C-13

ELEVENTH MEETING OF EUROPEAN MEAT RESEARCH WORKERS
BEOGRAD, AUGUST 16th to 22th, 1965.

CHANGES OF SPECIFIC GRAVITY OF HAM AND BEEF ROUND MUSCLES IN THE PROCESS OF AGEING

Žarko Trumić
Bogdan Maksimović
Jovan Rajić
Dušan Vasiljević

Yugoslav Institute of Meat Technology
Beograd

Ž.Trumić, B.Maksimović, J.Rajić, D.Vasiljević

CHANGES OF SPECIFIC GRAVITY OF HAM AND BEEF ROUND MUSCLES IN THE PROCESS OF AGEING

The complex of physical and chemical changes in the meat begins from the moment of killing of an animal and ends when the meat from the culinary point of view reaches its optimum (11). Glage (4) defines these occurrences as "physiological destruction", considering them as an extention of exchange of matters in a living organism with the participation of its own cell enzyms. In his opinion - this is lacking only physiological reparatory activity as one of essential features of living tissue. In foreign and domestic literature these processes are generally defined as "meat ageing".

However, regardless the definition itself, all authors agree that the essence of post-mortal occurrences in meat make two processes: glycolisis and proteolisis. In the course of the first process, muscles are dominated by the decomposition of intravital synthesized glycogens together with the creation of considerable quantities of lactic acid and a rather abrupt decrease of pH. Besides, glycosis is followed by prevention of protein swelling off of meat, the consequence of which is the "letting out" of meat juice and the loss of ability of meat to bind added water. The second process is

characterised by the decomposition of highly molecular proteins into more simple compounds, the result of which is the softening of meat and a gradual increase of its pH.

The examination of post-mortal autolytic changes in the meat is possible to be carried on by the use of chemical, physico - chemical and physical methods. For this purpose it is determined: the content of glycogen , the content of lactic acid and the total quantity of reductive sugars; changes of pH reaction, electric conductivity of muscles, their consistency, water binding ability and letting out of its own juice. We have not found in available domestic or foreign literature any data on changes of specific gravity of muscles in the course of meat ageing, on dynamics and regularity of development of these changes and their eventual correlation with mentioned physical, physico-chemical and physical changes in the complex of ageing.

A.H. KIRTON and R.A. BARTON (5) determined the quantity of fats in sheep caracasses carried on by measuring of specific gravity. They observed that in eviscerated carcasses of sheep there is a definite relationship between these two values. On the basis of authors conclusion the method of the determination of fat contents carried on by measuring of specific gravity of carcasses, examined in other animals, is possible to be applied in sheep as well.

KRAYBILL and al. (7) examined simultaneously the quantity of fat in beef by the application of various treatments - by the method with antipyrin; by measuring of specific gravity; by means of ether-extracts and the method of fat

isolation. They observed that these four methods provided identical results.

BROWN, HILLIER and WHATLEY (2) previously carried out experiments in laboratory animals with the purpose of examination of application possibilities of measuring of specific gravity for the determination of fat contents in pig carcasses. Specific gravity of pig carcasses was determined by measuring of carcasses in the air and water after 24 hours of chilling. On the basis of the authors'finding, in this way it is possible to estimate rather correctly the relationship between meat and fat . Specific gravity - combined with other methods of the determination of fat and lean meat- does not provide more correct data than those obtained by measuring of specific gravity only.

PEARSON and al (lo) enlarged the cited examinations; they set the task to find out data on the quantity of fat , namely meat, in the whole carcass, by measuring of specific gravity of cuts of the carcass . On the basis of their results, specific gravity of the whole leg was to some extent a safer index than specific gravity of the whole carcass. On the other hand, they assure that this method provides safer and more exact data on the quality of meat than it is possible to observe on the basis of measuring of the thickness of back fat .

KLINE, ASHTON and KASTELIC (6) observed that the average specific gravity of forty pig carcasses after 0; 24; 48; and 72 hours of chilling was o,997; 1,o21; 1,o25; and 1,o28.

DOORNEBAL, WELLINGTON and STOUFFER (3) claim that the most correct determination of carcass composition is

obtained by a complete physical and chemical analysis. This method is, however, expensive and requires a lot of time. The second method of carcass estimation comprises various kinds of measuring - the thickness of back fat, the diameter of muscle fibers and the like. The authors quote the determination of specific gravity as a very "promising" method. Of all examined measurings of the carcass, specific gravity showed the highest correlation with chemically determined percentage of proteins - o,91, and fats - o,95.

Methods of determination of carcass quality bi means of measuring of specific gravity, can also be applied in living animals. PACE and RATHBUN (9) measured specific gravity of guinea-pigs and compared it with specific gravity of their eviscerated carcasses. A similar experiment was carried out in cattle by KRAYBILL, BITTER and HANKINS (8).

BEHNKE, FEEN and WELHANI (1) used "density" of body for the estimation of fatness of man. Identical examinations were carried out in laboratory and domestic animals. They claim that the method is sufficiently correct and possible for a practical determination of fatness, namely fattening.

--- . ---

Taking into consideration the cited data on the research carried out in this field, we set the following task in our work:

- to examine specific gravity (SG) of the following muscles of ham and beef round: quadriceps femoris, biceps femoris, semimembranosus, semitendinosus, that is: immediately after killing and after 12, 24 and 48 hours of keeping at the temperature of cooling room (4-6°C);

- to register pH values and the percentage of freely let out juice in the cited muscles of ham and beef round, unter the same conditions and identical time intervals; and

- to define the course of specific gravity curve (SG curve) in the process of ageing of ham and beef round (on the basis of average values for all examined muscles) and to establish its relationship with pH curve.

Materials and Methods

All the examinations were carried out in the laboratory and departments of slaughter-house "Timok" at Zaječar. The following technique was used in this work:

1. Material for examinations.- White pigs aged 8 to 10 months and cattle aged 6 to 9 years were used in the examinations.

2. Preparations of examined muscles.- Muscles were prepared immediately after the cutting of animals. Pig muscles were cleaned from fat tissue and tendons, but without damaging ot their anatomic entity. Beef rounds were also cleaned from fat and tendons, and because of their size, after the preparation

they were cut into approximately equal pieces weighing from 34o to 42o grams.

3. Measuring of specific gravity of muscles was carried on by means of specially constructed precise hydrostatic scales. Pig muscles were measured as a whole; beef muscles - as it was already mentioned - in pieces of a definite size. In the interval of two examinations, the meat was kept in the cooling room, namely in the water, at the temperature between 4 and 6°C. The relative humidity of the air ranged between 8o and 9o per cent. The temperature of water (aqua fontis), in which muscles were measured, was always 13°C (± 2°C), and the muscles 3o°C (± 3°C). After the measuring, each sample was carefully "dried" with hydrofile tissue. Measurings were carried on as follows: m.quadriceps femoris, m.biceps femoris, m.semimembranosus and m.semitendinosus. The intervals between the killing of animals and the first examinations of muscles, shown in the tables with 0 hours, amounted to 45 minutes in pigs and 1 hour and 3o minutes in cattle. Specific gravity of muscles was calculated after the following formula:

$$SG = \frac{Wa}{Wa - Ww}$$

Wa = weight of a muscle in the air

Ww = weight of a muscle in the water

4. Measuring of muscle pH.- For the measuring of pH, parallel muscles of the same animal were used in every experiment. Immediately before the measuring, muscles were cut in small particles with a knife on a wooden plank. Then, 5o grams of every

250

muscle were mixed in Erlenmayer's flask with 2oo grams of boiled destilled water. Flasks were sealed with rubber corks and put into the holders of the vibrator (Microid Flask Shaker - Griffin and George, London). After 15 minutes of shaking, the extract was filtrated through an filter paper, and pH was measured immediately afterthat. The measuring of pH was carried out with Pye's pH meter (Cat.Nr. 11o86).

5. Determination of juice quantity which meat lets out in the course of ageing.- 5oo grams of meat were put into a glass funnel under which was set a graduated glass cyllinder. The quantity of freely let out juice was measured after 12, 24 and 48 hours.

6. Calculation of average values.- Every datum put into the tables in the Chapter "Results" represents an average value of the nine examined samples (9 muscles of nine different animals) Average values were calculated by dividing of totals of all values with 9.

R e s u l t s

Pork

In this part of the work, the authors examined specific gravity (SG), pH values and the quantity of freely let out juice in the following ham muscles: quadriceps femoris, biceps femoris, semimembranosus and semitendinosus. The results of these examinations are shown in the tables 1, 2, and 3 and in the figures 1, 2, and 3.

From the Table 1. and the Figure 1. it can be seen that specific gravity of examined muscles in the process of ageing is increasing. Besides, this increase is more intensive in the first 12 hours after the killing of an animal, and later its intensity is decreasing. The relationship of differences in initial values of specific gravities of some muscles are practically - with insignificant exceptions - maintained to the end of the experiment. Differences in initial and final values of SG of the same muscle vary in very narrow limits: from o,oll for m.semimembranosus to o,ol3 for m.quadriceps femoris and biceps femoris. However, it is essential to stress that in none of the cases in the course of all these experiments - concerning comparisons of initial and final values of SG - we could observe a decrease of SG.

Values of pH for every examined muscle were individually given in the Table 2., and graphically shown in the Figure 2. Initial differences, which we observed in this case among some muscles, diminished after 48 hours of ageing. Thus, it is possible to establish that muscles with a higher initial pH - quadriceps femoris and biceps femoris - after 48 hours of ageing, had a somewhat lower pH. However, these differences - although evident - were very small.

On the basis of average values of SG (Table 1.) and average values of pH (Table 2.), we constructed a SG and a pH curve (Figure 3.) for all examined ham muscles. The course of SG curve allows the following statement: the values of specific gravity of ham muscles are sufficiently noticable and regularly

increased in the process of ageing. Intensity of this increase is the strongest in the course of the first 12 hours of ageing; later, it considerably decreases in the following 36 hours. The average value of the difference of initial and final SG amounts to o,ol2 (Table 1.). The course of pH curve, in relation to the course of SG curve (Figure 3.) is practically identical; the difference is in the fact that pH curve shows a decrease of initial values, and SG curve their increase.

The Figure 3. also shows the curve of quantity of meat juice which muscles let out in the course of 48 hours of ageing. The shown course is only additional data in the complex of these changes, which will be more treated in the discussion of results.

Starting from the point that in the basis of observed changes of SG of muscles lies the process of evaporation and spontaneous loss of meat juice - we carried out an experiment in which examined muscles were kept in the water (the temperature of the water ranged between 4 and 6°C) in the course of 48 hours of ageing. The results are shown in the Table 3. and in the Figure 3. It can be easily noticed that SG decreases in this case. In other words, SG curve of muscles, whose ageing in the water, is identical by its course and intensity to the pH curve of the same muscles (Figure 3.). The average difference of initial and final SG value amounts to o,oo8 (Table 3.).

FIG. 1. SG CURVES OF SOME HAM MUSCLES IN THE COURSE OF AGEING

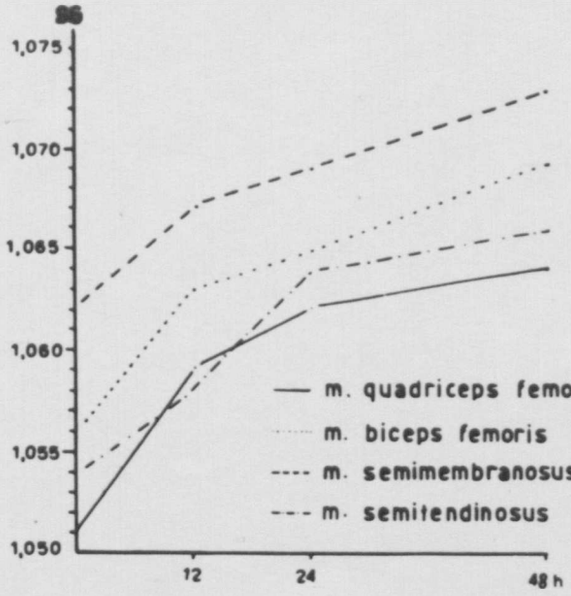


FIG. 2. pH CURVES OF SOME HAM MUSCLES IN THE COURSE OF AGEING

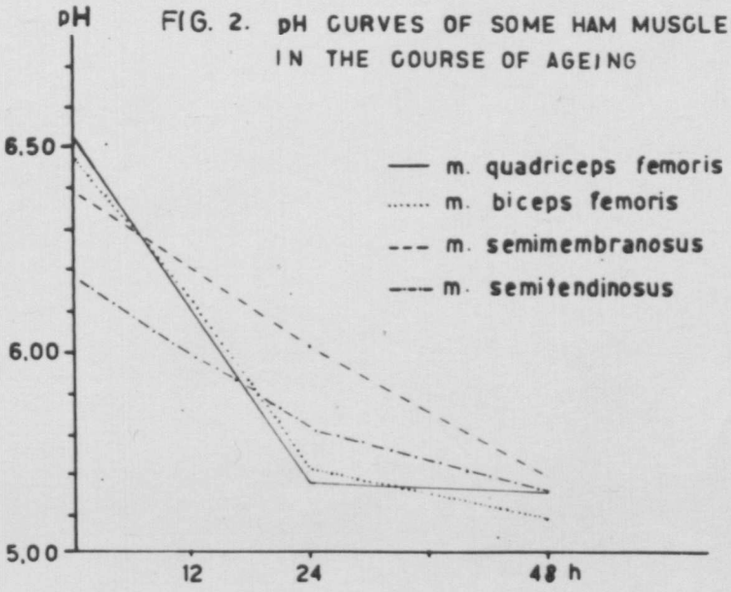
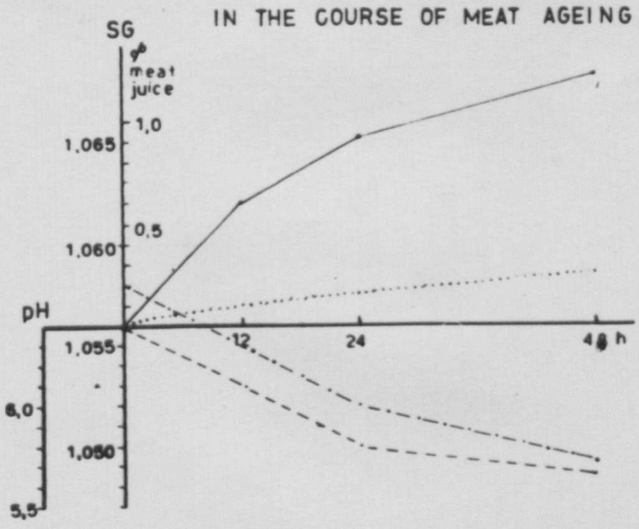


FIG. 3. HAM. SG, pH AND PERCENTAGE OF MEAT JUICE CURVES (ON AVERAGE) IN THE COURSE OF MEAT AGEING



SG Changes of Some Ham Muscles in the Course of Ageing

Table 1.

Examined muscles	SG values of muscles after killing				
	Immediately	12 hours	24 hours	48 hours	Differences between initial and ending values
m.quadriceps femoris	1,o51	1,o59	1,o62	1,o64	o,o13
m.biceps femoris	1,o56	1,o63	1,o65	1,o69	o,o13
m.semimembranosus	1,o62	1,o67	1,o69	1,o73	o,o11
m.semitendinosus	1,o54	1,o58	1,o64	1,o66	o,o12
Average values	1,o56	1,o62	1,o65	1,o68	o,o12

Changes of pH Values of Some Ham Muscles in the Course of Ageing

Table 2.

Examined muscles	pH values of muscles after killing			
	Immediately	12 hours	24 hours	48 hours
m.quadriceps femoris	6,53	6,11	5,68	5,65
m.biceps femoris	6,47	6,13	5,71	5,59
m.semimembranosus	6,39	6,2o	6,o1	5,69
m.semitendinosus	6,18	5,99	5,81	5,7o
Average values	6,39	6,11	5,8o	5,66

SG Changes of Some Ham Muscles in the Course of Ageing in Water

Table 3.

Examined muscles	SG values of muscles after Killing				
	Immediately	12 hours	24 hours	48 hours	Differences between initial nad final values
m.quadriceps femoris	1,056	1,047	1,045	1,042	0,014
m.biceps femoris	1,057	1,057	1,056	1,053	0,004
m.semimembra-nosus	1,064	1,062	1,058	1,058	0,006
m.semitendi-nosus	1,055	1,053	1,049	1,046	0,009
Average values	1,058	1,055	1,052	1,050	0,008

Beef

The examination of specific gravity of beef round muscles in the course of ageing was carried on in the same way and under the same conditions as in ham muscles. The Table 1A and the Figure 1A show that beef muscles in the course of ageing have also an increase of specific gravity. In relation to pig muscles, this increase is somewhat smaller and ranges from 0,006 for m.semimembranosus to 0,010 for m.semitendinosus; the average value of increase, namely the differences of initial and final SG for all muscles, amounts to 0,008 (Table 1A.). In relation to the same ham muslces, beef round muscles are characterised, besides the mentioned one, by a stopage of the intensity of SG

FIG. 1A. SG CURVES OF SOME BEEF ROUND MUSCLES IN THE COURSE OF AGEING

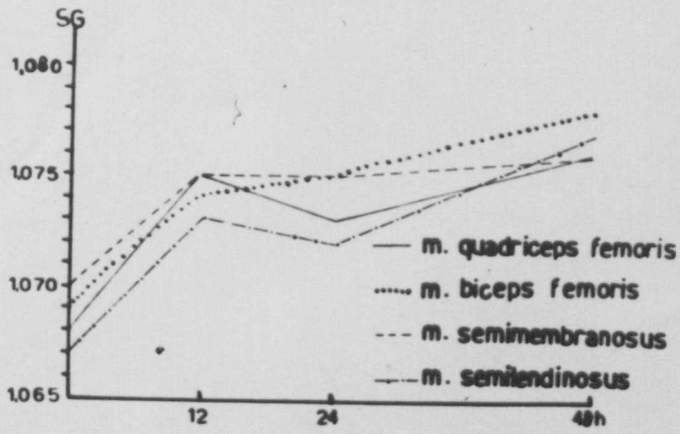


FIG. 2A. pH CURVES OF SOME BEEF ROUND MUSCLES IN THE COURSE OF AGEING

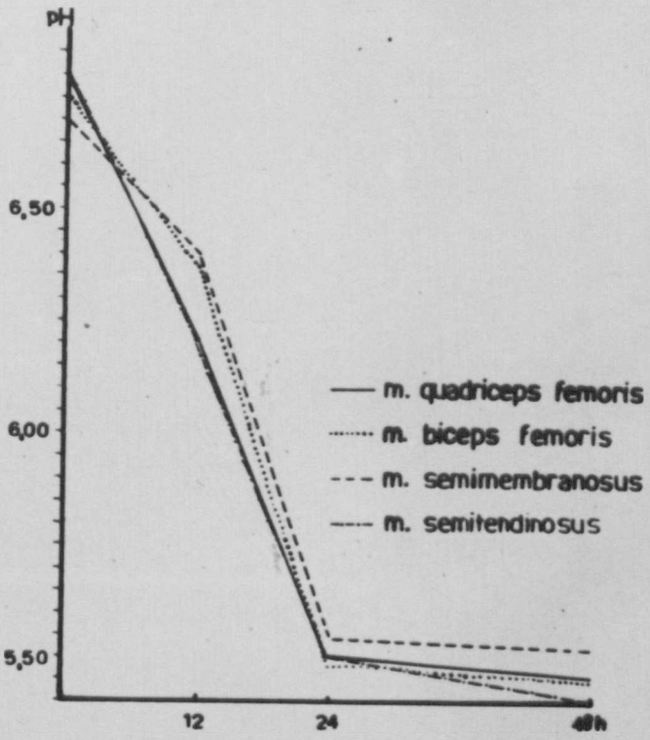
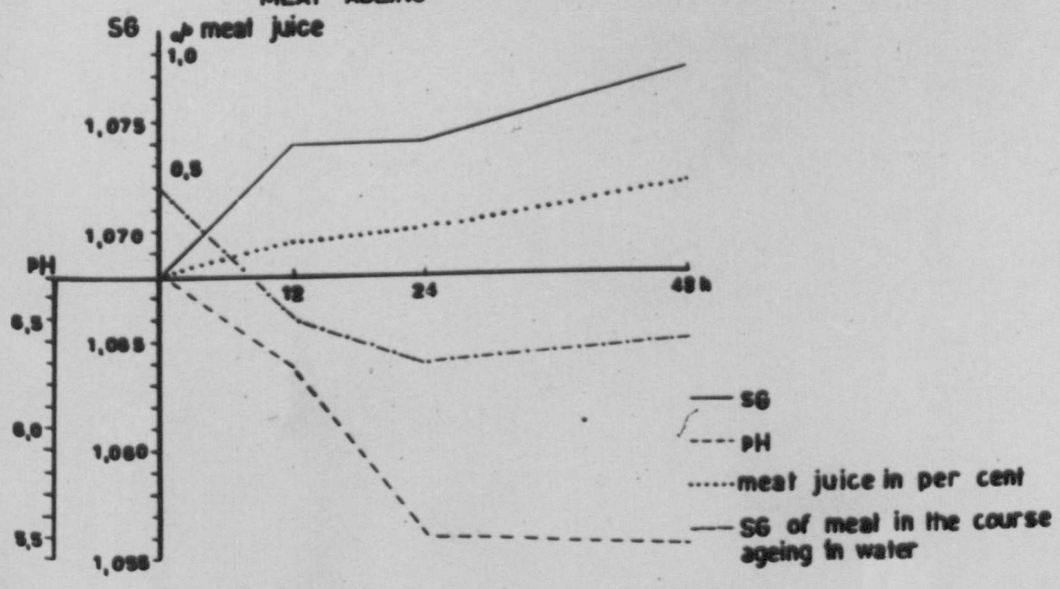


FIG. 3A. BEEF ROUND. SG, pH AND PERCENTAGE OF MEAT JUICE CURVES ON AVERAGE IN THE COURSE OF MEAT AGEING



increase between 12 and 24 hours. In this period, we observed even in mm.quadriceps femoris and semitendinosus noticable decrease of SG (Figure 1A); m.semimembranosus showed a stagnation, and m.biceps femoris a minimal increase. The period from 24 to 48 hours of ageing characterises the increase of SG, but of a smaller intensity than in the first 12 hours.

The Table 2A and the Figure 2A provide data on the changes of pH of examined beef round muscles. In comparison with the data for ham muscles, it is possible to notice as follows: first, the differences between pH of examined beef muscles are smaller, and second, final pH of beef round muscles i considerably lower.

SG Changes of Some Beef Round Muscles in the Course of Ageing

Table 1A

Examined muscles	SG values of muscles after killing				
	Immediately	12 hours	24 hours	48 hours	Differences between initial and final values
m.quadriceps femoris	1,068	1,075	1,073	1,076	0,008
m.biceps femoris	1,069	1,074	1,075	1,078	0,009
m.semimembranosus	1,070	1,075	1,075	1,076	0,006
m.semitendinosus	1,067	1,073	1,072	1,077	0,010
Avarage values	1,068	1,074	1,074	1,077	0,008

Changes of pH values of Some Beef Round Muscles in the Course of Ageing

Table 2A

Examined muscles	pH values of muscles after killing			
	Immediately	12 hours	24 hours	48 hours
m.quadriceps femoris	6,79	6,21	5,5o	5,45
m.biceps femoris	6,74	6,37	5,47	5,44
m.semimembranosus	6,7o	6,4o	5,53	5,51
m.semitendinosus	6,8o	6,2o	5,5o	5,4o
Average values	6,76	6,29	5,5o	5,45

SG Changes of Some Beef Round Muscles in the Course of Ageing in the Water

Table 3A

Examined muscles	SG values of muscles after killing				
	Immediately	12 hours	24 hours	48 hours	Differences between initial and final values
m.quadriceps femoris	1,o69	1,o63	1,o62	1,o66	o,oo3
m.biceps femoris	1,o73	1,o68	1,o67	1,o67	o,oo6
m.semimembranosus	1,o72	1,o66	1,o64	1,o65	o,oo7
m.semitendinosus	1,o76	1,o66	1,o64	1,o64	o,o12
Average values	1,o72	1,o66	1,o64	1,o65	o,oo7

By the construction of SG curve and pH curve - on the basis of average values obtained for all examined muscles (Figure 3A) - we can, but only partially, repeat the statement we have already done, examining ham muscles: the values of specific gravity of beef round muscles are noticably increasing in the course og ageing. The intensity of this increase is stronger in the course of the first 12 hours of ageing. The following 12 hours are characterised by a period of stagnation. An increase of SG of smaller intensity appears after this period. In comparison with examined ham muscles, the difference of initial and final SG of beef round muscles is smaller for one-third: it amounts to o,ol2 in hogs, and o,oo8 in cattle. The course of pH curve in relation to the course of SG curve shows in the period from 12 to 24 hours of ageing definite deviations: pH is intensively decreasing, and SG is keeping its level. Their course is practically identical in other examined phases of ageing.

Similarly to the examinations carried out in pork ham muscles the Figure 3. provides data on the quantity of freely let out juice in the course of ageing of beef round muscles, as well as the change of their specific gravity in the process of ageing in the water (Table 3A and Figure 3A) It can be noticed that in beef muscles during the ageing in the water appears a decrease of SG. In this case initial and final values show difference of o,oo7.

D i s c u s s i o n

The results of our experiments show that the decrease of pH value of meat, as a consequence of the complex of post-mortal physical and hemical changes, is followed by a very regular increase of its specific gravity. For this reason, the dynamics of pH decrease is adequate to the dynamics of SG increase. First of all, this statement refers mostly to results obtained by the examination of pork muscles. Beef muscles are characterised by a certain inhibition in the increase of SG, and this happens, as we set it forth, in a definite and limited time period; at present, we are not able to explain this phenomenon.

It is quite comprehensible that the defined change of SG curve - both of beef and pork muscles - should be considered only in conditions in which experiments were carried out. It is logical to expect that a change of examination conditions can also be reflected on the change of the course of SG curve.

In our opinion, the essence of occurrences causing an increase of specific gravity of muscles in the course of their ageing make two processes: - first - evaporation or the loss of water, and second - spontaneous letting out of meat juice, respectively the loss of water and organic and mineral matters soluble in it. A qualitative relationship between these two processes is considerably conditioned by the degree of an increase of specific gravity in the course of meat ageing. "Density" of meat is increased by evaporation and its specific gravity grows.; with the loss of meat juice the water mostly

disappears, as well as organic and mineral matters soluble in it. Therefore, in this case an increase of specific gravity of meat should be expected, but it will be less pronounced than the one caused by evaporation.

Results of the experiment with ageing of muscles in the water speak in favour of the statements set forth above. The change of the course of SG curve, namely its regular decrease, in this case cannot possibly be differently explained than by muscle hydration, from one side, and by extraction of organic and mineral matters from the meat, from the other side. Besides, these two processes are synergetically reflected on the decrease of specific gravity.

As it is known, post-mortal autolytic changes in the meat are characterised, besides other occurrances by protein swelling off: by letting out of cell juice into intercellular spaces, and further, by its free pouring out. This process, as a constituent part of complex post-mortal occurrencies in the meat, also represents beside evaporation, a factor which causes a change of its specific gravity. Thus, specific gravity of meat, namely its changes, and post-mortal autolytic processes - are the most closely connected. Further, this fact shows that SG curve, as an indicator of post - mortal autolytic changes in the meat, has not only a theoretic, but also a practical value. From the other hand, it is clear that it is impossible to speak about the value of specific gravity of meat at all; it is indispensable to precise correctly what sort of meat it is dealt

with fresh or aged meat, as it is the case with the defining of its pH values.

Following the analogy of established facts, it is not difficult to see the possibility that, on the basis of the course of SG curve in the process of meat ageing, can also be brought conclusion about the course of pH curve. In this way its pH can also be approximately determined by a determination of initial and final values od specific gravity of examined meat, namely by a determination of differences between these two values. However, in our opinion, it is necessary to undertake more detailed and complete examinations, especially in those cases when the pH curve assumes an irregular course. Namely, it is necessary to observe whether the SG curve is also changed under the influence of the same factors which can change the course of pH curve.

At the end, however, it is of a special interest, both for the theory and the practice of meat technology, to examine the SG curve in the course of various technological ways of meat processing: in the process of its thermic treatment, frezing, curing, smoking, mincing, etc. The pivot examinations, as well as the first results that we have obtained, provide sufficient reasons to proceed with the research in this direction.

C o n c l u s i o n s

On the basis of experiments and results obtained in our work, we set forth the following conclusions:

1. Specific gravity (SG) of ham muscles - mm.quadriceps femoris, biceps femoris, semimembranosus and semitendinosus - in the process of their ageing, increases very regularly. The dynamics of this increase is adequate to the dynamics of decrease of pH of the same muscles, under the identical conditions of ageing.

2. Specific gravity of corresponding muscles of beef round increases in the course of ageing as well. The dynamics of this increase is also adequate to the dynamics of decrease of pH of the same muscles, with the exception of the period from 12 to 24 hours of ageing. A stagnation in the increase of specific gravity of beef muscles is noticable in this period.

3. On the basis of differences between initial specific gravity of examined muscles and its final value after the end of ageing, it is possible to conclude rather correctly about the course of autolytic processes and values of pH of examined meat. In our opinion, this statement should, however, be checked in further examinations.

CHANGES OF SPECIFIC GRAVITY OF HAM AND BEEF ROUND MUSCLES IN THE PROCESS OF AGEING

Summary

The study of post-mortal autolytic changes in the meat is possible to be carried on by the application of chemical, physico-chemical and physical methods. For this purpose are determined: the contents of glycogens, the contents of lactic acid, and the total quantity of reductive sugars; changes of pH reaction, electrical conductivity of muscles, their consinstency, ability of binding of free water and letting out of its own juice. In the available domestic and foreign literature we have not found data on the change of specific gravity of muscles in the course of ageing, on the dynamics and regularity of development of these changes and on their eventual relationship with the cited physical, chemical and physico-chemical changes in the complex of meat ageing. Therefore, we set the following task in our work:

- to examine specific gravity of the following ham and beef round muscles: quadriceps femoris, biceps femoris, semimembranosus and semitendinosus, immediately after the killing and after 12, 24 and 48 hours of their keeping at the temperature of the cooling-room (4-6 C).

- to register pH values and the percentage of freely let out juice from the cited ham and beef round muscles under

the same conditions and identical time intervals; and

- to define the course of specific gravity curve (SG curve) in the process of ageing of ham and beef round (on the basis of average values for all examined muscles) and establish its relationship with pH curve.

On the basis of experiments and obtained results, we set forth the following conclusions:

1. Specific gravity (SG) of ham muscles - mm.quadriceps femoris, biceps femoris, semimembranosus and semitendinosus- in the process of their ageing, increases very regularly. The dynamics of this increase is adequate to the dynamics of decrease of pH of the same muscles, under the identical conditions of ageing.

2. Specific gravity of correcponding muscles of beef round increases in the course of ageing as well. The dynamics of this increase is also adequate to the dynamics of decrease of pH of the same muscles, with the exception of the period from 12 to 24 hours of ageing. A stagnation in the increase of specific gravity of beef muscles is noticed in this period.

3. On the basis of differences between initial specific gravity of examined muscles and its final value after the end of ageing, it is possible to conclude rather correctly about the course of autolytic processes and values of pH of examined meat. However, in our opinion, this statement should be checked in further examinations.

VERAENDERUNGEN SPEZIFISCHEN GEWICHTES DER MUSKEL DES SCHWEINE - UND RINDSSCHLEGELS IM REIFENPROZESSE

Zusammenfassung

Das Verfolgen der postmortalen autolytischen Veränderungen im Fleische kann man durch Anwendung der chemischen, physikchemischen und physischen Methoden durchführen. Zu diesem Zwecke werden bestimmt:der Inhalt des Glykogen, der Milchsäure und die Gesamtzahl der reduzierenden Zucker; Verfolgung der Veränderung der pH Reaktion, elektrischer Widstand der Muskel, deren Konsistenz, der Binde fähigkeit des freien Wassers und Absetzung des eigenen Saftes. Die Angaben über das Wechseln des spezifischen Gewichtes der Muskel im Reifenprozess des Fleisches, über die Dynamik und die Regelmässigkeit der Entwicklung dieser Veränderungen und derer eventuellen korelativen Verhältnisse mit den angeführten physischen, chemischen, physikchemischen Veränderungen im Komplexe des Fleischreifens - in der erreichbarer einheimischen und ausländischen Literatur haben wir nich vorgefunden. Deswegen haben wir in unserer Arbeit folgende Aufgabe festgestellt:

- Untersuchung des spezifischen Gewichtes folgender Muskel des Schweines und des Rindes: quadriceps femoris, biceps femoris, semimembranosus, semitendionosus - und zwar unmittelbar nach dem Schlachten und nach 12, 24, und 48 stundigen Lagerung

bei der Kühlschranktemperatur (4 bis 6°C).

- Unter denselben Bedingungen und identischen Zeitintervalen, Registrierung der pH Werte und Prozentzsatz des frei abgesetzten Saftes aus den erwähnten Muskeln des Schwein und Rindsschlegels, und

- definieren die Kurve des spezifischen Gewichtes im Reifenprozess des Schweins-und Rindsschlägels (auf Basis des mittleren Wertes für alle untersuchten Muskel) und feststellen das Verhältnis mit der pH Kurve.

- Unter denselben Bedingungen und identischen Zeitintervalen, registrieren die pH Werte und Prozente des abgesetzten Saftes aus den erwähten Muskeln des Schwein-und Rindsschlägels, und

- definieren den Lauf der Kurve des spezifischen Gewichtes im Reifeprozess des Schwein-und Rindsschlägels (auf Basis des mittleren Wertes aller untersuchten Muskel) und feststellen ihr Verhältnis mit der pH Kurve.

Auf Grund der Versuche und ergebenen Resultate ziehen wir folgende Schlüsse:

1. Spezifisches Gewicht der Muskel des Schweinsschlägels - mm quadriceps femoris, semimembranosus und semitendinosus - in deren Reifeprozess, wächst sehr ragelmässig. Dynamik dieses staigens ist adekvat der Dynamik de pH senkung derselben Muskeln unter identischen Reifebedingungen.

2. Spezifisches Gewicht der entsprechenden Muskel des Rindschlägels im Reifeprozess steigt ebenfalls. Dynamik

dieses Steigerung ist ebenso adekvat der Dynamik der pH Senkung derselben Muskeln mit Ausnahme des Zeitabschnittes von 12 bis 24 stundigen Reifens. In dieser Periode kommt zur Steigerungs stockung des spezifischen Gewichtes der Rindsmuskel.

3. Auf Grund der Differenz zwischen des inizialen spezifischen Gewichtes der untersuchten Muskel und dessen Endwertes nach beendetem Reifen, ist es möglich beiläufig ein genaues Urteil über den Lauf der autolytischen Prozesse und der pH Werte des untersuchten Fleisches zu bringen. Dennoch, nach unserer Meinung, diese Feststellung muss noch immer weiter überprüft werden.

LITERATURE CITED

1. Behnke, A.R., Feen, B.G., and Welham, W.C. 1942*
2. Brown, C.J., Hillier, J.C., and Whatley, J.A., 1951*
3. Doornenbal, H., Wellington, G.H., and Stouffer, J.R., 1962, Cornell University, Ithaca.
4. Glage; cited after Savić I.: Klanice i tehnologija mesa, Beograd, 1952.
5. Kirton, A.H., Barton, R.A., Nature, Vol.178, p.92o, 1956.
6. Kline, E.A., Aschton, G.C., and Kastelic, J., 1955*
7. Kraybill, H.E., Bitter, H.L., and Hankins, O.G., 1951* *
8. Kraybill, H.E., Bitter, H.L., and Hankins, O.G., 1952* *
9. Pace, H., Rethbun, E.N. 1945*
10. Pearson, A.M., Bratzler, L.J., Deans, R.J., Hoefer, J.A., Reineke, E.P., and Luecke, R.W., 1956*
11. Savić I. Klanice i tehnologija mesa, Beograd, 1952.

* after Harrington: Pig Carcass Evaluation, Technical Communication N^{o} 12 of the Commonwealth Bureau of Animal Breeding and Genetch, Edinburgh, 1958.

* * after Zobrisky, S.E., Lasley, J.F., Brady,D.E., Weaver, L.A., Pork Carcass Evaluation, Research Bulletin 554, July, 1954, University of Missouri Colege of Agriculture, Agricultural Experiment Station.

ИЗМЕНЕНИЕ УДЕЛЬНОГО ВЕСА МЫШЦ СВИНОЙ И ГОВЯЖЬЕЙ ЗАДНЕЙ НОГИ В ПРОЦЕССЕ СОЗРЕВАНИЯ

Р Е З Ю М Е

При исследовании послеубойных автолитических изменений в мясе возможно применять химические, физико-химические и физические методы. С этой целью устанавливаются: содержание гликогена, молочной кислоты и сумма компонентов редуцирующих сахар; затем следят за изменениями pH реакции, электропроводимости мышц, их консистенцией, способности связывать свободную воду и отпускать собственный сок. В доступной нам отечественной и иностранной литературе, данных об изменении уд.веса мышц в процессе созревания мяса, о динамике и правильности прохождения этих изменений и их эвентуальных коррелятивных отношениях с приведенными физическими, химическими и физико-химическими изменениями в комплексе процессов созревания мяса нами не найдены. Поэтому, в нашей работе мы поставили перед собой задачу:

- исследовать удельные веса (T) следующих мышц задней ноги свиней и рогатого скота: quadriceps femoris biceps femoris, semimembranosus, semitendinosus , причем непосредственно после убоя и после 12, 24 и 48 часов хранения при температуре холодильника (4 - 6°C);

- в тех же условиях и подобных интервалах по времени регистрировать pH и процент свободно отпущенного сока из приведенных мышц задних ног свиней и рогатого скота, и

- определить диаграмму кривой удельного веса (T кривая) в процессе созревания свиной и говяжьей

задних ног (на базе средних показателей для всех исследовавшихся мышц) и установить ее соотношение с кривой pH.

На основании опытов и достигнутых результатов нами сделаны следующие выводы:

1. Удельный вес (T) мышц свиного окорока - mm. quadriceps femoris, biceps femoris, semimembranosus , semitendinosus - в процессе созревания возрастает весьма правильно. Динамика данного процесса адекватная динамике уменьшения показателя pH тех же мышц в подобных условиях созревания.

2. Удельный вес мышц говяжьей задней ноги в процессе созревания также возрастает. Динамика данного возрастания также адекватна динамике уменьшения показателя pH тех же мышц за исключением периода с 12-го до 24-го часа созревания. В данном периоде происходит некоторый застой роста удельного веса говяжьих мышц.

3. На основании величины разницы между начальным и окончательным, после созревания, удельными весами исследовавшихся мышц возможно, приблизительно точно судить о происхождении автолитических процессов и показателей pH исследовавшегося мяса. И все же, по нашему мнению, данную констатацию необходимо при дальнейших исследованиях все еще проверять.