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RESEARCH ARTICLE

Technologies for Processing Unfermented Grape Pomace in Compound Feed Production

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ABSTRACT

This article addresses processing technologies of unfermented grape pomace into a feed ingredient. Grape pomace accounts for up to 25% of the processed grape mass, representing a by-product of winemaking and a valuable raw material resource. The study analyzes the current state of research on grape pomace processing, including its chemical composition characterized by the presence of polyphenols, organic acids, dietary fiber, as well as macro- and microelements. In the experimental part of the study, a capillary electrophoresis system ("Kapel 105-M") was used to assess the amino acid composition. Using this system, the amino acid profile of poultry compound feed was analyzed with the inclusion of dried and ground grape pomace and seeds. The effect of three inclusion levels (10%, 17.5%, and 25%) was evaluated. Granulometric composition of the samples was analyzed, including determination of the fineness modulus and particle size distribution across fractions. A relationship between the content of essential amino acids and the inclusion level of grape pomace was established, supporting its use as a feed additive.

INTRODUCTION

The growth in food production required to ensure food security inevitably leads to an increase in the volume of waste generated by the processing industry. This creates significant economic and environmental challenges, as the disposal of such waste streams requires substantial costs. The problem of the comprehensive and rational utilization of secondary resources of the food industry is observed in all countries with a developed food sector [1]. This issue necessitates not only effective waste disposal but, more importantly, its recycling and valorization. Food waste that, after processing, becomes a source of valuable components is commonly referred to as "secondary material resources" [3]. A key step in addressing this problem is the development of technologies that enable not merely the disposal of waste, but its integration into economic circulation as a valuable raw material. For example, press residues, oilseed cakes, and other by-products of food processing can serve as sources of nutrients for animal feed, valuable bioactive additives, as well as raw materials for biofuels and organic fertilizers [2].

By-products of viticulture have found extensive application across various sectors of the economy. Their broad applicability is due to the presence of diverse biologically active compounds. During grape processing in the wine and non-alcoholic beverage industries, a substantial amount of waste is generated (15–20%) [3], the rational utilization of which enables the recovery of additional food components of considerable interest and value for different industries [4]. In particular, grape pomace is rich in structural polysaccharides, a complex of phenolic compounds, and contains significant amounts of residual proteins, lipids, and essential amino acids. The presence of these valuable components provides not only nutritional but also functional biological value of this raw material [5].

Within the context of modern agro-industrial development, the task of designing resource-saving technologies and scientifically substantiated formulations for feed and feed additives is of particular relevance [6]. Grape pomace (grape marc), a high-yield by-product of winemaking, is considered a promising raw material for the compound feed industry. Its incorporation into feed formulations allows for the partial replacement of expensive ingredients, contributing to the preservation of nutritional value while reducing production costs [1,7]. The aim of this study is to provide a scientific substantiation for the use of dried and milled grape pomace and grape seeds as unconventional feed ingredients in poultry compound feed formulations. A key aspect of the research is the evaluation of the effect of incorporating these components at different inclusion levels on the amino acid composition of the feed mixture, as one of the most important indicators of its nutritional and biological value.

LITERATURE REVIEW

Recent scientific literature considers grape pomace as a promising component of feed additives for farm animals, including poultry. A number of studies indicate that the inclusion of dried grape pomace in compound feed formulations can positively affect the physiological status of poultry as well as the quality of derived products.

As noted above, grape pomace is a rich source of polyphenols and is therefore of interest as a feed additive for enriching animal diets with antioxidants. The study in [8] aimed to evaluate the effect of including 50 g/kg of grape pomace in the diet of laying hens. The experiment assessed productive performance, internal and external egg quality parameters, and the content of vitamins A, E, and gallic acid in the yolk. The results demonstrated that pomace supplementation improved yolk color, which reflects enhanced internal egg quality. No significant effect on vitamin content in the yolk was observed. However, the concentration of gallic acid increased, suggesting that certain phenolic compounds from the diet can be transferred into eggs, thereby improving their quality. At the same time, the accumulation of such polyphenols was associated with a reduction in eggshell thickness.

Thus, the use of grape pomace in poultry feeding can be considered a promising approach for producing eggs enriched with phenolic antioxidants and improved internal quality characteristics. However, its application requires careful monitoring of eggshell strength parameters.

The study in [10] confirmed the high value of winery by-products as an alternative to conventional feed additives due to their strong antioxidant potential. The research evaluated the effect of grape flour obtained from pomace and seeds in broiler diets with the aim of modulating physiological parameters. Poultry were fed diets supplemented with 3% and 6% pomace, 3% and 6% grape seeds, as well as their mixtures over periods of 7, 21, and 42 days. Blood analysis revealed that all tested additives induced significant changes in enzyme activity (esterases, alkaline phosphatase, peroxidase) and metabolite levels (glucose, reactive oxygen species, glutathione). The most pronounced positive effect was observed with grape seed flour, particularly after 21 and 42 days of feeding. These findings confirm that winery by-products possess considerable antioxidant activity and can be safely incorporated into poultry diets at different growth stages, contributing to improved physiological status.

Inulin and grape pomace are also actively studied as feed additives capable of influencing poultry productivity. The study in [11] evaluated the individual and combined effects of 10 g/kg inulin and 50 g/kg grape pomace on broiler performance, immunity, and antioxidant status. A 42-day experiment conducted on Ross 308 broilers showed no significant effects on weight gain, carcass yield, or intestinal viscosity. However, both additives positively influenced the antioxidant defense system: grape pomace increased catalase activity, while inulin elevated beta-carotene levels. Additionally, an increase in ascorbic acid and tocopherol concentrations in the bloodstream was observed under the influence of both components. Therefore, although both inulin and grape pomace enhance antioxidant protection, their combined use should be limited.

Phytogenic feed additives are natural sources of various bioactive compounds, including essential oils, flavonoids, and plant tannins. They are increasingly used in animal husbandry and poultry production as natural growth promoters and as alternatives to antibiotics, improving productivity by suppressing pathogenic intestinal microflora and enhancing feed utilization. The study in [12]

investigated the effect of 0.2% chestnut and grape pomace extracts on the performance of 864 broilers, as well as on meat quality and intestinal immune response, considering age and sex factors. The results showed that the additive significantly improved growth performance and enhanced mucosal immune response in the intestine. Moreover, age and sex were associated with the most pronounced transcriptional changes.

It should be emphasized that grape pomace represents a valuable secondary resource due to its high content of bioactive compounds. The authors of [13] systematized current knowledge on the chemical composition of grape pomace and its potential applications. The study provides an analysis of key groups of biologically active compounds, including polyphenols, anthocyanins, and dietary fiber, which contribute to antioxidant activity and other beneficial properties. Considerable attention is also given to modern "green" extraction technologies that enable efficient recovery of valuable components while minimizing environmental impact.

Currently, winery by-products are finding applications far beyond their traditional uses. The successful implementation of such approaches encourages producers to adopt environmentally sustainable practices. As the industry increasingly embraces these innovations, the potential for broader application in agriculture and other sectors continues to expand, contributing to the development of more sustainable production systems.

MATERIALS AND METHODS

In this study, white grape pomace obtained from two cultivars of Don breeding, Platovskiy and Pukhlyakovskiy, was used as the raw material for the feed additive. These cultivars belong to the breeding program of the Ya. I. Potapenko All-Russian Research Institute of Viticulture and Winemaking. It should be emphasized that the pomace was unfermented, which provides an advantage over fermented material due to the preservation of its original chemical composition, unaffected by fermentation processes.

At the initial stage, grape seeds were separated from the pomace to enable their independent utilization. Subsequently, both fractions were dried in accordance with GOST 13586.5–2015 "Grain. Method for determination of moisture content." This approach ensured the preservation of nutrients and prevented spoilage during storage. The standardized drying procedure minimized the degradation of thermolabile compounds.

Particle size distribution represents a critical technological and physiological parameter in feed production, as it directly affects mixture uniformity, feed intake, and digestibility. The optimal particle size enhances the bioavailability of nutrients.

In accordance with GOST 18221–99 "Complete compound feeds for agricultural poultry. Specifications," for laying hens older than 14 weeks, the residue on a sieve with openings of 3 mm in diameter should be at least 2%, and the proportion of whole grains should not exceed 0.5%. As an upper limit, the requirements for broilers were adopted, namely a residue on a 3 mm sieve not exceeding 15% and whole grains not exceeding 0.5%. For pomace, the coarse fraction was removed, as prolonged grinding or increased mill rotation speed leads to the formation of excessive fine (dust-like) fractions.

The particle size distribution of the ground dried grape seeds was as follows: less than 1 mm, 59.45%; 1–2 mm, 25.35%; 2–3 mm, 14.65%. The proportion of whole and insufficiently ground seeds did not exceed 0.5%.

A sample with n = 400 g was subjected to quartering, followed by the selection of subsamples of 100 g each for granulometric analysis. The confidence probability was P = 0.95, with three replicates analyzed.

Table 1: Particle Size Distribution of Samples

Types of raw materials	**Particle size distribution, % (mean values)**			
	Particle size range, mm			
	Δ>3	2<Δ<3	1<Δ<2	Δ<1
Compound feed	1.2	19.51	29.27	50
Pomace	4.74	44.02	35.26	15.98
Grape seeds	0.5	14.65	25.35	59.45

For such specific components as dried and milled grape pomace, control of particle size distribution is particularly important, as it determines uniform incorporation into the feed mixture and, consequently, the stability of the nutritional and functional properties of the final compound feed.

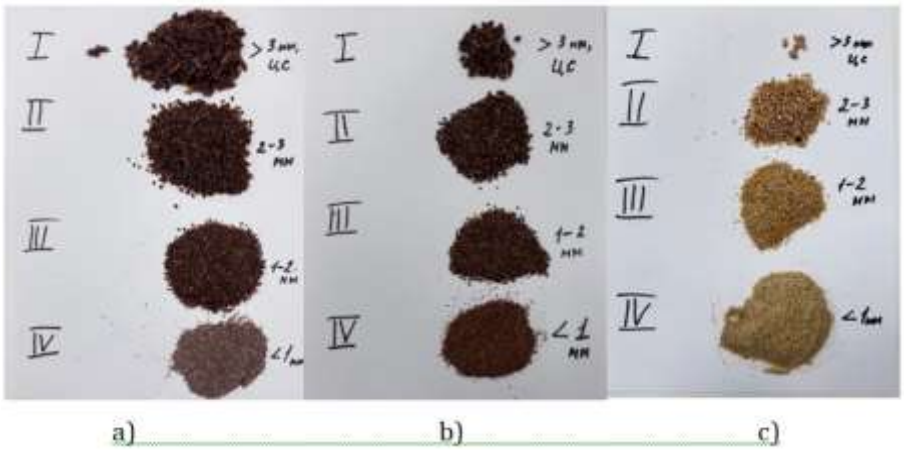

Figure 1: Particle size distribution of samples:

a) Particle size distribution of grape seeds; b) particle size distribution of pomace; c) particle size distribution of compound feed

Particle size refers to the size of ingredient particles included in the feed, i.e., the degree of grinding prior to consumption by animals. This parameter is typically characterized by the geometric mean diameter, which indicates the average particle size, and the standard deviation, which reflects the variability of particle size within the mixture.

Although both the mean diameter and standard deviation depend on the particle size distribution of all ingredients in the diet, most feed mills primarily grind plant-based components, which constitute the largest proportion of the ration. Given their substantial influence on both feed efficiency and diet cost, it is essential that these ingredients are optimally ground.

A uniform particle size distribution prevents mixture segregation, ensures accurate dosing of additives such as vitamins and premixes, and enhances the efficiency of subsequent processing operations, including pelleting and extrusion. Therefore, particle size control is a critical prerequisite for the production of high-quality, safe, and economically efficient compound feed [9].

Based on prior data regarding the incorporation of pomace flour, the minimum and maximum inclusion levels of premixes in the final compound feed were determined. The experimental study was conducted using a design of experiments approach. A complete compound feed in crumble form was used as the reference sample, containing wheat groats, soybeans, soybean meal, fish meal, corn gluten, sunflower oil, and vitamins A, B, and C, among others. The experimental design is presented in Table 2. To ensure reliability of the results, a confidence probability of 0.95 was adopted, with three experimental replicates.

Table 2: Experimental Design

Experiment No.	Compound feed, g	Pomace, %	Grape seeds, %
1	50	25	25
2	50	17.5	17.5
3	50	10	10

The application of this method is обусловлена → The application of this method is due to the need to minimize the number of experiments while maintaining high reliability of results and enabling the development of a mathematical model of the process. Experimental design makes it possible not only to empirically determine the formulation but also to identify interactions between components, assess the significance of each factor, and transition from isolated trials to a systematic scientific approach.

A key aspect of the study was the evaluation of the effect of grape seed and pomace inclusion on the nutritional value of feed mixtures, particularly their amino acid profile [14]. To address this objective, the experimental work was carried out at the Laboratory of Biochemical and Spectral Analysis of Food Products of the Agro-Industrial Faculty of Don State Technical University.

The selection of analytical methods was determined by the need to obtain high-precision data on amino acid content in the studied samples. Therefore, capillary electrophoresis using the "Kapel-105M" system [15] was employed as the primary analytical technique.

The use of this equipment is justified by its high sensitivity and efficiency in the separation and quantitative determination of amino acids, which enabled reliable assessment of changes in the composition of feed mixtures depending on the concentration of the added components, namely grape seeds and pomace.

Figure 2: Capillary electrophoresis system "Kapel-105M"

The amino acid composition of the feed mixtures was analyzed by capillary electrophoresis using the "Kapel-105M" system in accordance with GOST R 52347–2005. Several samples with varying contents of grape pomace and grape seeds were examined, with the exact proportions presented in Table 1.

Sample No. 1 (0.1 g) was mixed with 10 cm^3 of hydrochloric acid (1:1) in a sealed vial with a septum. All samples were subjected to hydrolysis in a drying oven at 110°C for 16 h. After hydrolysis, the samples were cooled and filtered through a "blue ribbon" filter.

Aliquots of the hydrolysates (50 mm^3 from Sample No. 1) were evaporated to dryness in weighing dishes under a stream of warm air. The dry residue was sequentially treated with 150 mm^3 of

Na_2CO_3 and 300 mm^3 of FITC, incubated for 35 min at room temperature, then re-evaporated and dissolved in 500 mm^3 of distilled water.

Figure 3: Sample preparation for analysis after acid hydrolysis

Prior to analysis, the solutions were centrifuged at 5000 rpm for 5 min. The capillary system was rinsed with the background electrolyte for 3 min, followed by electrophoretic separation and quantitative determination of amino acids in the studied feed mixtures.

Analysis of amino acid composition is required to assess how the inclusion of grape pomace or grape seeds affects the protein nutritional value of the feed mixture [16]. Grape by-products contain not only fiber and polyphenols but also a certain amount of protein.

These data are essential for evaluating the effectiveness of a given additive in supplementing the feed mixture with limiting amino acids such as lysine, methionine, and threonine. This is essential for precise diet formulation, as an additive may enrich the feed with certain amino acids while creating imbalances in others, necessitating adjustments to the formulation [16, 17].

RESULTS OF THE STUDY

The objective of the experiment was to evaluate the effect of unconventional additives on the nutritional value of poultry diets. Various inclusion levels of dried and milled grape pomace and grape seeds were incorporated into the basal compound feed, and the resulting changes were assessed. The range of concentrations studied was selected in accordance with recommendations for the inclusion of plant-derived raw materials in poultry feed and amounted to 10%, 17.5%, and 25% of the total mass. The primary parameter under investigation was the amino acid profile of the resulting feed mixtures, as both the content and balance of amino acids determine the biological value of feed protein.

The experimental data obtained from laboratory analyses were systematized and processed. For clear presentation and comparative analysis of the effect of different inclusion levels of grape-derived additives on the content of each identified amino acid, all quantitative indicators were summarized in Table 3. This table makes it possible to trace the dynamics of changes in the concentrations of both essential and non-essential amino acids depending on the type of additive, pomace or grape seeds, and its proportion in the diet.

Table 3: Summary of Experimental Results

Amino acid	Compound feed	Grape seeds 25 %	Pomace 25 %	Grape seeds 17.5 %	Pomace 17.5 %	Grape seeds 10 %	Pomace 10 %
Arginine	2.61	8.195	4.353	8.386	7.558	6.796	9.444
Lysine	10.81	13.76	4.746	24.8	17.16	13.04	25.17
Tyrosine	0.6424	0.2432	0.2405	4.099	4.033	3.686	5.397
Phenylalanine	8.874	10.4	5.887	6.61	5.919	5.629	7.662
Histidine	2.888	3	0.8747	4.709	3.736	3.237	5.364
Leucine and isoleucine	12.68	13.58	6.662	16.66	14.82	13.5	19.36
Methionine	5.803	5.353	2.2	2.557	1.624	1.617	4.065
Valine	15.02	12.77	12.3	8.442	7.213	6.466	9.613
Proline	0.495	1.479	0.693	4.666	4.239	4.09	4.86
Threonine	18.48	12.89	6.642	14.39	8.743	6.876	12.79
Glycine	5.293	6.002	2.885	7.469	6.916	5.793	9.035

To visualize the obtained data and demonstrate the effect of the studied parameters on the overall amino acid composition of the feed mixture, Figure 4 was constructed.

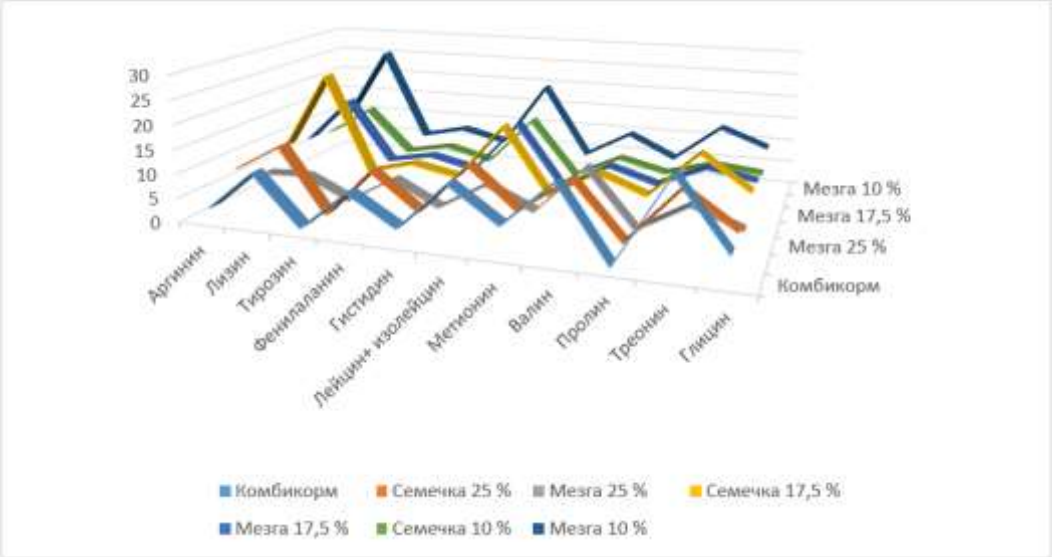

Figure 4: Summary graph of experimental results

The inclusion of ground grape seeds in compound feed had a significant effect on the amino acid profile. The best overall results were obtained at a seed inclusion level of 17.5%.

At this concentration, an increase in key amino acids was observed, including lysine (from 10.81% to 24.8%), arginine (from 2.61% to 8.386%), the sum of leucine and isoleucine (from 12.68% to 16.66%), and glycine (from 5.293% to 7.469%). At the same time, increasing the seed content to 25% led to a decrease in valine and threonine concentrations, confirming the importance of determining an optimal inclusion level.

Regarding the effect of pomace on the amino acid profile, the optimal level was 10%, at which the highest values were recorded for lysine (25.17%), leucine plus isoleucine (19.36%), histidine (5.364%), and arginine (9.444%). Increasing the pomace content to 25% resulted in a sharp decline in most indicators, for example, lysine decreased to 4.746%.

A comparative analysis of the two additives indicates that grape seeds are more effective for amino acid enrichment, providing a stable increase at a 17.5% inclusion level. Pomace demonstrates positive effects only at low inclusion levels (approximately 10%), whereas higher concentrations reduce the nutritional value of the feed. It is also noteworthy that increasing the concentration of both additives in some cases led to a reduction in methionine and valine content. This indicates the need for additional diet balancing through the inclusion of synthetic amino acids or alternative sources of limiting amino acids.

DISCUSSION

The study revealed a differentiated effect of grape processing by-products on the amino acid composition of compound feeds, which is attributed to differences in the chemical composition of grape seeds and pomace.

A nonlinear relationship between additive concentration and changes in the amino acid profile was observed. The increase in most essential amino acids at moderate inclusion levels, 10% for pomace and 17.5% for grape seeds, is associated with an optimal balance between the protein of the additive and the components of the basal diet. The decline in amino acid levels at a 25% inclusion rate is likely related to the high content of ballast substances, primarily fiber and polyphenols, which can bind proteins into poorly digestible complexes and hinder their degradation. Grape seeds demonstrate a more stable enrichment effect due to their higher content of storage proteins.

Pomace, which contains a significant proportion of skins and stems, is characterized by an elevated content of fiber and polyphenols and is therefore effective only at low inclusion levels of around 10%. Increasing its proportion to 25% results in the predominance of ballast components, as evidenced by a marked decrease in lysine content, an amino acid particularly sensitive to binding by polyphenols.

The experimental results demonstrate that the incorporation of grape processing by-products into poultry feed formulations can significantly enhance the amino acid profile. Grape seeds and pomace act as biologically active additives capable of targeted modification of amino acid composition; however, their effectiveness depends on precise dosage and requires consideration of associated ballast compounds.

The most pronounced positive effect was achieved with the inclusion of 17.5% ground grape seeds or 10% ground pomace. Exceeding these levels, particularly in the case of pomace, leads to a reduction in critical amino acids due to the high content of fiber and polyphenols, which reduce protein availability. These findings highlight the need for precise dosing of grape-derived additives in compound feed production and may be used to optimize formulations to improve their nutritional value.

CONCLUSION

In modern poultry production, alternative feed ingredients are increasingly utilized, driven by the need to reduce dependence on conventional feed resources, lower production costs, and implement waste-free technologies [18]. Among such raw materials, winery by-products, particularly grape pomace consisting of seeds and skins, are of particular interest. These by-products are generated in substantial quantities annually, making their disposal a significant challenge [19]. Recent studies indicate that grape pomace contains considerable amounts of proteins, lipids, fiber, and polyphenols, which exhibit antioxidant, antimicrobial, and anti-inflammatory properties [1,4]. As a result, grape pomace can be considered not merely a filler, but as a biologically active additive capable of influencing metabolism, immune response, and productive performance in poultry [20]. Review studies indicate that the inclusion of pomace in broiler diets may improve meat quality and physiological functions; however, the outcomes are strongly dependent on dosage, age, and breed characteristics [19].

In the present study, the suitability of ground grape seeds and pomace for enhancing the nutritional value of poultry diets was evaluated. It was established that the appropriate selection of inclusion levels allows for significant enrichment of feed mixtures with essential amino acids, particularly lysine, arginine, and the combined fraction of leucine and isoleucine.

The results also demonstrated that the effect depends on both the type and the concentration of the additive. The most favorable outcomes were obtained with the inclusion of 17.5% ground grape seeds or 10% pomace. Exceeding these levels, especially in the case of pomace, resulted in a reduction in the content of several amino acids. This effect is likely associated with the high levels of fiber and polyphenols, which can bind proteins into poorly digestible complexes.

The identified nonlinear relationship between additive concentration and changes in the amino acid profile highlights the necessity for precise dosage in compound feed production. The observed decrease in methionine and valine at higher inclusion levels of both additives requires additional formulation adjustments, as deficiencies in these amino acids may offset the benefits of enrichment.

The findings obtained can be applied in the development of compound feed formulations for poultry incorporating grape processing by-products. Further research should focus on the digestibility and bioavailability of amino acids in enriched feed mixtures, as well as on the evaluation of their effects on productivity indicators and physiological status of poultry.

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REFERENCES

Artamonov Effect of the dietary supplementation with extracts of chestnut wood and grape pomace on performance and jejunum response in female and male broiler chickens at different ages / A. Pascual, M. Pauletto, A. Trocino [et al.] // Journal of Animal Science and Biotechnology. – 2022. – Vol. 13, No. 1. – P. 1-17

Enriching Eggs with Bioactive Compounds through the Inclusion of Grape Pomace in Laying Hens Diet: Effect on Internal and External Egg Quality Parameters / B. Herranz, C. Romero, I. Sánchez-Román [et al.] // Foods. – 2024. – Vol. 13, No. 10. – P. 1553.

Evaluation of winemaking waste as secondary raw materials for the production of food products with enhanced biological activity / O. A. Chursina, M. G. Tkachenko, V. A. Taran [et al.] // Magarach. Viticulture and winemaking. - 2014. - No. 2. - Pp. 33-36.

Kholodova, T. A. Influence of the chemical composition of grape pomace on their further comprehensive use / T. A. Kholodova, E. V. Shcherbakova // Scientific support for the agro-industrial complex: Collection of articles based on the materials of the 79th scientific and practical conference of students on the results of R&D for 2023. In 2 parts, Krasnodar, April 25, 2024. – Krasnodar: Kuban State Agrarian University named after I.T. Trubilin, 2024. – Pp. 858-861.

Kruchinina, D. D. Analysis of the implementation of secondary processing at food enterprises in the Russian Federation / D. D. Kruchinina, E. D. Danchenko // New conceptual approaches to solving the global problem of ensuring food security in modern conditions: Collection of scientific articles of the 13th International Scientific and Practical Conference, Kursk, November 14, 2025. – Kursk: South-West State University, 2025. – Pp. 107-111.

Mechanization of concentrated feed preparation / D. A. Nekhoroshev, M. A. Biryukov, N. D. Nekhoroshev, D. D. Nekhoroshev // Innovative technologies in the agro-industrial complex in the context of digital transformation: Proceedings of the International Scientific and Practical Conference, Volgograd, February 13–14, 2025. – Volgograd: Volgograd State Agrarian University, 2025. – pp. 68–74.

Novel application and industrial exploitation of winery by-products / E. Kalli, I. Lappa, P. Bouchagier [et al.] // Bioresources and Bioprocessing. – 2018. – Vol. 5, No. 1. – P. 1-21.

Processing and use of secondary and low-value resources in the food industry / S. A. Sokolov, V. S. Kosachev, N. N. Sevatorov [et al.]. - Kerch: Operational printing house, 2023. - 231 p.

Production of domestic compound feed using non-traditional types of raw materials from processing and food industries / Zh. S. Alimkulov, M. T. Velyamov, T. M. Sarmankulov, T. M. Zhumalieva // Bulletin of the Almaty Technological University. – 2019. – No. 4. – Pp. 34-37.

Şen, G. Effects of Using Inulin and Grape Pomace in Broiler Diets on Performance, Carcass Yield, Intestinal Viscosity, Immunity, and Antioxidant Status / G. Şen, M. Başalan // Journal of the

Hellenic Veterinary Medical Society. – 2022. – Vol. 73, No. 3. – P. 4583-4592. – DOI 10.12681/jhvms.28031

Shkrabtak, N. V. Rational use of secondary resources in the food industry / N. V. Shkrabtak // Proceedings of the International Scientific and Practical Conference named after D.I. Mendeleyev, dedicated to the 60th anniversary of Tyumen Industrial University: Collection of conference articles. In 3 volumes, Tyumen, November 21-23, 2024. – Tyumen: Tyumen Industrial University, 2025. – Pp. 161-163.

Silage from viticulture waste in feeding ewes / M. P. Alikhanov, M. M. Alilov, Sh. M. Sharipov, G. M. Magomedov // State and prospects of development of the agro-industrial complex: Anniversary collection of scientific papers of the XV International scientific and practical conference, Rostov-on-Don, March 2–4, 2022 / Editorial board: I. M. Donnik [et al.]. – Rostov-on-Don: Limited Liability Company "DSTU-PRINT", 2022. – pp. 344–348.

The Effects of Red-Grape Seed and Pomace-Flour Dietary Supplementation on Broiler Chickens / M. Mauro, M. Vazzana, A. Attanzio [et al.] // Sustainability. – 2023. – Vol. 15, No. 23. – P. 16289. – DOI 10.3390/su152316289.