FACTORS DETERMINING THE FORMATION OF CURED MEAT PRODUCTS STRUCTURE PREPARED FROM COARSE-CUT MEAT

V.I. Hlebnikov, G.P. Sarycheva, H.N. Mutalov, A.V. Fazylov. Moscow Cooperative Institute, Moscow, USSR.

N.S. Mitrophanov, Sh. Kurakbaev, N.N. Fedutenko. Scientific and Development Division of Poultry Processing Industry "Komplex", Moscow region, USSR.

The present study was devoted to the investigation of the influence of such factors as brine conditions, mechanical processing (tumbling), brine ageing time and binding components (protein-lipid emulsion, fine-cut beef mince, sodium caseinate) on the structure formation of cured meats prepared from coarse-cut beef and chicken meats.

The best qualitative data of cured meats and the highest binding among separate meat pieces (chicken meat) is provided by the adding protein-liquid emulsion before tumbling, further tumbling for $1.8.10^3$s and consecutive ageing of cased product during 48-72 h.

The nature of adhesive forces among both beef and chicken pieces depending on brine curing time is identical, but beef meat was higher absolute data of the adhesive forces.

The technology of cured meat products based on coarse-cut meat is the most advanced. This technology allows to use the high quality raw materials most effectively. In this case the best cuts of meat are used in the form of meat particles or schrot. The rest parts characterised by high nutritional value, though less valuable in product appearance, are used in the form of fine meat or mince. In the creation of such products the main technological problem is the achievement of integral product with dense, homogeneous, unfibrous structure.

The separate meat particles binding in the whole block is determined by the adhesive forces arising during the contact between two bodies on the surface board, but in some cases the cohesive forces arise. The latter are formed by molecular binding forces in meat, which are determined by moleculture interaction and chemical binds. Evidently while the absolute integrity ham structure is present, the sample's rupture will be cohesive with breaking of muscle tissue.

If the meat pieces binding is provided by adhesive forces, there should be the breaking of the sample along the boarder surface. According to practice the absolutely adhesive process of meat pieces separation from substrate is not achieved while ham tearing. In the process of the structure ham forming using separate meat particles the liquid layer is created between them. The liquid layer is the solution of water-soluble and salt-soluble proteins and represents the boarder of ham breaking. When cooked ham is tested the breaking has its boarder along the layer too. The cooked layer becomes gel with the lower strength in comparison with muscle tissue.

The research was carried out on the beef (eye muscle of loin) and chicken (breast muscles) samples. Fine-cut beef mince, sodium caseinate and protein-lipid emulsion were used as binding components. Protein-lipid emulsion consisted of mechanically-deboned chicken meat (50%), rendered chicken fat (20%), sodium caseinate (4%), water (26%).

The product was formulated from cured and uncured coarse-cut meat (grinder hole 25 mm) and large piece meat (piece's weight up to 250 g). Meat in moulds was cured by pumping, using NaCl-24%, $NaNO_2$-0.05% (brine solution - 10% of meat weight).

After that the samples were either tempered at 4°C during 48 h or immediately used for the preparation of cured meats. In the case of meat products with protein-lipid emulsion, the uncured meat was taken.

Mechanical meat processing was conducted on the laboratory horizontal tumbler with 0.9m diameter.

Prepared meat was stuffed in an artificial 0.09m casing and cooked at 85°C until the centre product temperature 72°C. The ham integrity was evaluated both visually and by the samples rupture data obtained using the device "Poljana" by the method recommended. The rupture tension was determined according to the formula $\delta = P/F$ where P - the sample rupture force, N; F- sample section m^2.

According to practice meat curing mechanical processing and brine solution ageing have the most powerful influence on the integral structure formation of cured products. The cured products prepared without mechanical processing from salted (48 h cured aged meat) and unsalted (meat was salted just before stunning) meats were not characterised by the integrity. Even if it was possible to cut out a sample for determining rupture tension data on the rupture device, the results were not significant.

During the tumbling of cured and uncured meats just after 120-180 s the viscous protein solution appeared. Then it became thicker, denser and gel like. In $3.6\cdot10^3$s tumbling time the surface of meat pieces, especially of the chicken ones, became highly defibrated.

With the tumbling time increasing, the meat adhesive forces also tend to increase. This process is also true for all samples investigated (Fig.1).

The process of meat curing ageing (in $1.8\cdot10^3$s tumbling the meat was stuffed in casings and held at 2°C) leads to considerable meat structure strengthening (Fig.2)

Adhesive forces increase during meat brine curing points to a significant role not only of surface forces on the phases boarder, but of deep chemical changes in the process of cured product structure formation. Evidently there is a protein solution (gel) strengthening, which appeared among meat pieces, and a mutual penetration of the muscle tissue components and protein layer during brine curing. Practically it is expressed by the high strength of the samples made from unsalted meats characterised by more intensive mass exchange.

Among the 3 following binding agents such as protein-lipid emulsion (PLE), fine-cut beef mince and sodium caseinate, PLE provided the strongest gelous structure, the ham strength improving with the prolongation of tumbling time (Fig.3).

Brine cured meat products strength increases especially when prepared from unsalted meat PLE containing the whole quantity of salt and sodium nitrite according to the formula before tenderisation (Fig.4). It confirms the fact of increase protein layer strength and protein layer bind with muscle tissue under the more extensive mass exchanging.

The use of PLE with the higher content of curing mixture provides other advantages. The high content of salt and sodium nitrite inhibits the putrefactive microorganisms which allows two days storage before using. PLE of mechanically deboned meat improves the following characteristics of ham: tenderness and juiciness due to higher concentration of unsaturated fatty acids; integrity due to the use of meat mince as a binding component among meat pieces; finished product colour due to a high content of myoglobin and gemoglobin in meat mince.

The usage of sodium caseinate provides the stability of ham structure while heating. The highest degree of gel forming properties of sodium caseinate and soluble meat proteins appears while a certain ratio of fat, mechanically deboned meat and sodium caseinate is observed.

PLE meat product has an excellent taste, homogeneous structure, high yield of the finished product.

CONCLUSIONS

The tendency of adhesive forces binding among coarse-cut and large pieces of beef and poultry meat dependent on brine conditions, tumbling time, cured raw meat holding was established. The influence of the kind of binding components (PLE, fine-cut mince, caseinate) on the formation of the cured meats integral structure was determined.

The best qualitative data of cured meats and the highest binding among separate meat pieces was obtained by adding PLE before tumbling, further tumbling for $1.8 \cdot 10^3$s and consequitive cased product ageing during 48-72 h.

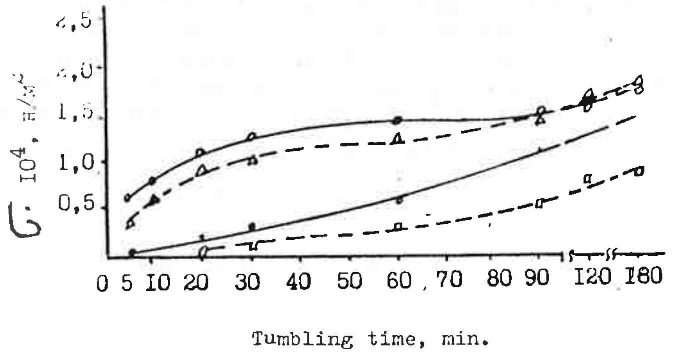

Fig.1. Rupture tension of cured meats depending on tumbling times:
1.-beef salted, brine aging 48 h.
2.-beef unsalted (immideately after curing)
3.-chicken meat salted
4.-chicken meat unsalted

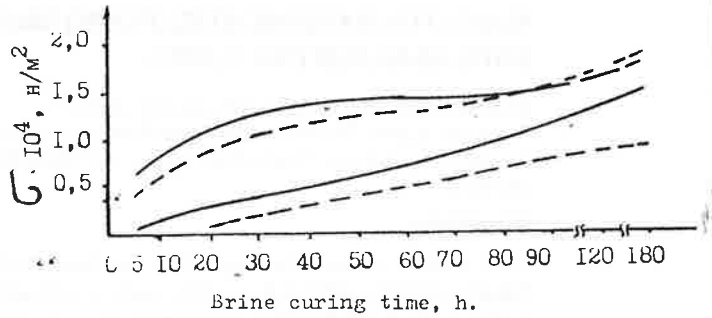

Fig.2. Rupture tension of cured meats in 30 min. tumbling and brine stuffed aging (Ref. Fig.1).

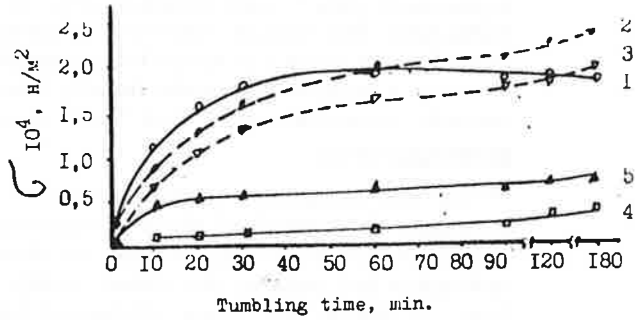

Fig.3. Rupture tension of cured meats prepared with binding components under different tumbling times
1 - beef salted and PLE
2 - beef unsalted and PLE
3 - beef and PLE (PLE contains all curing mixture).

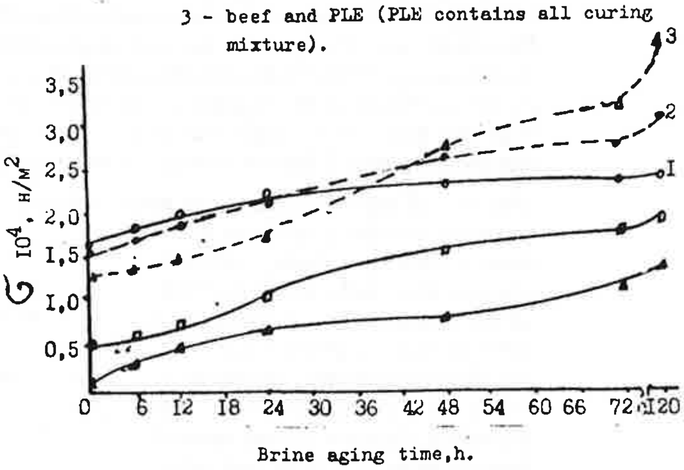

Fig.4. Rupture tension of cured meats in 30 min. tumbling and brine stuffed aging (Ref. Fig.3).