FOOD VALUE STUDY OF ACIDOPHILIC-WHEY ICE CREAM

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Abstract

The dietary structure of most people is extremely inconsistent with modern principles of rational nutrition and practical dietetics. By developing and improving the composition of products that increase the body's resistance in an unfavorable environment, including dairy, it is quite possible to improve the quality of human life, as well as to ensure the body's adaptation to unfavorable living and working conditions. Based on the results of previous studies, new types of acidophilic-whey ice cream, enriched with protein, have been developed. The amino acid composition and mineral composition of new types of ice cream enriched with protein were investigated with the help of amino acid and express analyzers. Based on the daily human need for these substances, it was concluded that the biological value of ice cream, enriched with a complex of proteins, increased by 15% in comparison with the control. It was also found that the introduction of pectin-containing raw materials into the composition of acidophilic-whey ice cream with protein concentrate provides a ratio of minerals that is close to the optimal for all age categories.

Key words: biological value, ice cream, milk whey, milk protein

Özet

Çoğu insanın beslenme yapısı, modern oranlı beslenme ilkeleri ve pratik diyetetik ile son derece tutarsızdır. Süt ürünleri de dahil olmak üzere olumsuz bir ortamda vücudun direncini artıran ürünlerin bileşimini geliştirerek ve iyileştirerek vücudun olumsuz yaşam ve çalışma şartlarına uyumunu sağlamanın yanı sıra, insan yaşam kalitesini iyileştirmek de mümkündür. Önceki çalışmaların sonuçlarına dayanarak, proteinle zenginleştirilmiş yeni tip asidofilik-peynir altı suyu dondurması geliştirilmiştir. Proteinle zenginleştirilmiş yeni dondurma türlerinin amino asit bileşimi ve mineral bileşimi, amino asit ve ekspress çözümleyicileri yardımıyla araştırıldı. İnsanın bu maddelere yönelik günlük ihtiyacına dayanarak, bir protein kompleksi ile zenginleştirilmiş dondurmanın biyolojik değerinin kontrol ile kıyaslandığında

%15 arttığı sonucuna varıldı. Protein konsantresi ile asidofilik-peynir altı suyu dondurmasının bileşimine pektin içeren hammaddelerin katılmasının, bütün yaş kategorileri için en uygun olana yakın bir mineral oranı sağladığı da anlaşılmıştır.

Anahtar Kelimeler: biyolojik değer, dondurma, kesilmiş sütün suyu, süt proteini

INTRODUCTION

Consumer rations often have an excess of foods with a high carbohydrate content and very little of the main sources of complete protein, dietary fiber and micronutrients. Scientific studies results of the actual nutritional status of the population in different regions indicate that the food status of children and adults is seriously impaired (FAO, 2017). The reason for this disorder is the deficiency of complete (animal) proteins, polyunsaturated fatty acids, vitamins, macro- and microelements, as well as dietary fiber. Conversely, there is an excess consumption of animal fats and easily digestible carbohydrates.

Milk proteins, especially whey, in terms of their amino acid composition, are among the most valuable proteins of animal origin (Rafiq S. et al., 2016). The mass fraction of proteins in ice cream of traditional composition is 2.0 - 3.5%, while in ice cream, enriched with proteins, it can increase to 6.7%. Protein concentrates, with which it is advisable to enrich ice cream, are dry whey, whey protein concentrates, caseinates, protein concentrates of soybeans, rice, peas, etc. In addition to the enrichment function, proteins play an important technological role in the formation of dispersed ice cream systems, which increases its organoleptic assessment (Goff , 2016).

Vegetable raw materials can be used to enrich ice cream with minerals and dietary fibers. The use of vegetable raw materials in combination with protein concentrates in ice cream will increase its nutritional value. Therefore, the development of ice cream new types with these components is an urgent area of scientific research.

MATERIALS AND METHODS

Based on the results of previous studies, new types of acidophilic-whey ice cream with a complex of protein concentrates (demineralized whey, sodium caseinate, whey protein concentrate and soy isolate) were developed. Pectin-containing vegetable purees from beets and broccoli were also added to ice cream (Mykhalevych et al., 2019). The amino acid composition was investigated with the LC2000 amino acid analyzer (Biotronik, Germany), and with the EXPERT 3L express analyzer, the mineral composition of new types of ice cream, enriched with protein.

RESULTS

For comparison, samples of classical composition milk ice cream (control) and acidophilic-whey ice cream were studied. The results are presented in table 1.

Table 1 - Amino acid composition of milk ice cream (control) and acidophilic-whey ice cream, enriched with protein

Amino acid name	milk ice cream (control)		acidophilic-whey ice cream	
	mg /100g	% to the total	mg /100g	% to the total amount

		amount		
lysine	161,707	7,36	301,4922	8,82
histidine	57,105	2,60	119,9816	3,51
arginine	59,318	2,70	109,0431	3,19
aspartic acid	157,169	7,15	219,1117	6,41
threonine	105,477	4,80	135,3638	3,96
serine	129,391	5,89	131,9456	3,86
glutamic acid	471,154	21,43	726,7261	21,26
proline	287,500	13,08	310,7216	9,09
glycine	48,320	2,20	45,80494	1,34
alanine	82,540	3,75	125,7927	3,68
Cystine +	11,667	0,53	63,92182	1,87
valine	117,000	5,32	216,7189	6,34
methionine	49,434	2,25	83,74784	2,45
isoleucine	95,469	4,34	141,8586	4,15
leucine	219,715	9,99	389,342	11,39
Tyrosine ++	42,843	1,95	86,14063	2,52
phenylalanine	102,785	4,68	210,566	6,16
the total amount of amino acids	2198,595	100,00	3418,279	100,00

Based on the data obtained, the calculation of the amino acid rate of essential amino acids was carried out. It was found that the limiting amino acid for milk ice cream (control) is methionine + cystine, and for acidophilic-whey ice cream, enriched with protein - threonine (Table 2).

Table 2 - Amino acid rate of milk ice cream (control) and acidophilic-whey ice cream, enriched with protein

Amino acid name	FAO/WHO standard "ideal protein", g/100g	Amino acid score, %	
		milk ice cream (control)	acidophilic-whey ice cream
lysine	5,5	134	160
threonine	4	120	99
methionine + cystine	3,5	79	123
valine	5	106	127
isoleucine	4	108	104
leucine	7	143	163
phenylalanine + tyrosine	6	111	145

Amino acid rate of each amino acid does not provide a general idea of the product biological value. To assess the degree of protein utilization, the coefficient of amino acid fast difference (CDAF) and product biological value were calculated. All excess amino acid content is used by the body for energy needs, and not for protein biosynthesis.CDAF is the arithmetic mean of amino acid fast (AF) excess of essential amino acids relatively to AF of limited amino acid. The maximum excess found in ice cream samples is provided by leucine. It has been proven that the lower the CDAF value, the more fully essential amino acids are used for the needs of biosynthesis.

Determination of biological value was carried out using the amino acid difference coefficient of AF:

$$BV = 100 - CDAF, \%$$

Biological value indicators (CDAF and BV) are shown in Figure 1.

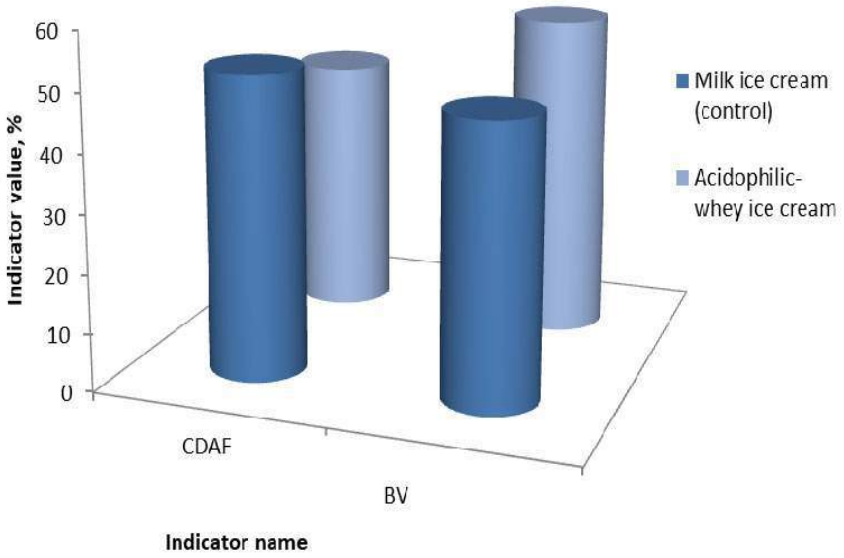

Figure 1. Indicators of biological value (BV) and the amino acid difference coefficient of AF of the test samples

Also, the content of macro- and microelements in the received product was determined. The mineral composition of acidophilic-whey ice cream, enriched with protein, is given in table 3.

Table 3 - Mineral composition of products

Minerals, mg / 100g	Milk ice cream	Beets	Broccoli	Acidophilic-whey ice cream, enriched with protein with a dose of 10% vegetable paste
Sodium	51	46	32	49,8
Potassium	148	288	317	163,5
Calcium	136	37	48	126,7
Magnesium	17	22	22	17,5
Phosphorus	101	43	65	96,3
Iron	0,1	1,4	0,74	0,2

DISCUSSION

The obtained values were compared with the daily human need for minerals according to order № 1073 dated 03.09.2017 "On the approval of the norms of the physiological needs of the population of Ukraine in basic nutrients and energy" (order of Ministry of health of Ukraine) and the integral speed (nutritional value) of products was determined by the mineral composition.

The introduction of protein complex into the ice cream provides an increase in biological value by 15% in comparison with the control. It is known that the absorption of calcium depends on the content of phosphorus and magnesium in the product (Paunier at al. 1992). Ensuring the full use of the above minerals by the human body occurs at an optimal ratio: calcium : magnesium 1 : 0.5 and calcium : phosphorus - 1 : 1 (DeLuccia at al., 2019).
Based on this, it can be concluded that the ratio of minerals in ice cream, enriched with protein, for all age categories is as close to optimal as possible, and for the age group from 18 to 60 years, the ratio of calcium : magnesium is optimal.

CONCLUSION

Based on the research results, it can definitely be argued that the use of protein concentrates and pectin-containing vegetable raw materials in the composition of acidophilic-whey ice cream increases the food value of this product.

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