

Variation of quality traits during storage at low temperatures /freezing and cooling/

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DFD ground meat with and without addition of 5 % NaCl and 5-20 % water were frozen and stored for 20 weeks at  $-20^{\circ}\text{C}$ . Periodically cooking loss was determined in samples frozen with salt and also in samples frozen unsalted and then adjusted with salt and added water to the same composition that of the others.

It was clearly shown, that cooking loss was always lower with samples frozen unsalted and cooking loss increased with the amount of added water. There was no direct relationship between cooking loss and duration of freezing - after an initial reduction there was a statistically significant increase after 3 weeks of storage followed by further variations until the 20th week when it decreased again. Significant variation of quality traits /texture, odor, flavour/ during storage at low temperatures can be observed with other products /frozen cooked sausages and vacuum packed sliced products stored under  $5-7^{\circ}\text{C}$ /. Such variation in quality traits makes it difficult to establish shelf-life of meat products and convenience foods stored at low temperatures.

Qualitätsschwankungen bei dem in gekühltem oder in gefrorenem Zustand gelagerten Fleisch

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Ein Teil des rohen Hackfleischs, hergestellt aus DFD Muskel wurde bei  $-20^{\circ}\text{C}$  gefroren und gelagert, aus dem anderen Teil wurde mit 5 % NaCl und mit Fremdwasserzugabe von 5-20 % ein Brät hergestellt, das in der gleichen Weise gefroren und gelagert wurde. Während der Lagerung wurden die Kochverluste der mit Salz und Fremdwasser verfertigten Bräte untersucht und wurden die Kochverluste aus dem gefrorenen Rohfleisch ohne Salz hergestellten Bräten bestimmt. Eindeutig konnte festgestellt werden, dass der Kochverlust bei den gefrorenen, ohne Salz vorbereiteten Bräten immer niedriger war und mit der Menge des Fremdwassers im Zusammenhang stand. Der Kochverlust änderte sich mit der Zeitdauer der Gefrierlagerung nicht linearisch. Nach der Senkung in der Anfangsperiode hat sich der Kochverlust an der 3.-en Woche signifikant erhöht, dann durch Minimal- und Maximalwerte, an der 20.-en Woche endgültig vermindert. Die signifikanten Qualitätsschwankungen /Geruch, Geschmack, Konsistenz/ bei Kühl- oder Gefrierlagerung sind auch in anderen Fällen zu beobachten. /in vakuum verpackten Fleischprodukten/. Diese Erscheinung macht die Haltbarkeitsbestimmungen der kühl-oder gefrier gelagerten Fleischprodukten problematisch.

L'instabilité de certains caractéristiques de la viande au cours du stockage en état congelé ou réfrigéré

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Une partie de la viande crue du type "dark cutting" a été congelée et stockée à  $-20^{\circ}\text{C}$  dans un état hachée; de l'autre partie on a préparé une pâte avec 5 % de NaCl et 5-20 % de l'eau ajoutée. Les échantillons ont été ensuite congelés et stockés de la même façon. On a examiné la perte de cuisson de tous les échantillons.

Dans l'ensemble, on peut dire que la perte de cuisson des pâtes congelées et préparées sans sel était toujours plus basse et augmentait en fonction de la quantité de l'eau ajoutée. La perte de cuisson ne changeait pas d'une manière monotone pendant la durée du stockage en état congelé. Après une diminution initiale, la perte de cuisson a augmenté jusqu' à la 3<sup>ème</sup> semaine, puis traversant plusieurs de minimums et de maximums a diminué définitivement jusqu' à la 20<sup>ème</sup> semaine.

L'instabilité de certains caractéristiques /odeur, goût, consistance/ peut être observée au cours d'un stockage à température basse en cas des produits finis réfrigérés ou congelés aussi. C'est le phénomène qui rend difficile la détermination de la durée de stockage des produits finis ou semi - préparés congelés ou réfrigérés.

Изменение качественных показателей при хранении в охлажденном и замороженном состоянии.

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Часть измельченного сырого мяса типа DFD заморозили и хранили при температуре  $-20^{\circ}\text{C}$ , другую часть мяса смешали с 5% поваренной соли и 5-20% посторонней воды и затем подобным же образом заморозили и хранили. Из фарша с солью и посторонней водой периодически определяли потерю веса приварке, в то же время из сырого замороженного мяса без соли приготавливали фарш точно такого состава и определяли также потерю веса при варке. Результаты опытов показали, что потеря веса фарша, приготовленного из замороженного мяса без соли была всегда меньше, и росла с увеличением количества добавленной воды.

В то же время потеря веса не изменялась линейно со временем хранения в замороженном состоянии — после начального снижения на третьей неделе значительно увеличилась, затем проходя через минимумы и максимумы на двадцатой неделе снизилась.

Значимое изменение качественных показателей (консистенция, запах, вкус) наблюдалось и в других случаях хранения при низкой температуре (замороженные колбасные изделия, нарезанные изделия в вакуумной упаковке).

Это явление затрудняет определение срока хранения полуфабрикатов и готовой продукции в охлажденном и замороженном состоянии.

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Introduction

The large seasonal variation in slaughtering and the demand for a constant supply of consumers bring about the transitional accumulation of raw material, convenience food or finished products stored frozen or cooled.

Considering the wide variation in composition and structure of meat products, storage is expected to result different quality changes depending on the products involved.

The present work was designed to evaluate the cooking loss of chopped cured pork as affected by salt and water during freezing by the amount of added water and by the time of freezing. In addition, the change in quality traits of several meat products were followed during storage /refrigerated or frozen/ in order to establish their shelf life.

Materials and Methods

Preparation and freezing of chopped-cured pork

Post rigor /5 day pm/ porcine semimembranosus and biceps femoris muscles of pH 6,2-6,4 were collected and ground through a 3 mm grind plate. Portions of ground meat were mixed for 3 min with 5% NaCl and different amounts of added water /5, 10, 20 %/. Additives were related to the weight of raw meat. Samples of different water content were packed into cans of 5,5x7 cm, closed and left to stand in refrigerator /4°C/ for 24 hrs then frozen and stored at -20°C for 20 wks. Unsalted ground meat portions which served as control were also frozen in cans of the same size. Periodically duplicate samples of each level of added water were thawed for one day at 4°C then cooled for 1 hr at 80°C in ultra-thermostat. After cooking cans were cooled in tap water and stored in refrigerator overnight then opened. Simultaneously, control meat portions were also thawed for one day at 4°C, opened and duplicate samples for each level of added water were prepared with 5% NaCl and with appropriate amounts of water. Mixtures were packed into cans again and cooled after a day of standing. Cooking loss was expressed as the percentage of the difference between the raw and cooked weight of mixtures related to the raw weight. Cooking loss was also determined immediately before freezing.

Storage and sensoric evaluation of finished products

All types of meat products investigated were packed into plastic bags, frozen and stored at -20°C.

Color, texture, taste, odour were evaluated by a laboratory panel of 4 members using 2 replicates for frozen and 3 replicates for cooled products. In case of frozen samples each parameter was evaluated on a scale of +4 to -4 with +4 being the most acceptable. With cooled products a temperature of 5-7°C was applied during storage, the quality parameters were evaluated on a scale of 1 to 7 with 7 being the most acceptable. Each product was evaluated before storage. Samples were appropriately prepared before sensoric evaluation in a standard manner and were given to the panelists according to the consumers' usages /e.g. Frankfurter was boiled, cured pork cuts smoked then cooked, lever sausage roasted/.

Results

Figure 1. shows the cooking loss of pork meat frozen after mixing with 5% NaCl and water in an amounts of 5% /a/, 10% /b/ and 20% /c/ as compared to the cooking loss of pork meat

frozen simultaneously without additives and adjusted to the same composition after thawing. It has been found that: 1/ samples frozen unsalted gave a significantly lower cooking loss  $/p < 0,1/$  than that of with frozen salted, 2/ means of cooking loss significantly increased with the amount of added water, 3/ the time courses of cooking loss were not parallel between samples frozen salted and unsalted 4/ there are no direct relationship between cooking loss and the duration of frozen storage - a significant increase of cooking loss can be seen on the 3<sup>th</sup> week followed by a further variation until the 20<sup>th</sup> week when it significantly decreased again. Changes in cooking loss were not accompanied by noticeable alteration of texture.

When various sausages were frozen and stored, out of the 6 types 5 showed a significant changes in all their quality parameters /color, taste, texture/ as a result of storage, however with one product only color and taste altered significantly. These results indicate that the texture of certain products is not affected by storage.

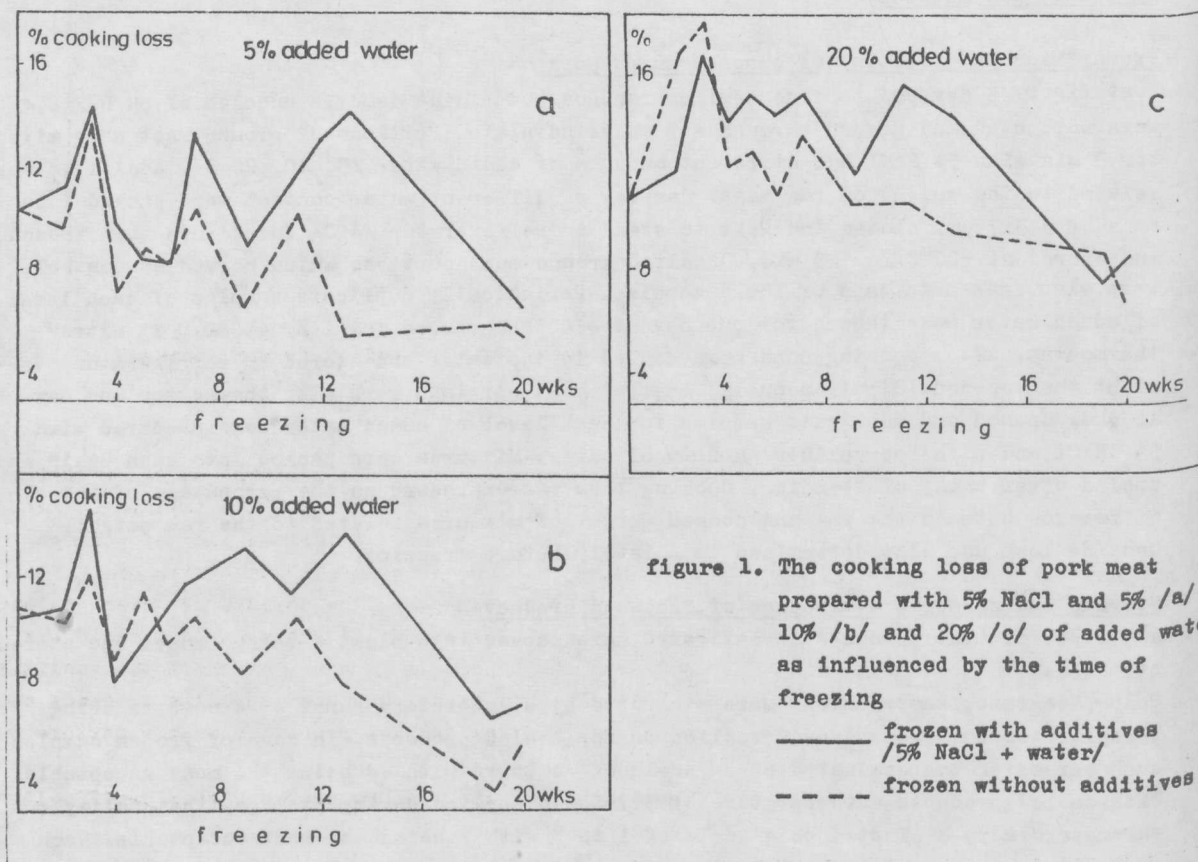


figure 1. The cooking loss of pork meat prepared with 5% NaCl and 5% /a/ 10% /b/ and 20% /c/ of added water as influenced by the time of freezing

— frozen with additives /5% NaCl + water/  
 --- frozen without additives

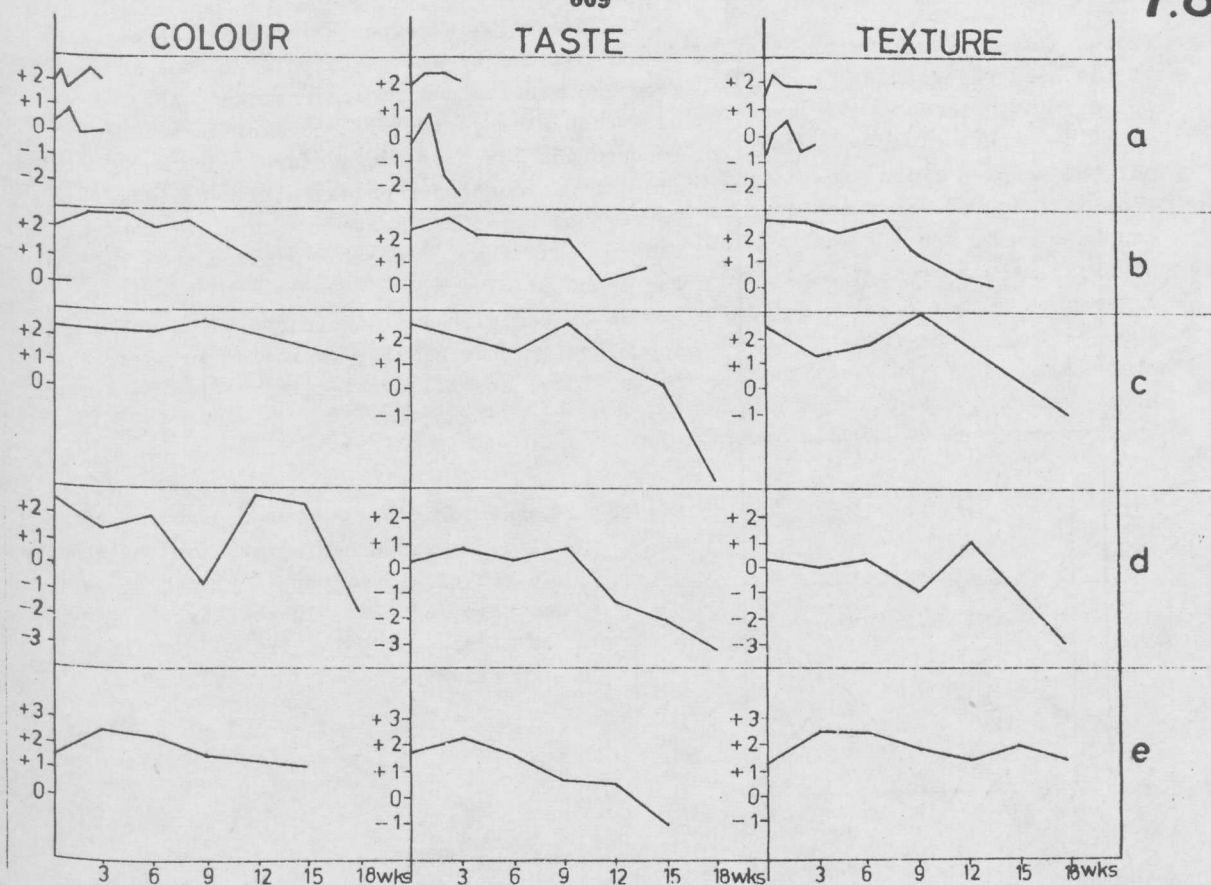


figure 2. Means for color, taste and texture scores of various sausages as affected by frozen storage  
a/Frankfurter b/ lever sausage c,d/ cooked-smoked sausages e/ mortadella type sausage

Figure 2. shows the color, taste and texture scores of various kinds of sausages that were significantly affected /  $P < 5\%$  / by the time of freezing except of the texture at /e/. It can be seen, that organoleptic parameters tended to change at various time of storage depending on both the parameter and the kind of product involved - the taste of Frankfurter /beef/ became unacceptable in a short time /a/, the texture of lever sausage fell in 6 wks while mortadella type product kept its texture score as long as 18 wks, its acceptability was limited only by taste and color. In general, organoleptic qualities tend to decrease with storage, however in case of some products an opposite tendency could be observed e.g. with cooked-smoked sausages /c,d/ an initial reduction in the texture was followed by a temporary increase. In case of cured-smoked pork cuts frozen unsmoked the texture scores significantly altered during freezing / $P < 5\%$ /.

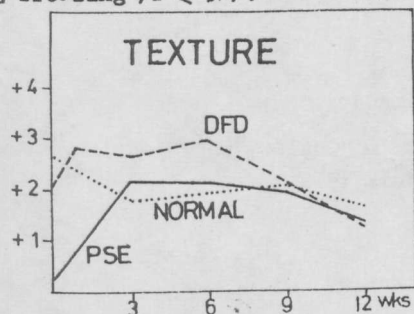
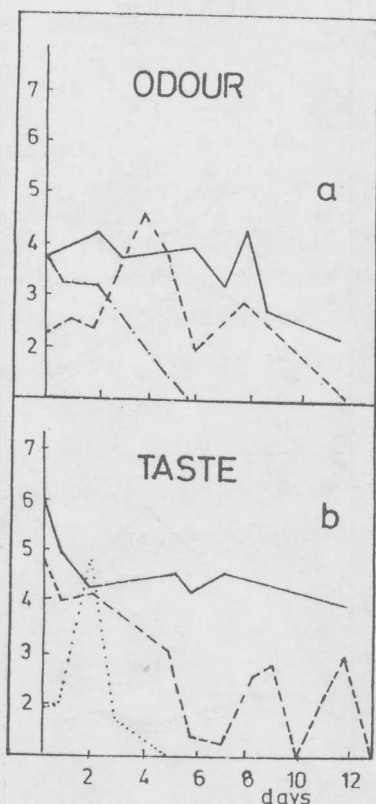


figure 3. Means for texture scores of smoked-cooked pork cuts prepared from PSE, Normal and DFD muscles as affected by frozen storage



In the figure 3..a definite increase can be seen in the texture of smoked-cured pork manufactured from PSE muscles and frozen unsmoked. After 3 wks of frozen storage texture score of this product reached the level of smoked cured pork manufactured from normal muscles when slightly decreased. Texture of cured DFD meats was superior to the others until the 6<sup>th</sup> week of storage when fell to the level of others. Vacuum packed sliced products stored at 5-7°C occasionally show similar variation in odour and taste. These are illustrated in the figure 4.

figure 4. Means for odour scores of vacuum packed sliced pressed ham/a/ and for taste scores of vacuum packed sliced Bologna sausage /b/ as influenced by the time of storage at 5-7°C from 3 different experiments.

### Conclusion

These results suggest, that quality traits - mainly texture of frozen products and occasionally the taste and odour of vacuum packed products stored at 5-7°C exhibit a non linear change - a temporary increase of sensoric scores may occur followed by a slow or rapid reduction. Generally, it is assumed that the change of quality traits during storage shows a monotone decrease with random fluctuation caused by the uncertainty of the methods of determination /1,2,3/. As it can be seen from the results, frequently waving curves are obtained with maximums and minimums caused by a real fluctuation of quality traits and not by random errors. The statistical analysis of these curves also confirms this hypothesis.

Such variation of quality traits renders difficult to establish the shelf life of certain kind of meat products.

Regarding the temporary increase in the quality traits it can be presume that one of the physical, chemical or bacterial actions may improve them.

The presence of salt during frozen storage makes the muscle tissue more sensitive to freezing producing higher cooking losses.

### References

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