

COLD STORAGE INFLUENCE ON THE MUSCLE PROTEINS OF VACUUM
PACKED CHICKEN HAM

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SUMMARY: Electrophoretic and spectrophotometric investigations on the proteins of chicken ham stored in vacuum packages for 8 month at temperature of 0 to 4°C was carried out. Twenty seven protein fractions of PAGE with preserved quantity and quality in the end of the investigation were detected. For interpretation they were grouped in 11 fractions.

The quantity of accessible SH-groups and extractable proteins were determined during the storage period. Certain increase of the accessible SH-group quantity during the 1th and 4th months of storage was determined. In the end of the period, i.e. on the 8th month of storage the least values were specified regarding the initial period of study. The extractable protein increased during storage. The statistical interpretation, showed insignificant differences of protein spectra determination ($F_x < 95\%$), but for the accessible SH-groups and extractable proteins the differences were significant, $F_x > 99.9\%$ and $F_x > 95\%$ respectively.

INTRODUCTION: It is well known that the myofibrillar proteins comprise the biggest share of the proteins in the muscle tissue. They have been studied in depth due to the fact that they greatly affect the quality of the meat during the different technological processes. An important indicator in this respect is the degree of the proteins' extrability which points to the change of their colloid properties in the meat and meat products during the technological processing and storage.

The SH-groups, which determine the secondary and tertiary structures of the protein molecule, are very important in defining the structure of the proteins. According to Khan et al (11) and Hofman (10) the SH-groups serve as "indicator" when the protein molecule is damaged.

Having in mind the scarce data about the changes which occur in the muscles proteins in the pasteurized meat products, we set ourselves the aim to study them in chicken ham stored for 8 months in vacuumed packages at temperatures slightly above zero.

MATERIALS AND METHODS: Ham from freshly cooled and boneless chicken breast (90%) and 10% chicken batter. Dry salting through rubbing in, after which the meat was kept 16 h in the refrigerator (ice box) at 0 - 4 °C.

It was tumbled in the course of 6 h and then filled in 5kg vacuum packages. The thermal processing was carried out in the course of 5 h at 76 - 78 °C. The packages underwent cold water cooling up to 8 °C. Afterwards the processed ham was stored in refrigeration at 0 - 4 °C in the course of 8 months (in the dark). The following analyses were carried out:

- defining the myofibrillar proteins in PAGE according to Laemmli (12) and Hames and Rickwood (8).
- accessible SH-groups according to Sedlak and Lindsay method (14).
- extractable protein according to Soloviov's method (4).

We took samples of fresh ham for our analysis which served as controlling factor during our investigations and the 8 month storage period.

We applied the disperse method of Snedekore (3) for the mathematical data processing.

RESULTS AND DISCUSSION: 27 protein fractions, grouped for interpretation in 11 protein fractions; were detected by the electrophoretic investigation. See electropherogramm 1 and 2 and table 1. They are distributed accordingly: No1 and 2 - myosin light chains, fraction No3 - troponin C with 17800 daltons corresponding to ferritin with 18500 at HMW; fraction No No from 4 - 11 - corresponding to HMW from 18000 - 36000 daltons; fractions 12a and 12b - tropomyosin with 36000 daltons corresponding to the LDH of the marker.

Fraction No13 - troponin B with 39000 daltons; fraction No14 - M - protein with 45000 daltons (at the beginning of the investigation) and No No 14a and 14b (at the end of the 8 month storage period); fraction No15 - actin with 49000 daltons; fraction No No from 16 to 22, fraction 23 and 24 - ~~A~~-aktinin; No25 - C protein and No No 26 and 27 - myosin.

The general conclusion from the electrophoretic study is that during the investigation period no changes in the number and quantity of the protein spectrum was detected.

It should be noted that after the 8 month storage fraction M - protein, indicated by No 14, was divided into two subfractions, but in a quantitative respect we estimated it as one fraction. According to Hay at al. (9) this fraction is typical for the breast muscles, which coincides with our calculations.

If we compare the myosin of the thermally processed ham to the untreated meat [ref. to data of Goll at al. (6)] we will see how this protein fraction is more sensitive to high temperatures than the rest of the fractions.

Interesting results as regards the extractable protein and the quantity of the accessible SH-groups were obtained (ref. table 2).

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A certain increase of the accessible SH-groups was determined: from 0.134 mM/100g product to 0.185 mM/100g product during the first month and 0.165 mM/100g product in the 4th month. This increase is in connection with the process of protein disintegration during the storage period and coincides with the stand of Vorontsov and Bolshakov (1). From that moment on the accessible SH-groups quantity showed a tendency to drop. At the end of the investigation period a decrease of 0.086 mM/100g product was determined. On one hand this decrease could be explained by a certain reactive ability of the SH-groups to combine with the nitrite salt [as asserted by Sušić et al. (16)] as well as with its adjustments to the double links of the unsaturated butyric acids (13).

As far as the extractable proteins are concerned; they showed a general tendency of increase - from 1.0675 mg% at the initial stage to 1.4750 mg% at the final stage of the investigation. In this respect our results coincide with the stand of Grau (7). According to him under heat denaturation coagulated protein unfolds its structure which results in the further disintegration of the proteins.

In contrast to our results Popov and Yanishlieva (2) and Sedlaček (15) consider that the denaturation of the protein substances of the meat during a prolonged storage leads to a decrease of the extractable proteins due to the formation of complexes between the peroxides and peptides.

The statistical interpretation showed insignificant differences of the myofibrillar protein spectra $F_x < 95\%$. But for the accessible SH-groups and extractable proteins according to the one-factor analysis the differences were significant; $F_x > 99.9\%$ and $F_x > 95\%$ respectively.

CONCLUSIONS: We can draw the following conclusions from the investigation carried out on muscle proteins of chicken ham stored in vacuum packages for 8 months at temperature of 0 - 4 °C.

1. The cold storage of the vacuumed packed chicken ham has no influence on the protein spectrum of the myofibrillar proteins.

2. During the storage period a decrease of the accessible SH-groups quantity and an increase of the extractable protein was determined.

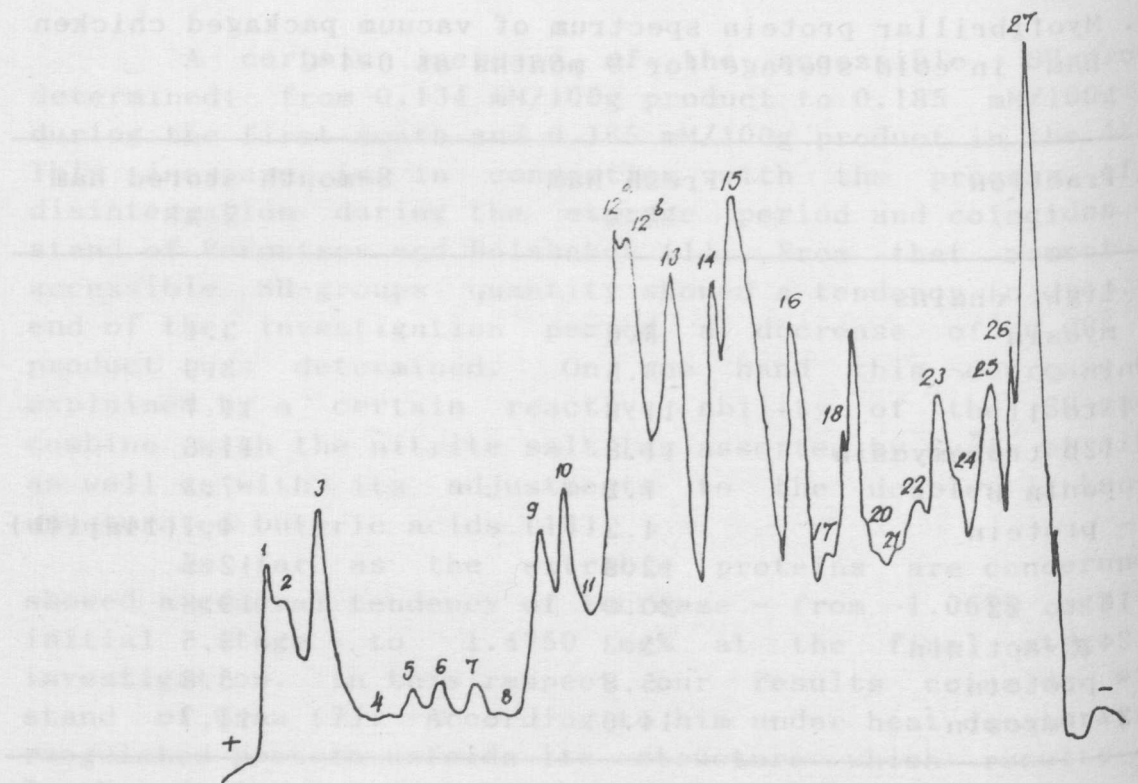
Table 1. Myofibrillar protein spectrum of vacuum packaged chicken ham in cold storage for 8 months at 0-4°C

Protein fraction	Fresh ham \bar{x} %	8-month stored ham \bar{x} %
1 and 2 light chains		
myosin	3.0	3.1
3-troponin C	3.5	3.9
from 4 to 11	11.8	11.7
12a and 12b tropomyosin	11.8	11.6
13 - troponin B	7.2	7.3
14 - M - protein	4.2	4.1(14a,14b)
15 actin	12.8	12.5
from 16 to 22	20.0	19.8
23 and 24 α -actinin	5.3	5.5
25 - C - protein	5.8	5.8
26 and 27 -myosin	14.6	14.7

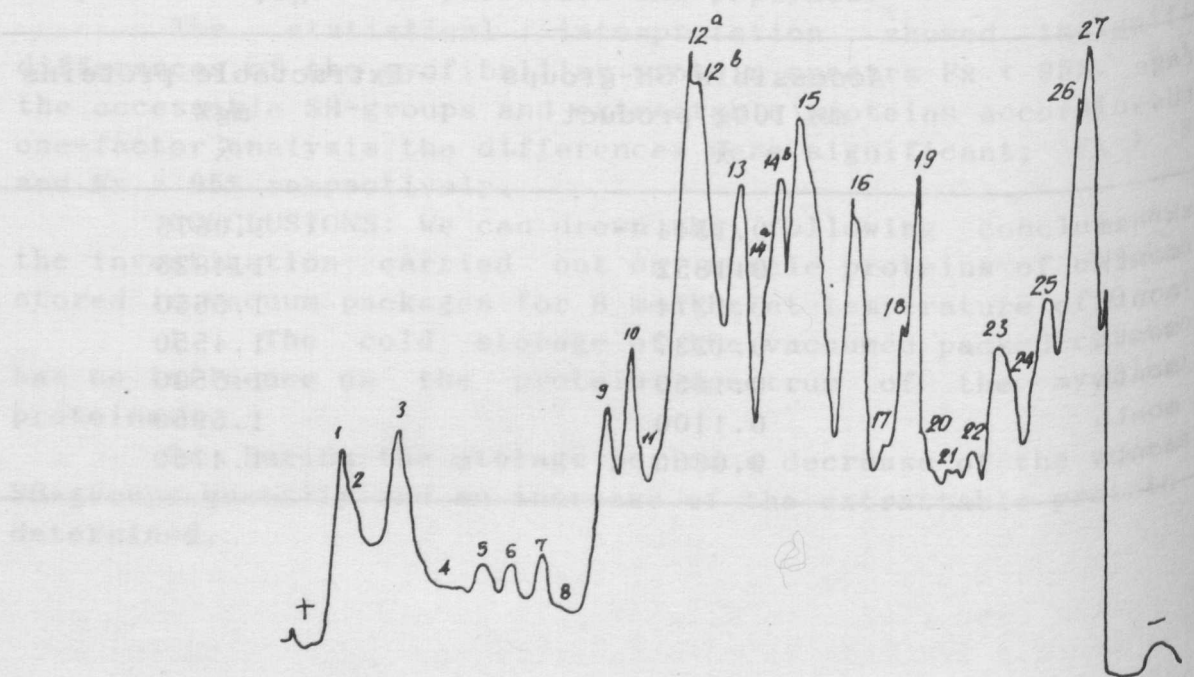
Table 2. Acceptable SH-groups quantity and extractable protein in vacuum packed chicken ham in 8-month cold storage at temperature from 0 - 4 °C

n=4

Storage months	Accessible SH-groups mM/100g product \bar{x}	Extractable proteins mg% \bar{x}
Fresh ham		
1th month	0.1344	1.0675
2th month	0.1852	1.4825
3th month	0.1374	1.5650
4th month	0.1237	1.4550
6th month	0.1650	1.5500
8th month	0.1100	1.5950
8th month	0.0860	1.4750



Electropherogramm 1 - Fresh Ham
(Myofibrillar protein spectrum)



Electropherogramm 2 - Ham Stored
For 8 Months
(Myofibrillar protein spectrum)

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