Verwertung von Schlachttierblut bei der Herstellung von Vollmilchaustauscher

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Es wird über Ergebnisse der Untersuchungen zur Entwicklung des Vollmilchaustauschers unter Verwendung von Schlachttierblut und Formelelementen sowie von Hydrolysat des keratinhaltigen Rohmaterials und von Knochenfett berichtet.

Die chemische Zusammensetzung des entwickelten Produktes wird im Vergleich zu den herkömmlichen Vollmilchaustauschern und zu Vollmilch gegeben.

Es wurde die Zusammensetzung der Fett- und Aminosäuren, sowie der Mineralstoffe bei Austauschern mit Vollmilch oder Formelementen im Vergleich zu Ersatz- und Vollmilch studiert.

Mit Hilfe der Mikroskopie wurde die Fettdispersität bei den entwickelten Vollmilchaustauschern im Vergleich zu Kontrollmustern (Vollmilch) ermittelt.

Auf Grund der durchgeführten Untersuchungen wurde festgestellt, dass das entwickelte Produkt den herkömmlichen Vollmilchaustauschern an analysierten Werten nicht nachsteht.

The use of slaughter animals' blood in the production of a whole milk replacer

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Results of a study concerning the preparation of a whole milk replacer (WMR), using slaughter animals' whole blood and formed elements, as well as hydrolyzed keratin-containing materials and bone marrow, are reported.

The chemical composition of the developed product is given along with that of the conventional replacers and whole cow's milk.

The fatty acid, amino acid and mineral compositions of replacers containing whole blood or formed elements were compared to milk-based replacers and whole milk.

Fat component dispersity in the developed replacer, as compared to controls (whole milk), was determined microscopically.

On the basis of the experimental data it was concluded that the product obtained was not inferior to the traditional whole milk replacers.

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Utilisation du sang du bétail de boucherie dans la production du succédané du lait complet

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Citation des résultats de l'étude sur l'élaboration du succédané du lait complet (SLC) au sang complet du bétail de boucherie et aux éléments de forme aussi bien qu' au hydrolisat des matières premières contenant de la kératine et de la graisse d'os.

On cite aussi le composé du produit élaboré en comparaison avec des succédanés traditionnels et avec le lait complet de vache.

On a étudié le composé des acides gras, des acides aminés et des minéraux des succédanés au sang complet ou aux éléments de forme en comparaison avec des succédanés du lait et avec le lait complet.

On a déterminé par méthode microscopique la dispersité du composant gras dans des succédanés élaborés en comparaison avec ceux de contrôle (le lait complet).

En se basant sur l'étude fait, il a été constaté que le produit obtenu ne cède pas aux succédanés traditionnels du lait complet selon les indices étudiés.

Использование крови убойных животных в производстве заменителя цельного молока

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Приведены результаты исследований по разработке заменителя цельного молока (ЗЦМ) с использованием крови убойных животных и форменных элементов, а также гидролизата кератинсодержащего сырья и костного жира.

Дан химический состав разработанного продукта в сравнении с традиционными заменителями и цельным коровьим молоком.

Изучен жирнокислотный, аминокислотный и минеральный состав заменителей с использованием крови или форменных элементов в сравнении с молочными заменителями и цельным молоком.

Микроскопическим методом определена дисперсность жирового компонента в разработанных заменителях в сравнении с контрольными.

На основании проведенных исследований установлено, что полученный продукт по изученным показателям не уступает традиционным заменителям цельного молока.

The use of slaughter animals' blood in the production of a whole milk replacer

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At present in this country and abroad there appear data on numerous and extensive studies into the development of feedstuffs to be used as replacers of whole milk (WMR) when rearing young farm animals.

A common trend in all the compositions is the use - as the protein component - of products resulting from the commercial processing of milk, vegetable and animal fats, carbohydrate extenders, as well as mineral salts, vitamins and antibiotics (1-3).

To solve the problem of intensive rearing of young animals, some authors suggest that a meal of the animal origin, i.e. blood, fish, meat-&-bone or bone ones, be added to WMR formulations (4-7). In the USSR and abroad, as the protein component of WMR there is a growing use of hydrolyzed keratinous materials, of hide flesch and by-products (8-11), their proportion of the total WMR being, however, negligible. At the same time a search for a replacer of milk protein in WMR is a very urgent task with regard for the world shortage of food proteins.

An important source of such protein is slaughter animals' blood or some fractions thereof. A high level of perfect proteins in blood indicates the reason of its wide use as a protein source in food and feed products.

The utilization of blood in a WMR composition renders it possible to reduce the amount of milk protein used to feed young farm animals and to provide its rational use, since the organoleptical qualities of this perishable material limit its application in food production.

At the All-Union Meat Research Institute (VNIIMP) studies have been carried out which resulted in the development of original replacers of whole milk containing whole blood or its fractions (formed elements, plasma) and hydrolyzed keratinous materials as the protein component, bone fat as the fat component and sugar as the carbohydrate component (9).

Taking into account a peculiar composition of this replacer, of great interest is the estimation of its amino acid, fatty acid and mineral analyses and the comparison of the data derived with similar characteristics of whole milk and traditionally prepared WMR on the milk basis.

With this aim in view, the authors prepared two test WMR batches with whole blood or its formed elements added. Their composition is presented in Table 1.

Table 1

Components (as dry solids)	Composition, %	
Whole blood	50	-
Blood formed elements	-	35
Hydrolyzed keratinous materials	15	20
Bone fat	30	40
Sugar	5	5

The above ingredients were thoroughly homogenized by means of sonic vibrations, the resulting emulsion being spray-dried.

The chemical composition of WMR and whole milk is compared in Table 2.

Table 2

Product	Content of (%)				
	WATER	FAT	ASH	PROTEIN	CARBOHYDRATES
Test replacers:					
with whole blood	7.0	30.0	4.0	54.0	5.0
with formed elements	8.0	40.0	4.0	43.0	5.0
Controls:					
regenerated milk	9.0	14.5	6.5	32.0	38.0
WMR for calves	5.0	17.0	6.0	30.0	42.0
whole powdered milk	4.0	25.0	5.0	28.0	38.0

Test WMR amino acid composition was analyzed by means of liquid ion-exchange chromatography. The data obtained were compared with the amino acid analysis of whole milk and milk-based WMR, viz. regenerated milk and WMR for calves (Table 3). Regenerated milk contains skimmed dry milk (81%), fat (13%), premixes (3.5%), starch (2.5%); WMR for calves contains skimmed dry milk (80%), concentrated phosphatides (5%), fat (15%).

Table 3

Amino acid	Content, % of protein				
	Test WMR		Controls		
	with whole blood	with formed elements	cow's milk	regenerated milk	WMR for
Lysine	6.79	11.16	7.8	4.83	6.38
Histidine	4.63	6.18	2.5	4.49	2.60
Arginine	4.12	4.61	3.5	3.13	3.06
Aspartic acid	12.35	10.43	7.1	6.84	7.71
Threonine	4.35	4.29	4.3	3.93	4.52
Serine	5.33	4.78	6.0	4.42	5.66
Glutamic acid	13.59	10.77	16.3	19.59	23.19
Glycine	5.82	4.94	0.9	1.83	1.91
Alanine	7.89	8.2	5.2	2.86	3.46
Cystine	0.52	0.23	1.2	0.62	0.45
Valine	6.83	6.67	6.6	5.9	5.66
Methionine	1.17	1.11	2.5	1.69	2.45
Iso-leucine	1.62	0.84	5.5	4.75	4.39
Leucine	11.86	11.65	9.6	8.21	9.81
Tyrosine	4.05	2.84	4.3	4.41	4.39
Phenyl-alanine	5.92	6.70	5.2	4.3	4.97
Tryptophane	0.82	0.57	1.4	-	-
Proline	4.03	4.22	-	-	-

The data indicated make it clear that by the amino acid content the test WMR are not, practically, inferior to cow's milk and milk-based WMR. Thus, the total amount of the seven basic essential amino acids (iso-leucine, leucine, lysine, methionine, phenyl-alanine, threonine and valine) constitutes 38.4% and 42.4% in test WMRs (respectively), 33.5 and 38.1% in regenerated milk and in WMR for calves (respectively) and 41.5% in whole milk.

The fatty acid composition of the fat component in both test and control WMR and in whole milk was studied by means of gas-liquid chromatography. The data derived are summarized in Table 4.

Table 4

Fatty acid	Content of fatty acids in fat, %			
	Test WMR	Controls		
		WMR for calves	Regenerated milk	Whole milk
Lauric $C_{12:0}$	0.1	0.8	0.28	1.7
Myristic $C_{14:0}$	2.8	2.5	1.73	9.3
Tetradecenoic $C_{14:1}$	0.7	0.2	0.22	1.2
Pentadecanoic $C_{15:0}$	0.5	0.2	0.35	-
Iso-palmitic $C_{16isp:0}$	0.2	-	-	-
Palmitic $C_{16:0}$	27.7	15.3	21.5	25.4
Palmitoleic $C_{16:1}$	5.0	0.5	1.2	5.0
Heptadecanoic $C_{17:0}$	1.3	0.5	0.8	-
Stearic $C_{18:0}$	17.9	17.0	13.0	10.7
Oleic $C_{18:1}$	40.1	34.7	44.1	32.4
Linolic $C_{18:2}$	2.5	32.7	10.8	4.0
Linolenic $C_{18:3}$	0.7	0.6	0.5	-

As is seen from Table 4. test and control replacers contain identical fatty acids. The total content of unsaturated fatty acids in test WMR and whole milk varies within 32.4—44.1%. The content of the essential fatty acids in whole milk and test WMR is close and it is much inferior to that in control WMR.

A small difference in fatty acids between the developed product and whole milk indicates possible satisfactory assimilation of the fat component of the test WMR.

A comparative mineral composition of whole milk, control and test replacers is given in Table 5.

Table 5

Macro- and micro-elements	Content, %, in Test WMR		Controls		
	with whole blood	with formed elements	WMR for calves	regenerated milk	powdered cow's milk
Calcium	0.032	0.0186	1.27	1.9	1.072
Phosphorus	0.282	0.202	0.724	0.9	0.976
Magnesium	0.0367	0.077	was not determined		0.145
Potassium	0.232	0.148	-	-	1.5
Sodium	0.752	0.646	-	-	0.55
Iron	0.027	0.0615	0.0001	0.001	0.02

The results obtained show that the developed product contained less phosphorus and calcium salts and more ferrous salts as compared to whole milk and control WMR. A higher level of iron salts in the developed product is determined with the utilization of blood and especially of formed elements.

Our studies demonstrated that, to increase phosphorus and calcium levels, it is necessary to add phosphorus and calcium salts to the developed replacers.

One of the basic characteristics of fat emulsions, to which the developed replacers belong, is fat phase dispersity.

The size of fat globules influences emulsion stability and assimilation of the emulsified fat by an animal's organism.

Fat phase dispersity was determined with a device of the "Millipore Co." (USA). The size of fat globules was measured by the maximum chord. The preset size value was varied within 1 to 10 mcm. Since fat particles have the round shape, the maximum chord is equal to their diameter, the error being 1.5-2.7%. The diameter of individual particles was checked with an electronic pencil. Measurement results on the dispersion composition of test and control WMR are presented in Table 6.

Table 6

Sample	Fat globules distribution by diameter (mcm), % 1	2	3	4	5	6	7	8	9
Test replacers:									
with whole blood	30	25	22	6	4	2	4	6	1
with formed elements	34	22	19	7	3	1	4	7	3
Controls:									
WMR for calves	42	36	7	6	3	2	2	1	1
whole milk	13.7	24.4	19.5	18	8.3	6.0	4.3	3.2	2.6

The analysis of the data obtained shows that the dispersion composition of the fat component of test replacers is about similar to that of whole milk. From here follows that the conditions of fat dispersion in the process of test WMR preparation render it possible to yield an emulsion, which is approaching cow's milk as far as this characteristic is concerned. The above chemical and physico-chemical results prove that the suggested replacer is not inferior to similar milk-based products and in some aspects it approaches cow's milk.

Though the data on the chemical and physico-chemical analyses are important indices of the feeding value of replacers, they are, however, insufficient to judge their intrinsic quality. The primary criterion of the evaluation is the biological value, i.e. a specific response of the animal to a feedstuff, and particularly, the maximum assimilation degree, excellent organoleptical qualities and absolute safety.

A relative biological value of the test WMR was studied microbiologically using as the test microorganism Tetrahymena pyriformis (12). As control, milk-based WMR was used, its biological value veing taken as 100%.

Thus, the relative biological value of the WMR containing whole blood is 100%, and of that containing formed elements - 95%.

The experiments carried out indicated that blood can be successfully used as a protein component of WMR.

The amino acid, fatty acid and mineral compositions, as well as the overall quality of WMR containing blood (its biological value) show convincingly that the formulations of WMR developed are not inferior to similar products based on milk.

A possibility of utilizing whole blood or its fractions for the above formulations contributes to a more complete satisfaction of human demands for such a valuable food product as milk due to its removal from feeding rations of animals.

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