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RESULTS OF DETERMINING THE NUTRITIONAL COMPOSITION OF MEAT AND BONE MEALS INTENDED FOR FODDER MIXTURE

Abstract. The article discusses the utilization of livestock waste from slaughterhouses in the production of feed additives, suitable for broiler chickens, using highly nutritious food waste. The study presents results for moisture, protein, crude fat, and ash content in waste samples from various animals (foals, calves, and bone meal). Notably, the fat content was 9,6% in foal flour, 8,0% in calf flour, and 31,7% in bone meal. The research revealed that while a sample made from bone meal is high in fat (31,7%), the sample with the lowest amount of crude fat (8,0%) was from calf flour. These findings suggest the development of a new compound feed mixture, utilizing waste from agricultural animal slaughter, which is formulated to rapidly increase the weight of meat birds.

Keywords:. feed mixture, by-product, foal embryo flour, calf flour, bone flour, feed fertility, protein content, crude fat content.

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Introduction. The primary raw materials for feed mixtures for agricultural animals and birds are grain crops, predominantly barley and wheat. Additionally, oats, corn, millet, and triticale are utilized. Notably, 65-70% of the content of a 1-ton feed mixture comprises these grain crops. In preparing enriched feed mixtures, the ingredients include protein-vitamin mixtures, premixes, by-products from slaughtering agricultural animals, and a wide variety of mineral raw materials. Feed flours containing animal by-products are highly nutritious due to their richness in essential amino acids and proteins (50-60%). Furthermore, meat-bone and bone flours are particularly abundant in calcium and phosphorus. Therefore, the processing industry's development strategy may involve several comprehensive measures: diversifying the range of manufactured products, modernizing production technologies, and broadly incorporating previously underutilized raw materials, including secondary animal-derived raw materials.

Bones are primarily utilized in the production of edible fats, meat mass, semi-finished meat and bone products, dehydrated soups, and various other food products.

They are also used in making feedstuff materials, adhesives, and gelatin. The proportion of bones obtained varies with the type and fat content of the meat. For instance, processing first-category beef yields 21,2% bones, while second-category beef yields 24,2%. In the case of pork, second-category pork processing results in 13% bones, and third-category pork yields 10,3%.

Compound feed enterprises manufacture their products using scientifically formulated recipes developed by research institutions, or in line with established norms concerning chemical composition and nutritional value. These formulations also take into account recipes calculated by the customers themselves. The process of devising recipes for compound feed and protein-vitamin supplements adheres to methodological guidelines sanctioned by the Ministry of Agriculture of the Republic of Kazakhstan.

The nutritional value of a fodder unit, characterized by a bulk weight of 450-480 g/l and a moisture content of 13%, is considered standard for high-quality oats. These oats comprise 12% protein, 32% fat, 9,2% fiber, and 58% nitrogen-free extractive substances (NFES). This composition of the fodder unit indicates that 1 kilogram of such oats can contribute to the accumulation of 150 grams of fat in cattle.

Chickens are fed based on their age group: broiler (meat) chicks aged 1-30 days, 31-70 days, and young chickens aged 121-180 days. In the feed recipe, different types of animal feed can be used interchangeably, provided they maintain the specified total amount of animal protein.

Małgorzata Karwowska, Sylwia Łaba, and Krystian Szczepanski [1] highlighted that food losses and waste in the meat sector are a relevant and widespread issue. It is estimated that 23% of production in the meat sector is lost or wasted. The largest portion occurs at the consumption level, accounting for 64% of the total volume of food waste, followed by production (20%), distribution (12%), and primary processing (3,5%).

Animal blood, a by-product of slaughter, stands out as one of the most valuable yet relatively inexpensive secondary raw materials in terms of food and biological properties. It is abundant in a variety of organic and mineral substances, including both macro- and micro-elements. Blood composition can include up to 18% proteins, 80% water, and up to 2% non-protein substances and minerals (N.A. Velichko et al.) [2].

According to H.A. Aubakirov [3,4], in various regions of the Republic of Kazakhstan, facilities have been processing animal carcasses into meat and bone meal, examples being in the Turkestan region and Arys city. In major metropolitan areas of the republic, such as Almaty, Astana, Shymkent, Karaganda, and Taraz, animal slaughtering primarily takes place in equipped military areas, and in specialized slaughtering workshops associated with local markets and industrial combines. The utilization of these secondary raw materials as feed additives for livestock, poultry, and fish not only enhances the productivity of the animals being fed but also reduces the production costs of the final products. This is attributed to the completeness and balance of various essential nutritional substances in the feed mixtures.

Despite the current shortage of animal protein, the nutritional substances derived from bones are not being efficiently utilized. A considerable portion of the bones obtained from the meat industry is sold as they are. When bones are used inefficiently in this way, a significant part of their protein content, edible fats, and minerals remain unutilized as a food resource. In the industrial processing of bones for food purposes, the meat residues and bone fat, along with the most valuable component - proteins, are separated and used for feed and technical purposes. Bone

fat is valuable because it is rich in monounsaturated fatty acids. Compared to other fats derived from animals, it has a soft consistency, a distinctive pleasant smell and taste, and excellent emulsifying properties.

Conditions and methods of research. This study, focused on determining the composition of meat and bone meal, was carried out in a laboratory in Astana city. This was part of a collaborative effort between M.Kh. Dulaty Taraz Regional University and the JSC "Livestock and Veterinary Science and Production Center". Sample measurements were conducted using a Navigator scale from OHAUS CORPORATION, USA, and a BINDER model BD 115 drying oven was used for drying the samples. To ascertain the composition of the meat and bone meals, the FOSS NIRS ds2500 express analyzer was utilized.

Sampling and Preparation of Feed Flours, Determination of Composition of Meat and Bone Flours, were based on the following standard requirements:

- GOST 17681-82 Feed flour from animals. Test methods.
- GOST 13496.15-97. Feed, compound feed, raw materials for compound feed. Methods for determining crude fat content.
- GOST 32195-2013 (ISO 13903 2005) Feed, compound feed. Method for determining amino acid composition.
- GOST ISO 6498-2014 Feed, compound feed. Preparation of samples for tests.
- GOST 13496.3-92 (ISO 6496-83) Compound feed, raw materials for compound feed. Method for moisture determination.
- GOST 13496.4-93 Feed, compound feed, raw materials for compound feed. Methods for determining nitrogen content and crude protein.

Research results. During the research, embryos obtained as by-products during the slaughtering of horses and cattle at slaughter facilities were selectively collected (see Figures 1 and 2).

Figure 1. Measuring the Horse Embryo

Figure 2. Preparing the Horse Embryo for Drying

The weights of the foal and calf meatballs were measured using a special electronic Navigator scale (by OHAUS CORPORATION, USA) (see Figure 1). Then, after being minced and turned into minced meat (see Figure 2), they were dried in a BINDER (model BD 115) drying oven at a temperature of 50°C.

During the analysis of meat and bone flours, the composition of their ingredients was determined using the FOSS NIRS ds2500 express analyzer and a mill for preparing the powder (see Figures 3 and 4).

Figure 3. The FOSS NIRS ds2500 Device

Figure 4. Powder Preparation Mill

During the research, the composition of foal, calf, and bone flours was determined. The sample data obtained from the FOSS NIRS ds2500 express analyzer were automatically displayed on a computer monitor. The indicators of various samples displayed on the computer monitor based on the test data (see Figures 5, 6, 7) were compared with each other.

Sample Report

FOSS

Network: Mosaic

Instrument group: NIRS DS2500 group

Instrument: КАТУ имени С.Сейфуллина

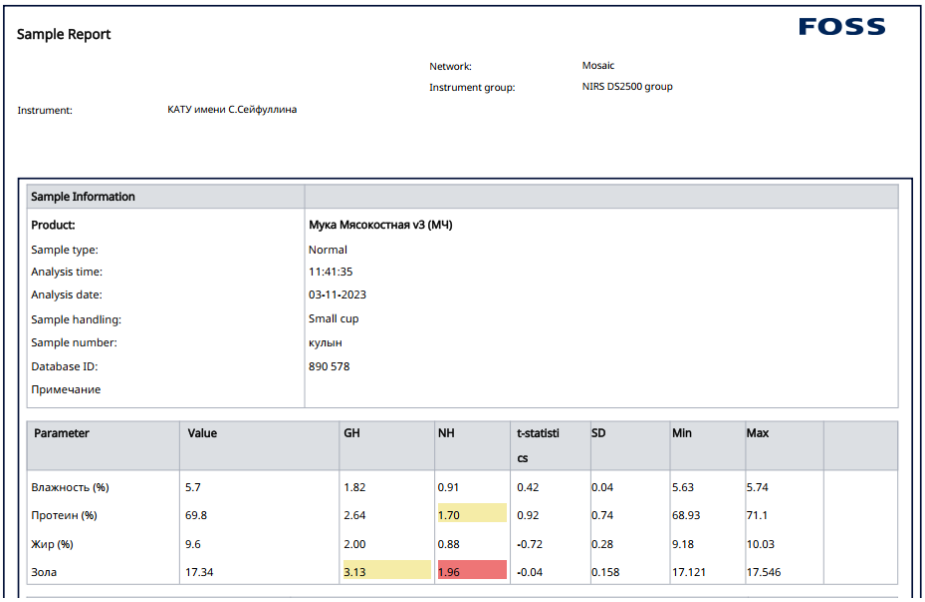
Sample Information	
Product:	Мука Мясокостная v3 (МЧ)
Sample type:	Normal
Analysis time:	11:44:12
Analysis date:	03-11-2023
Sample handling:	Small cup
Sample number:	Меруерт проба
Database ID:	890 579
Примечание	

Parameter	Value	GH	NH	t-statistics	SD	Min	Max
Влажность (%)	5.0	5.09	2.24	0.08	0.18	4.82	5.29
Протеин (%)	28.7	6.74	3.07	-3.13	1.07	27.55	30.12
Жир (%)	31.7	3.68	2.30	6.11	0.44	31.12	32.3
Зола	25.41	8.40	5.64	0.75	0.708	24.487	26.509

Figure 5. Test indicators of bone flour obtained from the express analyzer

During the analysis of the bone flour sample (see Figure 5), the total moisture content was 5 ± 0,18, crude protein (protein) – 28,7 ± 1,07, fat – 31,7 ± 0,44, and ash

content – 25,41 ± 0,708. The variation indices were respectively 0,08; -3,13; 6,11, and 0,75. The reliability of the obtained data is within the limits (P<0,01; P<0,05).



Sample Report

FOSS

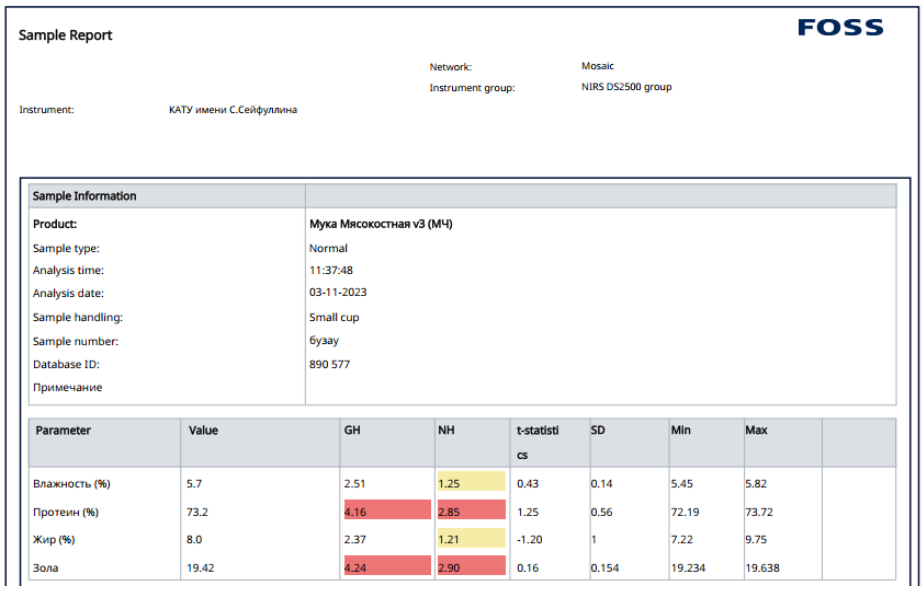
Network: Mosaic
Instrument group: NIRS DS2500 group
Instrument: КАТУ имени С.Сейфуллина

Sample Information	
Product:	**Мука Мясокостная v3 (МЧ)**
Sample type:	Normal
Analysis time:	11:41:35
Analysis date:	03-11-2023
Sample handling:	Small cup
Sample number:	кулын
Database ID:	890 578
Примечание	

Parameter	Value	GH	NH	t-statistics	SD	Min	Max
Влажность (%)	5.7	1.82	0.91	0.42	0.04	5.63	5.74
Протеин (%)	69.8	2.64	1.70	0.92	0.74	68.93	71.1
Жир (%)	9.6	2.00	0.88	-0.72	0.28	9.18	10.03
Зола	17.34	3.13	1.96	-0.04	0.158	17.121	17.546

Figure 6. Indicators of the test results for foal flour obtained from the express analyzer

The results of the analysis of the foal flour sample (see Figure 6) showed the total moisture content to be 5,7±0,04, crude protein (protein) – 69,8 ± 0,74, fat – 9,6 ± 0,28, and ash content – 17,34 ± 0,158. The variation indices were respectively 0,42; 0,92; – 0,72 and -0,04. The reliability of the obtained data is within the limits (P<0,001; P<0,01).



Sample Report

FOSS

Network: Mosaic
Instrument group: NIRS DS2500 group
Instrument: КАТУ имени С.Сейфуллина

Sample Information	
Product:	**Мука Мясокостная v3 (МЧ)**
Sample type:	Normal
Analysis time:	11:37:48
Analysis date:	03-11-2023
Sample handling:	Small cup
Sample number:	бузау
Database ID:	890 577
Примечание	

Parameter	Value	GH	NH	t-statistics	SD	Min	Max
Влажность (%)	5.7	2.51	1.25	0.43	0.14	5.45	5.82
Протеин (%)	73.2	4.16	2.85	1.25	0.56	72.19	73.72
Жир (%)	8.0	2.37	1.21	-1.20	1	7.22	9.75
Зола	19.42	4.24	2.90	0.16	0.154	19.234	19.638

Figure 7. Indicators of the test results for calf flour

The results of the analysis of the calf flour sample (see Figure 7) indicated the total moisture content to be 5,7±0,14, crude protein (protein) – 73,2 ± 0,56, fat – 8,0 ± 1,0 and ash content – 19,42 ± 0,154. The variation indices were respectively 0,43; 1,25; – 1,20 and 0,16. The reliability of the obtained data is within the limits (P<0,01).

In research, we analyzed data on the nutritional norms of compound feed in the diet of broiler chickens at different stages of growth and development (Table 1).

Table 1

Nutritional norms of complete ration compound feed

Meat chicks	Food unit	Exchange energy	Protein	Cellulose	Mineral elements			Amino acids	
					calcium	phosphorus	sodium	lysine	Methionine + cystine
5-30 days	-	1215	21-23	5,5	0,9-1,0	0,8	0,35-0,40	1,0	0,70
31-56 days	-	1215	19-21	5,5	0,7-0,8	0,7-0,9	0,35-0,40	0,90	0,60

Animal feed flour derived from animals should conform to the requirements outlined in Table 1, as per organoleptic, physicochemical, and bacteriological indicators.

In calculating the nutritional value of compound feed, data from tables on feed units (or metabolizable energy), digestible protein, crude fiber, fat, minerals, and amino acid content are utilized.

Table 2

The maximum norm for incorporating certain components into compound feed for agricultural poultry, in grams

Feed type	Adult bird	Young bird (chick)
Blood flour	5	5
Meat and bone flour	10	7
Bone flour	2	2
Crude fat	7	5

Based on the nutritional values listed in Table 2 for compound feed, a daily feed norm (ration) suitable for chickens or their chicks is developed. If the results meet the nutritional requirements for compound feed, the recipe is deemed correctly formulated and approved for production. Subsequently, the composition of the enriching mixture is verified according to the standards specified in the recipe. For young chicks, it is advisable to include 5 grams of blood flour, 7 grams of meat and bone flour, 2 grams of bone flour, and 5 grams of crude fat in their diet.

Discussion of scientific results. The study of technologies for obtaining and processing secondary animal products to prepare a nutritional additive suitable for feeding broiler chicks with high-quality food waste is a pertinent issue arising from contemporary demands. This is essential for the development of feed mixtures that effectively nourish meat-oriented poultry chicks. For this purpose, the significance

of utilizing raw material sources such as unused bones, blood, the lower parts of legs, lungs, and tracheas (in horses), tails (in horses, cattle, pigs, etc.), and meatballs from pregnant animals, which are often discarded during the slaughtering of animals, is substantial. Up to now, such by-products at animal slaughter facilities and enterprises have frequently been treated as waste and discarded. However, these secondary raw materials are exceptionally rich in essential nutrients for the body, including proteins, essential amino acids, carbohydrates, hormones, enzymes, vitamins, and mineral elements.

The analysis of data indicates that the protein content in calf flour is 73,2%, in foal flour it is 69,8%, and in bone flour, it is 28,7%. It is noteworthy that the sample with the highest protein content – 73,2% - is from the foal meatball. Among the samples, the one prepared from bone flour showed the lowest protein content at 28,7%.

The determination of crude fat content in various samples yielded the following results: the fat content in foal flour was 9,6%, in calf flour it was 8,0%, and in bone flour, it was 31,7%. The study found that while the sample made from bone flour was rich in fat (31,7%), the sample with the least amount of crude fat (8,0%) was from the calf meatball.

Conclusion. At meat processing enterprises of varying productivity levels, the implementation of technologies that ensure the full utilization of nutritional reserves is essential. When selecting suitable technologies, it is important to consider the morphological and chemical compositions of the raw materials being processed. These compositions depend on the types of meat used in production, the availability of specialized equipment, and the marketability of the final products.

Currently, a technology for processing the by-products of slaughtering agricultural animals is under development, along with a new compound feed mixture. This development forms the foundation for creating a recipe designed for rapid weight gain in meat birds. We have concluded that feed additives derived from animals, even in small quantities, enhance the digestibility of plant-based foods that constitute the primary component of compound feed.

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ЖЕМ ҚОСПАСЫНА АРНАЛҒАН ЕТТІ-СҮЙЕК ҰНДАРЫНЫҢ ҚОРЕКТІК ҚҰРАМЫН АНЫҚТАУ НӘТИЖЕЛЕРІ

Аңдатпа. Мақалада құнарлығы жоғары тағамдық қалдық өнімдерінен етті бағытындағы құс балапандарын қоректендіруге лайықты азықтық қоспа дайындауда мал сою бекеттеріндегі қалдық өнімдер құрамын пайдалану мәселесі қарастырылған. Түрлі жануарлар (құлын, бұзау және сүйек ұндары) қалдықтарының сынамалары құрамындағы ылғалдылық көрсеткішін, ақуыз, шикі май және күл мөлшерін анықтау нәтижелері берілген. Атап айтқанда, құлын ұнындағы май мөлшері – 9,6%, бұзау ұнындағы май мөлшері – 8,0% және сүйек ұнындағы май мөлшері – 31,7% құрады. Зерттеу барысында сүйек ұнынан дайындалған үлгі майға бай келсе (31,7%), ең аз көлемді шикі май (8,0%) бұзау шаранасынан дайындалған ұн үлгісінде екендігі анықталды. Алынған мәліметтер ауыл шаруашылығы жануарларын союдың қалдық өнімдерін қайта өңдеу арқылы жаңа құрама жем қоспасы әзірленеді де, соның негізінде етті құстардың салмағын тез өсіретін рецептура жасауға мүмкіндік туады.

Тірек сөздер: жем қоспасы, екіншілік өнім, құлын эмбрионынан жасалған ұн, бұзау ұны, сүйек ұны, азық құнарлығы, ақуыз құрамы, шикі май құрамы.

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РЕЗУЛЬТАТЫ ОПРЕДЕЛЕНИЯ ПИТАТЕЛЬНОГО СОСТАВА МЯСОКОСТНОЙ МУКИ ДЛЯ КОРМОВОЙ СМЕСИ

Аннотация. В статье рассмотрен вопрос использования отходов убойных пунктов для приготовления кормовой добавки с целью кормления цыплят мясного направления высокопитательным кормом. Приведены результаты определения показателя влажности, содержания белка, сырого жира и золы в пробах отходов различных животных (жеребят, телят и костной муки). В частности, содержание жира в муке жеребенка составило 9,6%, содержание жира в муке теленка – 8,0% и содержание жира в костной муке – 31,7%. Исследование показало, что если образец, приготовленный из костной муки, богат жиром (31,7%), то наименее объемное сырое масло (8,0%) находится в образце муки, приготовленной из телячего зародыша. Полученные данные свидетельствуют о том, что путем переработки отходов убоя сельскохозяйственных животных разрабатывается новая комбикормовая смесь, на основе которой создается рецептура быстрого увеличения веса мясных птиц.

Ключевые слова: кормовая смесь, вторичный продукт, мука из зародышей жеребенка, телячья мука, костная мука, кормовая фертильность, содержание белка, содержание сырого жира.