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CHANGING OF PROPERTIES OF EMULSION IN THE PRESENCE OF SHORT PASTRY CALCIUM ADDITIVES

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Анотація. *Мета дослідження – вивчити вплив кальцієвмісної добавки тваринного походження (напівфабрикату кісткового харчового) на щільність і стабільність емульсії для пісочного тіста. У тісто додавали добавку в кількості 5, 10, 15 і 20 % від загальної маси сировини, при цьому зменшили частку вершкового масла. Після додавання 5 % напівфабрикату кісткового харчового (НКХ) щільність емульсії знизилася порівняно з контрольним зразком на 3,6 %. Подальше збільшення дозування добавки сприяло зростанню щільності емульсії, але у зразку з 10 % НКХ значення цього показника було близьким до контрольного. Отже, після додавання НКХ кількістю 10 % сприяло підвищенню значення цього показника. Стабільність емульсій із 15 і 20 % добавки менша, ніж у контрольному зразку. Додавання добавки в кількості 10 % сприяє підвищенню стабільності емульсії, не змінюючи при цьому її щільність.*

Ключові слова: *добавка тваринного походження, напівфабрикат кістковий харчовий, кальцій, емульсія для пісочного тіста, стабільність.*

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Аннотация. *Цель исследования – изучить влияние кальцийсодержащей добавки животного происхождения (полуфабриката костного пищевого) на плотность и стабильность эмульсии для песочного теста. В тесто вносили добавку в количестве 5, 10, 15 и 20 % от общей массы сырья, при этом уменьшили долю сливочного масла. После добавления 5 % полуфабриката костного пищевого (ПКП) плотность эмульсии*

снизилась по сравнению с контрольным образцом на 3,6 %. Дальнейшее увеличение дозировки добавки способствовало росту плотности эмульсии, но в образце с 10 % ПКП значение этого показателя было близким к контрольному. Итак, после добавления ПКП в количестве 10 % значение этого показателя повысилось. Стабильность эмульсий с 15 и 20 % добавки меньше, чем в контрольном образце. Внесение добавки в количестве 10 % способствует повышению стабильности эмульсии и при этом не влияет на изменение ее плотности.

Ключевые слова: *добавка животного происхождения, полуфабрикат костный пищевой, кальций, эмульсия для песочного теста, стабильность.*

I. Rogovyi, *Cand. Tech. Sci. (Poltava University of Economics and Trade).* ***Changing of properties of emulsion in the presence of short pastry calcium additives.***

Summary. *The influence of calcium-containing additives of animal origin (semi- finished bone food) by the density and stability of the emulsion for short pastry. The additives were added in an amount of 5, 10, 15 and 20 % of the total weight of raw materials for short pastry with decrease in the proportion of butter. If you make 5 % semi – finished bon food (SFBF), the density of the emulsion is reduced compared with a control sample of 3,6 %.*

Further increase of the additive dispensing contributes to high density of the emulsion, but in the sample with 10 % of semi – finished bone food (SFBF) value of this indicator is close to the control sample . The stability study of samples allows you to show that the introduction of the semi-finished bone food (SFBF) in an amount of up to 10 % enhances the value of this parameter. However, the stability of emulsions with 15 % and 20 % of additive less than the control one. It means, that the introduction of additives in an amount of 10 % contributes to the stability of the emulsion without changing its density.

Given the identified emulsifying ability of semi- finished bone food (SFBF) the possibility of changing modes emulsion preparation for shortcrust pastry with the addition was studied. Emulsion sample for shortcrust pastry with the semi finished bone food, which has been whipped over the same time as the control sample (25 × 60 s), had close to it distribution of fat globules. In the case of reducing the duration of whipping up to 20 × 60 s with the nature of the distribution of fat globules in

the emulsion with the addition preserved. However, for emulsions with increasing content of semi- finished bone food characteristic small globules (up to 2 mm) and minimal (3 %) with a number of globules are larger than 8 millimicrons. The stability of the sample with the compared is higher to the control with the same duration of whipping. The recommended reduction in whipping of the emulsion for short pastry with semi- finished bone food is by 5 × 60 s.

Keywords: *additive of animal origin, semi- finished bone food, calcium, emulsion for short pastry, stability.*

The formulation of the problem in general. According to the WHO experts, 50% of human health depends on socio-economic conditions and lifestyle, and the most important component of the latter is food [1, 2]. Taking this into account the urgent problem of today's life is the development of new functional foods, whose structure would include the substances necessary for normal body functioning.

Currently a burning problem is the lack of calcium in the human diet. The shortage of the calcium level in the body gives rise to more than 150 diseases [3, 4]. Therefore, the search for new raw materials rich in digestible calcium is of paramount importance.

The analysis of recent research and publications. More often than not calcium salts are used as a source of calcium to enrich food [3]. But their absorbability depends on the condition of gastric secretion, which worsens with age. The best optimal from the medical perspective is the addition of calcium in the form of food premixes - mixtures of vitamins and minerals [5]. The use of premixes in Ukraine is limited because of their shortage and high cost. In our country the preference is given to food calcium enrichment not trough chemicals, but mainly through dairy products and secondary milk raw materials [6]. However, the use of these additives is problematic because of their short shelf life.

The promising calciferous raw material is food bone. There is a food processing technology for food bones of bovine cattle into semi-finished bone food (SFBF) containing 15.0 $\pm$ 0.1% of easily digestible calcium [7].

To enrich the human diet with calcium it is expedient to use calcium additives whilst processing the most used types of food. Pastry, including short pastry belong to this group. Short pastry is prepared based on the emulsion. Hence it is important to study the impact of SFBF on the emulsion quality for short pastry.

The formation of the article purposes. The purpose of the article is the study of the impact of calcium additives of animal origin (semi-finished bone food) on the properties of the short pastry emulsion.

The statement of the research. Whilst doing the experiment batching of emulsion components was carried out according to traditional recipes for the general semi-finished short pastry. Calcium additive SFBF was added in volumes of 5, 10, 15 and 20% of the total weight of raw materials into the short pastry with a reduced percentage of fat. Emulsion frothing modes were kept as in the traditional technology (duration - 1200 s, the number of revolutions of the equipment working body - 11 s^{-1}, temperature - 16 ... 20 ° C).

The quality of the emulsion was evaluated for its density and stability. The density was defined as the ratio of the emulsion sample mass to its volume. The value of stability was calculated by the ratio of the emulsion volume undestroyed by centrifuging to emulsion volume prior to centrifuging.

It is noted that when adding 5% SFBF the density of the emulsion is reduced as compared to the control sample by 3.6% (from 0.860 to 0.838 g / cm^3) (Table. 1).

Table 1

SFBF Impact on the Density and Stability of the Short Pastry Emulsion

Indicator	SFBF batching, % of the general amount of raw material of short pastry				
	0	**5**	**10**	**15**	**20**
Density, ± 0,005 g / cm^3	0,860	0,838	0,858	0,869	0,893
Stability ± 0,1 %	34,5	35,1	35,7	33,1	27,5

With further increase in additive batching the emulsion becomes of high density, in the sample of 10% SFBF this value is close to the control one (0.858 g / cm3), and the samples of 15 and 20% SFBF have density higher than in the control one by 1.1 and 3,8% respectively. The reduced density of the sample with 5% SFBF is caused by the fact that the additive has a relatively high humidity. That is, in the emulsion with the additive the quantity of additional moisture increases, and the availability of surfactants of whipping egg products contributes to its saturation with air bubbles, which leads to lower density. With further increase of the SFBF quantity the surfactants cannot hold more moisture, the ability to form bubbles decreases. In addition, SFBF has a bone inclusion (up to 0.5%), which burdens the system.

An important indicator of the emulsions quality is their stability, which is due to the existence of adsorption membranes phases on the interface. The emulsions are stable if the adsorption layers has the increased structural viscosity. The stability of the emulsion for short pastry is provided by protein egg products. The content of egg products in the emulsion without SFBF is 12.3%, which is sufficient for their high concentration in adsorption layers and which causes their increased structural viscosity.

Adding SFBF in the amount of 5 and 10% enhances the value of this indicator respectively by 1.7 and 3.5 relative percent (Table. 1). The stability of the emulsion with 15 and 20% additive is less by 4.1 and 20.3% respectively than in the control sample, because of the decrease in the quantity of proteins due to the reduction of the egg products share. In addition, SFBF contains fat (11%), which is located in non-emulsified condition, and water (45.5%), which leads to changes in the ratio of the dispersed phase and the dispersion medium and the simultaneous decrease of emulsifier.

Thus, the addition of 10% SFBF to short pastry emulsion contributes to its stability.

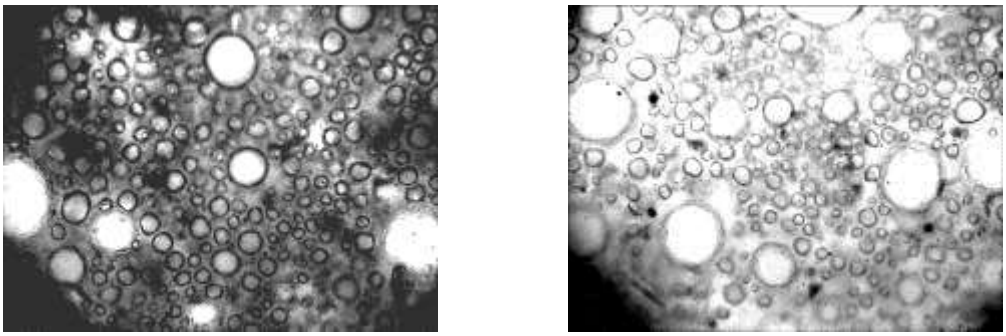
Taking into account the identified emulsifying capacity of the additive, it is expedient to consider the possibility of changing preparation modes for short pastry emulsion with SFBF The emulsion for the general semi-finished short pastry was taken for reference sample whose cooking time was 25 × 60 sec. There have been studied the emulsions, to which SFBF was added in the amount of 10% of the total mass of raw short pastry. The duration of prototypes whipping were 15 × 60 s, 20 s × 60, 25 × 60 sec. The stability was assessed by emulsion dispersion , which was determined by the nature of fat globules distribution using an electron microscope, and which is shown in Table. 2 and Fig. 1-2.

The sample of the emulsion containing additive was subject to whipping during the same time as the control sample (25 × 60 s), it had the distribution of fat globules close to the latter (Fig. 1,a b).

Table 2

The impact of whipping on the dispersion of the short pastry emulsion

Short pastry emulsion	**Whipping duration $\tau \times 60^{-1}$, c**	**Fat globules distribution (%) under their sizes, millimicron**				
		Up to 2	**2…4**	**4…6**	**6…8**	**More than 8**
Control sample	25	7	40	30	10	13
Experiment (with SFBF)	25	9	40	32	9	10
	20	8	39	31	11	11
	15	4	32	33	15	16



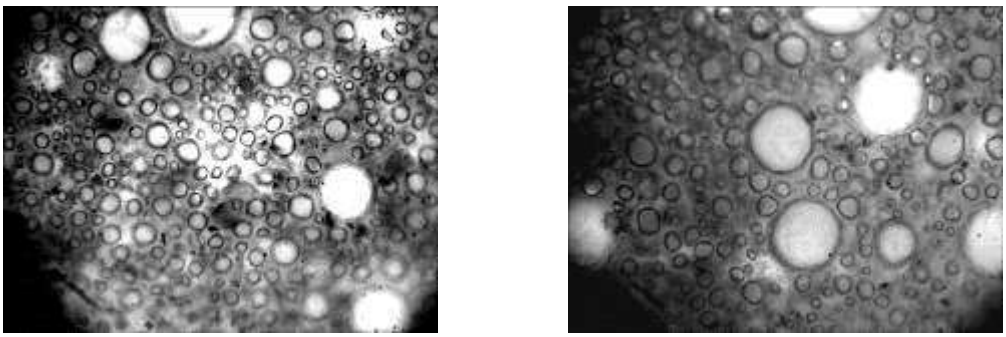
A B

Fig. 1. Emulsion Microstructure for Short Pastry, which Underwent Whipping 25 × 60 s (400 × magnification)

A - reference sample; B - a sample with SFBF

40% of ball sizes range from 2 to 4 millimicrons in these samples. However for the emulsions with SFBF the higher content of small balls (up to 2 millimicrons) and lower content (by 3%) of balls larger than 8 millimicrons is typical.. That is higher is the stability of the sample with SFBF compared to the control one with the same duration of whipping. At food industry enterprises the emulsion for short pastry is not subject to storing, so increasing its stability is inexpedient.

The sample of the emulsion with SFBF with whipping duration 20 × 60 s (Fig. 2a), is similar to the control one according to its microstructure. The amount of fat globules sized from 2 to 4 millimicrons is 39%, ranging from 4 to 6 millimicrons - 31%, which is not very different from the control emulsion. The amount of globules larger than 8 millimicrons is 2% less than in control sample, indicating a higher dispersion of the emulsion and its smaller ability to layer.



A B

Fig. 2. Emulsion Microstructure for Short Pastry, which Underwent Whipping A) 20 × 60 s B) 15 × 60 s. (400 × magnification)

Further reduction of whipping time is inexpedient which is indicated by the analysis of the microstructure for the sample with SFBF which was whipped for 15

× 60 sec. In it the amount of globules larger than 8 millimicrons is by 3% greater than in the control emulsion, which is the prerequisite for further coalescence. As compared with the control sample the share of globules ranging in size from 6 to 8 millimicrons increased by 5%, while the number of small globules (up to 2 and 2 to 4 millimicron) reduced (by 3 and 8% respectively).

The analysis of the research results has shown that it is expedient to reduce the duration of emulsion whipping adding 10% SFBF from 25 × 60 to 20 × 60 s (by 5 × 60 sec). This emulsion sample will have the same dispersion as the emulsion for traditional short pastry obtained during whipping for 25 × 60 sec.

Conclusions. It has been proven that the addition of calcium additive of animal origin (semi finished bone food) to the short pastry emulsion in the amount of 10% of raw short pastry improves the stability of the emulsion, and its density does not change. It has been noticed that the dispersion of emulsion samples with such content of additives prepared within 20 × 60 s, is the same as in the control sample obtained during whipping for 25 × 60 sec. As a result, it has been recommended to reduce the duration of whipping for the short pastry emulsion with SFBF by 5 × 60 sec.

The prospects for further research. In the future we plan to investigate the impact of semi finished bone food on short pastry adhesion strength.

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