6-22 ASSESSMENT OF SELECTED FUNCTIONAL AND TECHNOLOGICAL CHARACTERISTICS OF THE WHITE LIVEX PROCESSED FROM BLOOD PLASMA

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Several functional features of the white livex being a product processed from blood plasma after initial gelling of plasma at 25-30°C and thereafter pasteurization were investigated.Content of protein, dry matter, pH,water holding capacity /WHC/, emulsifying capacity /EC/ and emulsion stability /ES/ were determined.The amount of drip resulted from gravity syneresis at 4°C and under pressure and during simulated transportation /ST/ was also estimated.
No difference was found in protein content and pH between the livex and plasma used for the livex manufacturing.The EC of the livex was 2.5 times smaller and the ES 1.5 time worse in comparison to EC and ES of blood plasma.White livex is characterized by unsatisfactory WHC which was within the range of 15-17% /determined according to Grau-Hamm.The livex WHC depends on the initial amount of protein in plasma and on the period of refrigerated storage.The gravity drip after 24 hr. of storage amounts to 5.0% and increases up to 12.5% after 5 days of storage,while under pressure /P=5G/cm^2/ 15% and 30.5%, respectively.Release of liquid during ST under pressure of livex was 3.2% and 8.6% after 1 hr. and 3 hr.,respectively.
Unsatisfactory water holding capacity of livex will substantialy restrain the use of the livex as a meat substitute due to the fact that protein and dry matter content will be practically beyond the control.The restrain of the livex use as a meat substitute could also origin from worse than for plasma emulsifying capacity and emulsion stability.

INTRODUCTION

The widespread use of blood plasma, both in sausage and canned meat products manufacture,is conditioned by good biological and nutritive value of its proteins as well as by its functional properties, easy availability of the raw material in slaughterhauses and sausage processing plants and comparatively simple technology of obtaining the plasma./1/.These are the reasons why both natural blood plasma and plasma after such proceses as: condensation,precipitation,structuring /texturing/, spinning and co-precipitation with other protein sources e.g.milk protein has become a recognized and commonly used substitute of meat proteins./6/.
In literature, the technologies of obtaining precipitates or co-precipitates of the blood plasma proteins of significantly varied level of the protein content,form, and functional properties etc.,by means of thermal denaturation and coagulation resulting in protein precipitation in the presence of NaCl and calcium chloride in phosphate buffer solution has been described./7/. It has been proved that plasma derivative preparations obtained according to the technologies mentioned above are good substitutes of the muscle tissue proteins and recipe fat ingredient in the manufacture of e.g.emulsified sausages and pâte./8/.
Conceptionally different from the above mentioned technologies is the production of white livex.According to the patented technology of its manufacturing, it is obtained from blood plasma, after adding the toughening substances,in order to obtain a semi-processed product after 15-30 min. at 20-30°C, furtheron subjected to pasteurization ./2/.The final product is characterized by relatively solid,compact, slightly porous,gel-like structure of hard-elastic consistency, off-white colour with greyish hue.

MATERIAL and METHODS

The experimental material was white livex obtained from pig blood plasma /2/.The analysis of the selected functional and technological parametres was made after 24 hr of storage at 4°C.The livex was produced in the gel form of cyllindrical shape,6.0 cm in diameter weighing approx. 200 g. The experiment was repeated 5 times. The protein content was determined by Kjeldahl's method.Moreover pH,dry matter and water holding capacity /5/ was determined in the white livex previously comminuted in a mincer and laboratory grinder.Same parametres were determined in the raw material used for its production, i.e.pig blood plasma.The emulsifying capacity /EC/ of the livex and plasma proteins was determined by the method of Swift et al./3/. The emulsion was produced at 5000 rpm.Soya oil was introduced into the system containing 100 mg of protein in 20 mL of 0.3 M NaCl at constant rate of 17 cm^3/min. The EC was expressed in mL of the oil emulsified by 100 mg of the protein. The thermal emulsion stability / TES / was determined by the modified method of Towsend et al. /4/. 15 g of livex or liquid plasma were homogenized with 45 mL of oil and 25 mL of 2% NaCl for 60 sec. at 8000 rpm.The emulsion prepared in such a manner was weighed /approx. 30g/, put into centrifuging containers and heated in a water bath at 70°C for 30 min. and centrifuged thereafter. The TEC was expressed in a mL of the drip per 100 g of the emulsion.
The amount of the released liquid resulting from gel syneresis was determined in the uncomminuted livex during simulated transportation under 5 G/cm^2 pressure onto the gel block. The results were expressed in % of the released liquid in proportion to the initial sample weight after 1,2 and 3 hr of simulation respectively.The amounts of the drip were also determined using Carver's press where the % of the liquid released from the examined material of the initial weight of 50 g and at the pressure of approx.0.2 kG/cm^2 for 30 min. was determined.The release of liquid from the livex resulting from syneresis during storage at 4°C was determined by measuring the amounts of the liquid flowing out of the unloaded cylindrical blocks of the examined material of the same diameter as the height and 150 g of weight and at the pressure of 5 G/cm^2, after 5 consecutive days af storage at 4°C. The results were expressed in % of the released liquid in proportion to the initial sample weight.The statistical analysis was based on the determination of the essential statistical paramctres. The significant differences between the means were determined at the level of significance $P < 0.05$ using a t-Student test.

RESULTS and DISCUSSION

The experimental production series have been arranged within a row according to the decreasing protein content in the white livex under the capitals from A to E.On average, 6.06% of the protein was determined in the livex ranging from 4.8% /E/ to 7.18% /A/.Protein content in the plasma being the raw material for livex manufacture was found within the range from 5.40% /D/ to 6.77% /A/, and averaged 6.32% /Tab.1/.No difference was observed in the amount of protein in a particular batch of plasma and in the livex manufactured from it. In comparison with the protein contained e.g. in the product manufactured from blood plasma called "precipitated plasma pro-

tein" -/OBP/, the amount of protein determined in the livex is approx. 10% lower./8/ The livex pH was found within the range of 7.71 ± 0.07 units and it was 0.34 pH units higher than that determined for the pig plasma.However, this difference was not significant./Tab.1/. The mean dry matter content in livex amounts to 8.52% and ranges from 9.4% /A/ to 7.04% /E/./Tab.1/.The amount of free water in the livex increases with the decreased protein content from 81% in A series to more than 87% i E series.The water holding capacity is similar to that of the OBP preparation./8/.The emulsifying capacity of fat by the plasma ranged from 46.7 mL of oil/100 mg of protein /A/ to 41.1 mL of oil/100 mg of protein /C/ and on average it was 2.5 times higher than the value of this parametre determined for the livex./Tab.1/.This indicates that pasteurization resulting in the formation of gel-like structure of the livex deteriorates the fat emulsifying capacity significantly considering that livex is manufactured from plasma i.e. product characterized by excellent emulsifying properties.

The stability of the emulsion obtained from the livex is also smaller in comparison with that of the plasma since the sums of water and fat effluents from the emulsion processed from the livex were approx. 1,5 time larger than those determined for blood plasma and they amounted to 32.2 and 21.4 mL from 100 g of emulsion,respectively./Tab.1/.Determining the quantity of the effluents from the livex under the conditions of simulated transportation, it was observed that they increased when the protein content in the examined material decreased.On average,they were found at the level of 3.21%, 5.92% and 8.59% after 1.2 and 3 hr of simulated transportation, respectively.Determining the quantities of effluents using Carver`s press it was found that the amount of the released liquid increased from 15.55% /A/ to 26.73% /E/ averaging approx. 23.55% when the protein content in the livex decreased. /Tab.1/.

It was oserved during refrigerated storage of white livex that the amount to drip from the samples increased with lenghtening of the storage time and the decreasing protein content.During 5 days storage at 4°C it reached: 4.96%, 7.87%,10.14%,11.60% and 12.43%, respectively./Fig.1/.During the same time and climatic conditions of storage,but at the pressure of approx. 5 G/cm^2 the quantities of effluent resulting from gel synereris were: 3.05, 2.09, 2.06, 2.05 and 2.45 times greater and amounted to: 15.14%, 22.81%, 26.81%, 29.10% and 30.61% in proportion to the initial sample weight,respectively. /Fig.2/.

In order to determine the possibilities of substituting certain amounts of pork by white livex in the recipe of scalded comminuted meat products,the manufacture of scalded sausage was performed 3 times substituting 10% raw meat by the white livex or pig blood plasma.No adverse effect of livex on the batter viscosity,pH,yield, palatability and colour was observed in comparison with the following variants:control, i.e. produced from meat and fat raw materials only, and experimental processed with 10% of pig blood plasma as muscle tissue substitute.

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ple 1. Selected physicochemical, functional and technological features of the white livex and pig blood plasma used for its manufacture.

Series / Units		A		B		C		D		E		$\bar{x}$	S.D.
		$\bar{x}$	S.D	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D	$\bar{x}$	S.D.		
otein %	P	6,77	0,04	6,46	0,10	6,39	0,01	5,40	0,04	6,56	0,04	6,32	0,49
n=4	L	7,15	0,04	6,84	0,01	6,43	0,05	5,04	0,09	4,84	0,10	6,06	0,97
pH	P	7,30	-	7,55	-	7,45	-	7,20	-	7,37	-	7,37	0,14
	L	7,65	-	7,75	-	7,80	-	7,65	-	7,70	-	7,71	0,07
EC[a]	P	46,74	2,13	41,23	0,76	41,14	1,01	44,68	1,44	44,59	2,35	43,68	2,67
n=4	L	15,96	0,98	16,93	1,67	16,23	0,72	19,79	1,74	18,69	0,23	17,52	1,86
TES[b]	P	17,50	0,96	23,33	1,36	17,92	1,59	27,09	0,83	21,25	1,59	21,42	3,83
n=4	L	32,08	1,59	30,84	0,96	27,08	1,59	36,25	0,84	34,58	1,60	32,17	3,47
D.m.[c] n=4	L	9,40	0,31	9,12	0,06	8,95	0,03	8,07	0,37	7,04	0,01	8,52	0,90
F.W.[d] n=4	L	80,74	1,31	81,08	1,05	81,56	0,95	83,09	0,79	87,33	0,91	82,76	2,65
rver p.[e] n=3	L	19,55	1,11	22,03	0,94	23,39	0,70	26,06	1,18	26,73	1,16	23,55	2,87
E.S.T.[f]	1h	2,17	0,40	2,39	0,05	3,95	0,12	3,41	0,57	4,13	0,63	3,21	0,90
n=3	2h	3,53	0,57	4,79	0,41	6,81	0,19	6,86	1,01	7,60	0,84	5,92	1,67
	3h	4,97	0,73	6,75	0,64	9,22	0,43	10,15	1,38	11,84	1,56	8,59	2,68

Emulsifying capacity /mL oil/100 mg protein/.
Thermal emulsion stability /mL effluent/100g of emulsion/, $\bar{x}$-n=20.
Dry matter /%/, $\bar{x}$ -n=20.
Free water /%/, $\bar{x}$ -n=20.
Effluent in Carver press /%/ $\bar{x}$ -n=15.
Effluent during simulated transportation /%/, $\bar{x}$ -n=15

P = plasma
L = livex

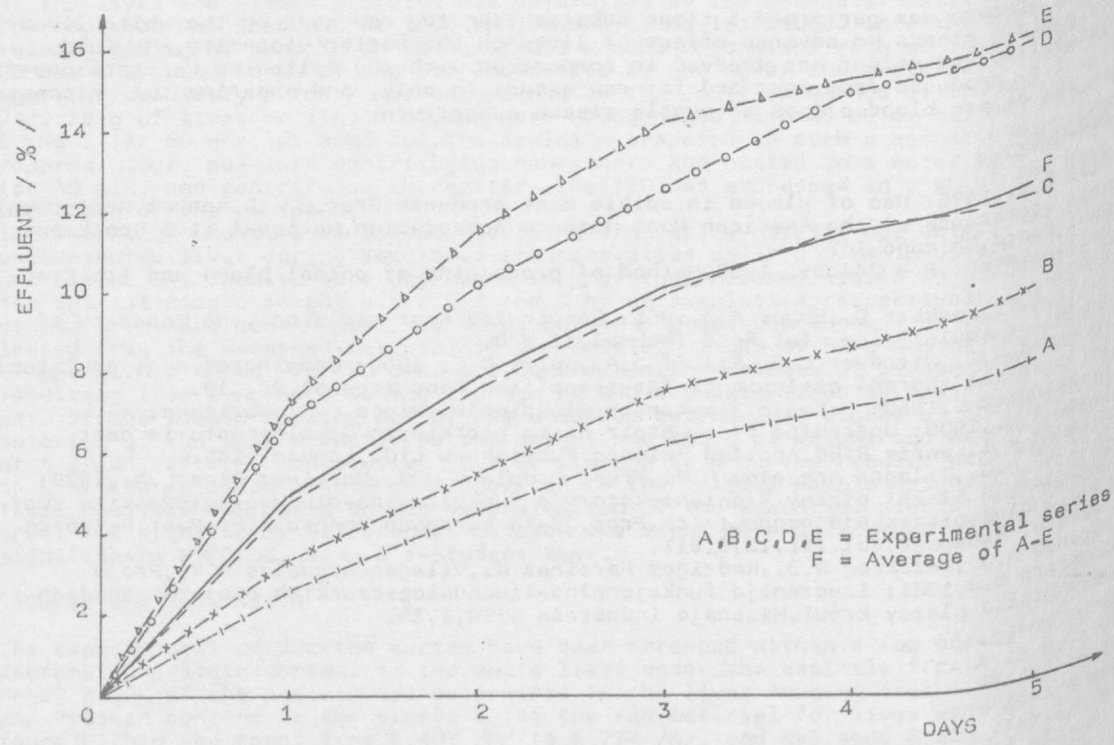

Fig.1.The dynamics of the effluent amount released from white livex during 5 days of refrigerated storage at 4°C.

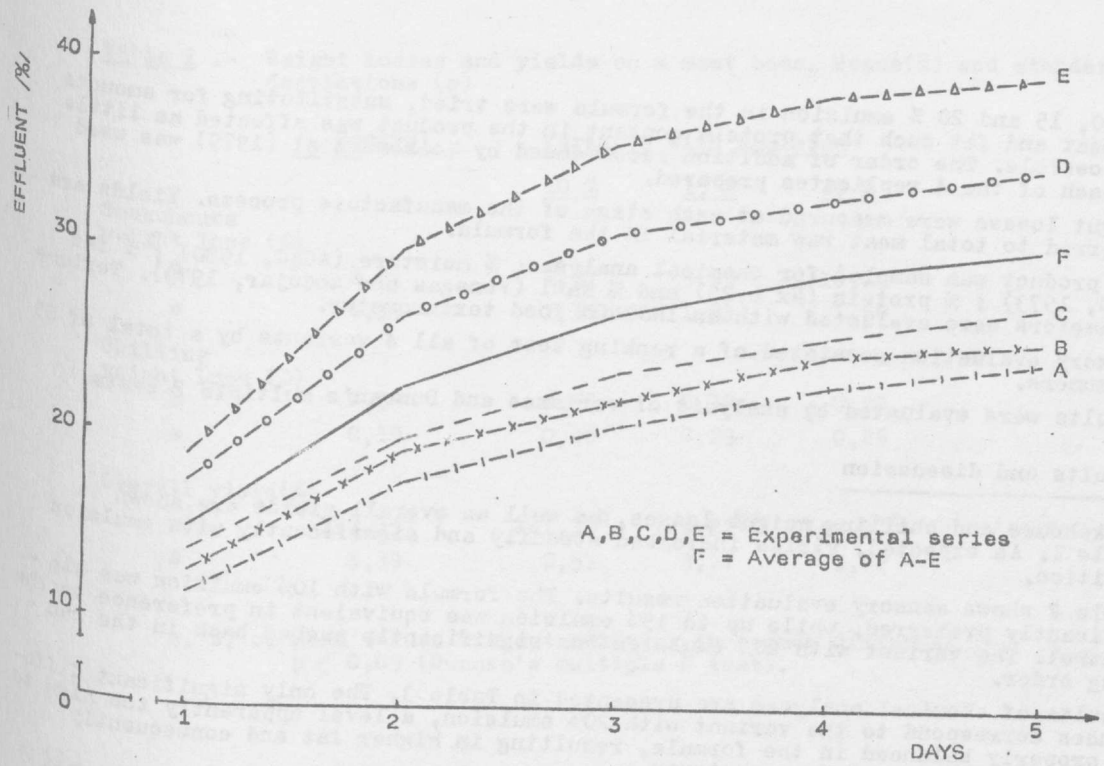

Fig.2. The dynamics of the effluent released from white livex during 5 days of refrigerated storage at 4°C under pressure of 5 G/cm^2.