ_{max} - PZ_o$ $\Delta TBSZ = TBSZ_{max} - TBSZ_o$



STUDIES FO SOME CHEMICAL AND PHYSICAL PROPERTIES OF MUTTON AND BUFFALO'S MEAT

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A number of 9 Ossimi male lambs and 3 buffalo male calves were used in this study. Lambs and buffalo calves were weaned at 4 months of age. Then fattening was carried out on a pelleted ration composed of cotton seed meal, 65%; wheat bran, 12%; rice bran, 20%; calcium carbonate, 2%; and sodium chloride, 1%. The daily intake for lambs and calves from weaning to slaughtering, the energy and protein content of each ingredient were as reported in the Ministry of Agriculture Bull. (1968). This experiment was carried out at the Farm of the Faculty of Agriculture Sciences at Moshtouhor.

The lambs were slaughtered at 8,10 and 12 months of age (3 lambs at each age), while three calves were slaughtered at 18 months of age. Jointing of lamb and buffalo calves carcasses was done in the same manner given by Darwish (1963) for buffaloes, to obtain similar cuts. After about 1½ hours of slaughter samples were taken from sir lion and rump cuts (fresh).

The moisture, crude protein, fat and ash contents were determined using the methods given by the A.O.A.C. (1970). For calculating the energy value total summation of moisture, protein, fat, and ash content was subtracted from 100; to obtain the carbohydrates content. Protein and carbohydrates contents (%) were multiplied by four, while the fat content (%) was multiplied by nine. Energy value was presented as cal/100 gm.

The water holding capacity (WHC) and plasticity were measured following the Grau and Hamm method (1957) as modified by Volvinskaia and Merkoolova (1958).

Protein water coefficient ($PWC = \frac{\%\ Protein}{\%\ Water}$) and protein water fat coefficient ($PWFC = \frac{\%\ Protein}{\%\ Water + \%\ fat}$) were calculated. According to Tsuladze (1972) the tenderness of muscle tissues increased with decreasing of PWC and PWFC values.

The physical properties of meat were also studied after one and six days of cold storage at 4^{o} c and after one and two months of frozen storage at -10^{o}c.

The results for all determinations are presented as mean values of three animals .

RESULTS AND DISCUSSION

A) Chemical composition

a) Effect of cut:-

Data given in table1, show the chemical composition of lambs and buffalo calves. It could be noticed that regardless the species and age , rump cut showed lower moisture content and higher dry matter content than the sir loin cut, which may be ascribed to the higher fat content in the first case (Table 1). Protein content was relatively lower for sir loin than the rump. The ash as well as the moisture contents were proportionally related to the protein content, while were inversley related to the fat content. Similar findings were reported by Sokolov et al .(1960). Due to the higher fat and protein content in the rump the energy value was higher as compared with that of sir loin cut. The carbohydrates content was always lower in the rump cut.

Table 1 The chemical composition of sir loin and rump of lambs and buffalo calves .

Contents		Lamb meat						Buffalo meat	
		8 mth. of age		10 mth. of age		12 mth. of age		18 mth. of age	
		Sir loin	Rump	Sir loin	Rump	Sir loin	Rump	Sir loin	Rump
Moisture	gm.%	63.20	61.20	62.30	60.40	61.70	59.70	58.60	56.30
	Retention%	-	-	98.58	98.69	97.63	97.55		
Dry matter	gm.%	36.80	38.80	37.70	39.60	38.30	40.30	41.40	43.70
	Retention%	-	-	102.45	102.06	104.08	103.87	-	-
Protein	gm.%	18.00	19.20	17.00	18.60	16.60	18.00	17.70	18.40
	Retention%	-	-	94.44	96.88	92.22	93.75	-	-
Fat	gm.%	17.50	18.30	19.20	19.80	20.30	20.90	22.40	24.00
	Retention%	-	-	109.71	108.20	116.00	114.21	-	-
Ash	gm.%	0.90	1.00	0.90	0.90	0.80	0.90	0.80	1.00
	Retention%	-	-	100.00	90.00	88.89	100.00	-	-
Carbohydrates	gm.%	0.40	0.30	0.60	0.30	0.60	0.50		
	Retention%	-	-	150.00	100.00	150.00	166.67		
Energy value	gm.%	231.1	242.70	243.20	253.80	251.50	262.10	274.40	290.8
		-	-	105.24	104.57	108.83	107.99	-	-

Table 2; The chemical composition of the rump as percentage of that for sir loin cut.

Contents %	Lambs			Buffaloes
	8thm.of age	10mth.of age	12mth.of age	18mth.of age
Moisture	96.84	96.95	96.76	96.08
Dry matter	105.44	105.04	105.22	105.56
Protein	106.67	109.41	108.43	103.96
F a t	104.57	103.13	102.96	107.14
A s h	111.11	00.00	112.50	125.00
Carbohydrates	75.00	50.00	83.33	60.00
Energy value	105.02	104.36	104.22	105.98

From table 2, it could be observed that the differences in the chemical composition between the two studied cuts, however existed, were not high, except for ash and carbohydrates contents; being 3.92-4.05% , 5.94-5.56%, 3.96-6.67%, 2.97-7.14%, 0.00-25%, 16.67-50% and 4.22-5.98% for moisture, dry matter, protein, fat, ash, carbohydrates contents and energy value respectively.

b) Effect of Species

From table 1, it could be noticed that the lambs meat showed higher moisture content and lower protein, fat and caloricity, specially when lambs of 12 months of age were compared with buffaloes, of 18 months of age . According to Sokolov et al , (1960), mutton retained higher fat content and caloricity; lower moisture and protein contents. The lower fat content and energy value (Table 1) found for lamb meat (compared to buffaloes) may be attributed to several factors such as the possible intense deposition of fat in the tail.

From table 2, it could be noticed that differences in the protein, fat and ash content as well as in the energy value between the rump and the sir loin cuts were relatively more pronounced for buffaloes meat than the lamb meat. Differences between the two cuts with regard to moisture, dry matter and carbohydrates were similar in lambs and buffaloes meat.

c) Effect of age:

With advancing of age the moisture, protein and ash contents decreased while the fat content increased (Table 1). Similar trends of changes due to age were reported by Lawrie (1974).

From table 2, it could be observed that differences between the two studied cuts were not affected by age except for fat and energy value, where such differences showed some decrease with advancing of age . This indicated that the deposition of fat with increasing of age may be relatively more pronounced in sir loin as compared with rump cut.

B) Physical properties

a) water holding capacity:-

Data presented in table 3, show the average water holding capacity of the lambs and buffaloes meat.

1- Effect of cut

From talbe 3, it could be noticed that, regardless to the age , species or storage conditions, the water holding capacity (WHC) was better for sir loin than the rump cut in as much as the area of exudative water by pressing (in cm was smaller in the first case than the latter one. This may be attributed to more water binding ability of proteins and lower connective tissue content in the sir loin than the rump cut (Lawrie, 1974).

Table 3, : The water holding capacity (in cm^2) of lambs and buffaloes meat as affected by storage conditions.

Water holding capacity		Lambs				Buffaloes	
		8mth. of age		12mth. of age		18mth. of age	
		Sir loin	Rump	Sir loin	Rump	Sir loin	Rump
Fresh	$C m^2$	2.2	3.5	4.1	5.3	4.5	5.7
samples	Retention%	100.00	100.00	100.00	100.00	100.00	100.00
24 hours at	$C m^2$	3.4	5.7	6.5	9.4	6.6	8.8
4°c	Retention %	154.55	162.86	158.54	177.36	146.77	154.39
6 days at	$C m^2$	2.9	4.8	5.9	8.3	7.22	9.6
4°c	Retention %	131.82	137.14	143.90	156.60	160.44	168.42
1 month at	$C m^2$	3.4	5.6	6.9	9.4	7.8	10.2
-10°c	Retention%	154.55	160.00	168.29	177.36	173.33	178.95
2 months at	$C m^2$	3.8	6.6	7.6	10.1	8.5	11.3
-10°c	Retention%	172.33	188.57	185.37	190.57	188.89	198.25

From table 4, it could be noticed that the fresh sirloin cut showed better WHC than the rump cut by 26. 67-59.09%.

Table 4: The water holding capacity of rump cut as percentage of that for the sir loin cut.

Samples		Fresh	1 day at 4^oc	6 days at 4^oc	1 mth. at-10^oc	2 mth. at-10^oc
Lambs	8 mth.of age	159.09	167.65	165.52	164.71	173.68
	12 mth.of age	129.27	144.62	140.68	136.23	132.90
Buffaloes	18mth.of age	126.67	133.33	132.96	130.77	132.94

2- Effect of species:

From table 3, it could be noticed that the WHC was better for lambs meat than the buffaloes meat, which may be atiributed to the lower connective tissue content in the former case than the latter one.

It could be aslo noticed that the differences in the WHC between the sir loin and rumps cuts were less marked for buffaloes than mutton regardless of age (Table 4). This may be due to the higher fat content in buffaloes meat than the lambs meat (Table 1). Lawrie (1974) reported that the higher WHC in pork than beef may be attributed to the higher fat content of pork which may loosen up the microstructure of pork, thus allowing more water to be entrained .

3- Effect of age :

With advancing of age the WHC of lambs meat decreased (Table 5). This decrease may be attributed to the lower binding ability of proteins and higher connective tissue content and firmness with increasing of age (Sokolov, 1965).

As the age of animals increased the differences in the WHC between the sir loin and rump cuts decreased (Table 5). Hence the deterioration of the WHC with age was more pronounced for the sir loin cut than the rump one. This may be attributed to the possible more deterioration of protein binding ability of the sir loin cut with increasing of age when compared with the rump one.

Table 5 : The WHC of the lambs meat after 12 months of age as percentage of the WHC at 8 months

Storage	0	1 day at 4^oc	6 days at 4^oc	1 mth.at -10^oc	6 mth.at -10^oc
Sir loin	186.36	167.65	165.52	164.71	173.68
Rump	151.43	144.62	140.68	136.23	132.90

4- Effect of storage :-

During cold-storage for 1 day the WHC decreased (Table3) due to the attack of rigor mortis which is usually accompanied by the decrease of PH towards the isoelectric point of proteins and the association of myosin with actin (Lawrie,1974). The WHC increased after 6 days of cold-storage (Table 3) due to aging which is accompanied by dissociation of actomyosin and increase of pH (Sokolov, 1965). At the end of cold-storage (6 days) the WHC did not reach the original level characterizing the fresh meat (Table 3) because of the incomplete dissociation of actomyosin and relatively low pH value of the tissues (Sokolov, 1965).

The WHC changes , after one day storage, were less marked for buffaloes meat than the lambs meat, because the top of rigor mortis was reached in the first case, being one day as found by El-Dashlouty et al ., (1967), while the top of rigor mortis for buffaloes meat was recorded after three days of cold-storage (El-Ashri and El- Dashlouty, 1970) . The imporvement of the WHC after six days of cold-storage was also more rapid for lambs than buffaloes meat which indicated that the aging of mutton is more rapid than for buffaloes meat (El-Dashlouty et al , 1967 and El-Ashri and El-Dashlouty, 1970).

The higher values of WHC for buffalo meat after six days of cold-storage as compared with one day storage indicated that after one day storage still more deterioration of WHC occured. Then possibly after three days storage the improvement begun.

During frozen storage the WHC was deteriorated. This could be attributed to the protein denaturation by freezing (Lawrie, 1974). The decrease of water binding ability was more pronounced for buffaloes meat than the lambs meat, indicating the possible more denaturation of proteins in the former case when compared with the latter one. Buffaloes meat contained higher fat content than the lambs meat. During frozen storage the oxidation and products of lipids renders the muscle protein insoluble which reduced the WHC of meat.

On storage the effect of age , species and cut was noticed as for the fresh meat (Tables 3,4 and 5).

B - Plasticity:

Plasticity was determined as indication for the meat tenderness. The increase of the area of pressed meat (in cm^2) indicates the more tender meat (Grau and Hamm, 1957).

1- Effect of cut:

Data in table 6, show the average plasticity (in cm^2) for the lambs and buffaloes meat.

From table 1, it could be noticed that the sirloin cut was more tender than the rump cut regardless the age, species and conditions of storage.

Data in table 7, show that the differences between the fresh sir loin and rump cuts were 25.81-26.67 %. The more tenderness recorded for the sirloin cut, as compared with the rump may be attributed to the lower connective tissue contents and firmness (Sokolov, 1965) as well as the better water holding capacity (Table 3).

Plasticity		Lamb				Buffaloes	
		8 mth. of age		12 mth. of age		18 mth. of age	
		Sir loin	Rump	Sir loin	Rump	Sir loin	Rump
Fresh sample	cm^2	3.6	3.0	3.1	2.3	2.7	2.2
	Retention %	100.0	100.0	100.0	100.0	100.0	100.0
1 day at 4°C	cm^2	2.7	2.1	2.2	1.6	2.1	1.7
	Retention %	75.0	70.0	70.97	69.57	77.78	77.27
6 days at 4°C	cm^2	3.2	2.5	2.6	1.8	2.0	1.6
	Retention %	88.89	83.33	83.87	78.26	74.07	72.73
1 month at -40°C	cm^2	3.0	2.4	2.4	1.7	1.9	1.5
	Retention %	83.33	80.00	77.42	73.91	70.37	68.18
2 month at -10°C	cm^2	2.5	2.0	2.0	1.4	1.6	1.3
	Retention %	69.44	66.67	64.52	60.87	59.26	59.09

2- Effect of species:

It was found that the buffaloes meat was less tender than the lambs meat (Table6). Ragab et al, (1966) reported that the buffaloes meat is generally tough and course when compared with cow's meat. This may be possibly due to larger amounts of connenctive tissues and more thick muscle fibres .

Table 7 : The plasticity of rump as percentage of that for sir loin .

Samples		Fresh	1 day at 4°c.	6 days at 4°c.	1 mth. at -40°c.	2 mth. at -10°c.
Lambs :	8 mth. of age	83.73	77.77	78.13	80.00	80.00
	12 mth. of age	74.19	72.73	69.23	70.83	70.00
Buffaloes:	18 mth. of age	81.48	80.95	80.00	78.95	81.25

From table 7, it could be concluded that the differences in tenderness between the sir loin and rump cuts (fresh samples) were higher for buffaloes (18 months of age) than lambs (12 months of age). The contrary may be found if the buffaloes meat was compared with lambs meat at 8 months of age . This may be due to complex effects of moisture , fat, WHC and connective tissue content and firmness .

3- Effect of age:

With advancing of age the meat tenderness decreased (Table 6 and 8) , which may be attributed to the increase of muscle fiber diameters and connective tissue content and firmness (Lawrie, 1974) as well as the deterioration of the WHC(Table 3).

From tables 7 and 8, it could be noticed that with advancing of age the differences between the tenderness of the sir loin and rump cuts increased, which may be due to the possible increase of the differences in the connective tissues.

Table 8: The plasticity of the lamb meat at 12 months of age as percentage of plasticity at 8 months.

Storage	0	1 day at 4°c	6 days at 4°c	1 month at -10°c.	2 months at -10°c
Sir loin	86.11	81.25	81.25	80.00	80.00
Rump	76.67	76.19	72.00	70.83	70.00

4- Effect of storage:

By cold-storage for one day, the meat tenderness decreased due to the attack of rigor mortis, which may be ascribed to the muscle contraction, association of myosin with actin, the decrease of water binding ability as well as the increase of connective tissue firmness (Abd El-Salam, 1978). After one day storage at 4°c the decrease of tenderness was more pronounced for lambs than buffaloes meat indicating the top of rigor mortis in the former case while the meat was still far away from full rigor in the latter case. The decrease of plasticity values after six days of cold-storage of buffaloes meat as compared with one day storage, indicates the possible more decrease of tenderness after three days storage i.e. on reaching the top of rigor mortis. After 6 days storage lamb meat showed marked improvement of tenderness due to aging , while the aging stage was still not reached in the case of buffalo meat.

By increasing of frozen-storage time, the tenderness of meat continuously decreased, which may be attributed to protein denataration and decrease of the WHC (Table 3). The decrease of the plasticity was more pronounced during frozen storage for buffaloes meat than lambs meat (Table 6) indicating the more WHC deterioration and the possible more changes of proteins in the formar case .

From tables 6,7 and 8 it could be noticed that the differences between the sir loin and rump cuts were still observed during storage. It may be also concluded that the rump cut showed more decrease of tenderness after one day storage at 4°c as well as during frozen storage and less pronounced improvement on aging when compared with the sirloin cut . Such results parallel the rate of WHC changes during storage (Table 3 and6).

C. Texture indices

The texfure indices were suggested by Tsuladze (1972) as an indication to the tenderness of different muscles and species of fish. The PWC and PWFC decrease as the tenderness of meat increases.

The values of the PWC and PWFC for fresh meat are given in table 9 .

Table 9 : The PW and PWF coefficients for lambs and and buffaloes meat .

Coefficients	Lambs				Buffaloes	
	8 mth. of age		12 mth. of age		18 mth. of age	
	Sirlion	Rump	Sirloin	Rump	Sirloin	Rump
P W C	0.2848	0.3138	0.2690	0.3015	0.3021	0.3268
P W F C	0.2231	0.2415	0.2024	0.2233	0.2185	0.2291

From tables 6 and 9, it could be noticed that the texture indices were valid as indications to the tenderness of different species and muscles but failed to indicate the changes of texture due to age . Both PWC and PWFC values were lower for lambs meat than the buffaloes meat and were lower for the rump tissues when compared with the sirloin, indicating that lambs meat and sir loin samples were more tender than the rump and buffaloes samples. Such results were in parallel with the values of plasticity (Table 6.).

As the age of animals increased the meat tenderness decreased as was found from plasticity values (Table 6) . Meanwhile PWC and PWFC gave unexpected results in as much as the values of these texture indices decreased with increasing of age (Table 9). The unexpected results could be explained on the basis that by increasing of age the rate of decrease in the protein content was marked (from 100% to 92.22% and 93.75%, i.e. by 7.78 and 6.25% for sirloin and rump cuts respectively) as compared with the rate of decrease in moisture content (from 100% to 97.63% and 97.55%, i.e . by 2.37 and 2.45% for sirloin and rump cuts respectively.) So the values of the PWC decreased with age. Similarly on calculating the PWFC the fat content increased with advancing of age wich reduced the PWFC values (instead of their increase with the decrease of meat tenderness) . There by when following the chages of tenderness with advancing of age the PWC and PWFC values should decrease which is the case in table 9. When the inverse values were calculated i.e. WPC and WFPC instead of PWC and PWFC (Table 10) The values of the texture indices increased with age, i.e. with decreasing of plasticity (Table 6) and tenderness .

Table 10 : The WPC and WFPC of lambs and buffaloes meat.

Coefficients	Lambs				Buffaloes	
	8 mth. of age		12 mth. of age		18 mth. of age	
	Sirloin	Rump	Sirloin	Rump	Sirloin	Rump
W P C	3.51	3.19	3.72	3.32	3.31	3.06
W F P C	4.48	4.14	4.94	4.48	4.58	4.36

But these inverse coefficients, in their turn, did not reflect the effect of cut or species on the meat tenderness.

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