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Effect of probiotic *Zoovit* LL and a combination of herbs on daily milk yield, physicochemical composition, somatic cells in milk and biochemical blood parameters in sheep Synthetic population Bulgarian dairy

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Abstract: The aim of the experiment was to investigate the effect of the addition of the probiotic *Zoovit* LL and a combination of the herbs nettle+chamomile on the daily milk yield, physicochemical properties, somatic cells in milk and biochemical blood parameters in Bulgarian dairy sheep from the synthetic population. The experiment was conducted at the Agricultural Institute in Stara Zagora, Bulgaria.

Significantly higher ($P<0.05$) daily milk yield in the group receiving the herbal supplement nettle+chamomile and the probiotic group ($P<0.01$). A higher level of dry non-fat residue ($P<0.05$), a higher lactose content ($P<0.05$), as well as a higher number of somatic cells in the probiotic group ($P<0.01$) were reported.

In the group receiving the probiotic *Zoovit* LL, a decrease in albumin ($P<0.001$), alanine aminotransferase ($P=0.001$), cholesterol ($P<0.01$), calcium ($P<0.05$), globulin and a higher concentration of phosphorus ($P<0.05$) were observed in the group consuming the herbal supplement.

Keywords: Synthetic population Bulgarian milk; probiotic; nettle; chamomile; milk composition; blood

INTRODUCTION

The increasing production of animal feed has raised the issue of the use of antibiotics as growth promoters and prevention of various diseases in farm animals. The long-term use of antibiotics in animals has caused widespread concern due to the development of resistant bacteria and the accumulation of antibiotic residues in animal products. In order to avoid the spread of antimicrobial resistance (AMR), finding an effective alternative to antibiotics has become an urgent need. Recent reports discuss alternative approaches that can be used to control AMR, including probiotics, prebiotics, antimicrobial peptides, essential oils. Probiotic therapies are currently an alternative to address the problems associated with increasing resistance due to the ability of probiotics to modulate the intestinal microbiota and the host immune system, as well as their ability to act as a growth factor.

In Bulgaria, one of the most widespread breeds is the Synthetic Population Bulgarian Dairy Sheep, which is the subject of numerous studies. Miteva et al. (2021), Stancheva et al. (2022), Miteva et al. (2023), Stancheva and Dimitrova (2024) study of milk yield, physicochemical properties of milk and factors that influence them.

According to Nalla et al. (2022), the use of probiotics to maintain the general health, immunity and nutritional needs of dairy animals could provide a sustainable solution to mitigate some of these problems.

Khattab et al. (2020) reported that when adding a probiotic to the ration of sheep, no significant differences were observed in the qualitative

composition of milk in terms of fat and milk sugar. Al-Shaar et al. (2023), using a combination of probiotic+enzymes, reported quantitative changes in milk yield, but no difference in its qualitative composition. Zaleska et al. (2015) found that the addition of a yeast-based probiotic significantly increased daily milk yield, milk fat and protein.

Claire et al. (2015) found that probiotic-treated goats had higher milk yield, but no differences were found in protein, fat, dry non-fat residue, and lactose. Payandeh and Kafilzadeh (2017) found no significant differences in milk yield and milk composition of sheep when probiotics were added to the diet, in contrast to El-Hawy et al. (2019), who reported an increase in milk yield ($P<0.05$).

In the past few years, the use of herbal products in the nutrition of productive animals has increased.

Stinging nettle (*Urtica dioica*) is one of the most popular herbs. The effect of using nettle in dairy animals has been reported by Humphries et al. (2014), Andualem et al. (2016), Fiol et al. (2016) and Gülhan et al. (2024). Khanal et al. (2017) found an increase in milk yield in dairy cows fed nettle supplements and a positive effect on milk quality.

Moghazy et al. (2018) and EL-Ghousein, (2010) describe the use of chamomile (*Matricaria chamomilla*). Ahmed et al. (2019) reported that adding chamomile to goats' diets increased milk fat content. Khattab et al. (2018) found that chamomile supplementation had a positive effect on the composition and daily milk yield of sheep and a decrease in somatic cell count.

Bronisław and Jarzynowska (2016) found no changes in the main chemical components of milk when herbs were added to sheep's feed. Wójtowski et al. (2025) found a positive effect of herbal mixtures on fat and protein content ($P<0.05$) in goats.

Khamisabadi and Fazaeli (2021) reported higher milk yield in sheep fed with herbal supplements, as well as an increase in dry matter and protein.

According to Gabr et al. (2023), the total somatic cell count in milk decreased, when a herbal mixture was added to the daily ration of lactating goats.

When adding water hyacinth to the diet of goats and sheep, Fanta et al. (2024) reported significant differences in aspartate aminotransferase, albumin and globulin, and albumin/globulin ratio when comparing sheep and goats. Khayyal et al. (2022) reported significant differences in goats receiving herbal supplements in terms of total protein, albumin, globulin and urea, transaminases. The authors did not find significant differences in cholesterol concentrations.

From the literature review, no definitive conclusion can be drawn at present about the effect of probiotics and herbal supplements on milk productivity, quality composition and biochemical parameters of blood in sheep. Further research is needed in this area, aimed at clarifying the influence of supplements and their versatile action.

The aim of the experiment is to determine the effect of adding the probiotic *Zoovit* LL and a combination of herbs nettle+chamomile on daily milk yield, physicochemical properties, somatic cells in milk and biochemical blood parameters in sheep of the Bulgarian Synthetic Dairy Population.

MATERIAL AND METHODS

The experiment was conducted at the experimental base at the Agricultural Institute - Stara Zagora. It included 45 sheep of the Synthetic Population Bulgarian Dairy breed, divided into three groups of 15 animals each, one control and two experimental. The groups were formed by the method of analogues, equalized in live weight, lactation and daily milk yield at the beginning of the experiment.

The sheep were raised in groups, provided with hay feeders, concentrated feed and drinkers with constant access to clean drinking water and lick salt according to the requirements of Ordinance № 40, on the conditions of keeping farm animals, taking into account their physiological needs.

During the experiment, the animals received concentrated feed (Table 1 and Table 2), meadow hay and natural pasture grass.

Table 1. Composition of compound feed for feeding

Component	% participation
Corn	51.700
Sunflower meal	25.000
Rye	20.000
Chalk	2.500
Salt	0.600
Premix- 16-97-K	0.200

Source: Authors' own elaboration

Table 2. Nutritional composition of compound feed for feeding

Component	% participation
Protein	15.920
Fat	2.863
Fiber	5.784
Moisture	11.221
Ca	1.027
P	0.512
Salt	0,660
Energy (Kcal/ kg)	2734.450

Source: Authors' own elaboration

Every day, the sheep from the three groups received 600 g/average per sheep of concentrated feed. The sheep from the first experimental group received a combination of the herbs nettle (5g) + chamomile (15g) / average per sheep, well mixed with the concentrated feed. The animals from the second experimental group received once a day 70 ml / average per sheep of the probiotic *Zoovit* LL, added immediately before feeding and well homogenized with the concentrated feed.

The probiotic *Zoovit* LL consists of the following strains of microorganisms: *Lactobacillus delbrueckii subsp. Bulgaricus, Streptococcus thermophilus, Lactobacillus casei, Kluyveromuces lactis, and Lactobacillus thamnosus*.

The chemical composition of the probiotic is presented in table 3.

When performing milk yield controls during the experimental period, the daily milk yield was determined by manual milking of each sheep in the milking parlor at the experimental base of the Agricultural Institute - Stara Zagora, Bulgaria.

Before adding the probiotic *Zoovit* LL and the herbal combination nettle + chamomile to the ration, a control period for daily milk yield was conducted and analyses were performed for the physicochemical composition and somatic cells.

The sheep from the three groups started with approximately the same milk yield before adding the supplements. The controls of the daily milk yield during the period of application of the additives were carried out in the months of April (first month), May (second month) and June (third month), respectively.

To measure the amount of milk during the controls, measuring jugs (accurate to 50 ml) were used. During milking, milk samples (50 ml each) were taken for analysis of the qualitative composition and the total number of somatic cells. The analyses were performed after the completion of each control and the milk was examined in the laboratory for the quality of milk and dairy products at the Agricultural Institute - Stara Zagora, Bulgaria.

To determine the qualitative composition of the milk, a Lactoscan milk analyzer was used, and to analyze the somatic cells in the milk, an LSCC - Lactoscan Somatic Cells Counter was used.

Table 3. Chemical composition of probiotic *Zoovit* LL

Component	% participation
Protein	30.29
Lactose	51.14
Fat	0.95
Dry matter	94
Lactic acid	2.75
Propionic acid	3.10
Minerals	8.76
Active cell count	not less than 3.10×10^7 cfu/g

Source: Authors' own elaboration

Blood for testing from 15 animals from each group (total 45) was taken in the morning after a 12-hour fast from the external jugular vein *(v. jugularis interna)* at the end of the experiment by the veterinarian of the experimental base. For the purpose of the analysis, vacutainers with a clot activator of 4 ml and 21G needles (0.8 x 38 mm) were used. After receipt, the blood samples were delivered to the laboratory complex at the Agricultural Institute - Stara Zagora, Bulgaria with subsequent analysis on a biochemical analyzer SMT-12V.

Statistical processing

The data were processed using variational statistics using the IBM SPSS Statistics 19 software product with the application of One-Way ANOVA. Homogeneity of variances was checked using Levene's test and the normal distribution of individual variables was checked using the Shapiro-Wilk test. When a difference was found at $P<0.05$, a post hoc Tukey HSD test was applied for multiple comparisons.

The figures were constructed using MS Excel 2016.

Differences at $P<0.05$ were considered statistically significant, and a trend was accepted at $P<0.10$.

RESULTS AND DISCUSSION

Figure 1 presents the results of the daily milk yield in sheep from the Bulgarian dairy synthetic population.

In April, a higher daily milk yield of 1.19 l was observed in the group receiving the herbal complex nettle + chamomile, compared to the group receiving the probiotic supplement *Zoovit* LL of 1.16 l. The differences between the two groups are statistically insignificant ($P>0.05$). In the control group, the reported value of the indicator is 0.95 l compared to the group receiving the herbal complex, with the differences being statistically significant ($P<0.05$).

Similar results were obtained in their studies by Borys and Jarzynowska (2016), as well as by Karageorgou et al. (2023), who found a significant increase in milk yield when adding a herbal complex to the ration of sheep.

During the second month of the experimental period, we reported significantly higher daily milk yield ($P<0.01$) in the first experimental group receiving herbal supplementation of 1.32 l and the group receiving probiotic of 0.98 l, compared to the control group, which registered the lowest level of the indicator of 0.74 l.

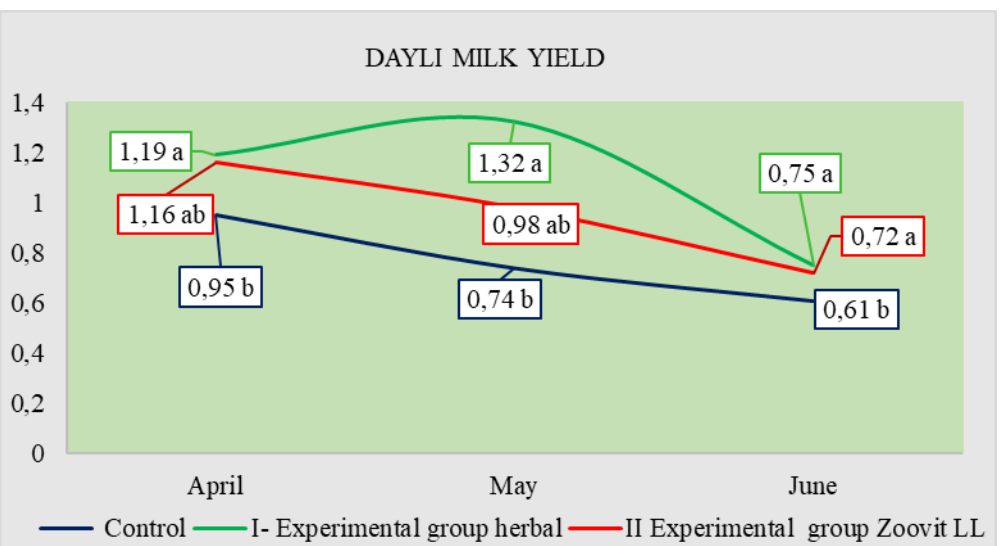


Figure 1. Daily milk yield in the period April-June, I

a; b – different letters indicate statistically significant differences at P<0.05

Source: Authors' own elaboration

In the third month of the experimental period, we report a significantly higher daily milk yield of 0.75 l in the group receiving the herbal complex and the experimental group with the probiotic preparation *Zoovit* LL of 0.72 l compared to the lower level of the indicator of 0.61 l in the control group. The differences are significant at P<0.01. According to Haiyan et al. (2017), when adding a probiotic supplement to the daily ration of lactating cows, a significant increase in milk yield was found in the experimental groups compared to the control group. Ma et al. (2020), in an experiment with Zaanski goats found an increased milk yield after taking a probiotic compared to the control group.

Figure 2 shows the results of the percentage of fat in milk in the months of April, May and June.

No statistically significant differences were found between the control and both experimental groups during the period April-June.

As lactation progresses, we observe the natural process of increasing fat. Our study found that the average milk fat content in the group receiving the probiotic *Zoovit* LL during the period April-May was higher than in the other two groups. In June, the control group reported a higher level of 8.01% of the indicator compared to the other two groups.

Khattab et al. (2020) reported a slight increase in milk fat when adding a probiotic to the ration when feeding sheep. In their study with cattle, Stobiecka et al. (2023) found no significant effect on fat and other milk parameters when adding a herbal mixture.

The results of the percentage of dry non-fat residues (SNF) are presented in Figure 3.

When analyzing the SNF in milk before receiving supplements, the values of the indicator are very close. During the first month of the experimental period, in all three groups - control, I and II experimental, the differences in the variation of the indicator are minimal and unproven. Accordingly, in the probiotic group, SNF registered a value of 11.28%, followed by the herbal group - 11.24% and the control - 11.17%. A significant effect on the level of SNF in milk when adding chamomile flowers to the ration of sheep was reported by EL-Ghousein, (2010).

In the second month of the experiment, we report a statistically significant difference (P<0.05) in the group that received the probiotic supple-

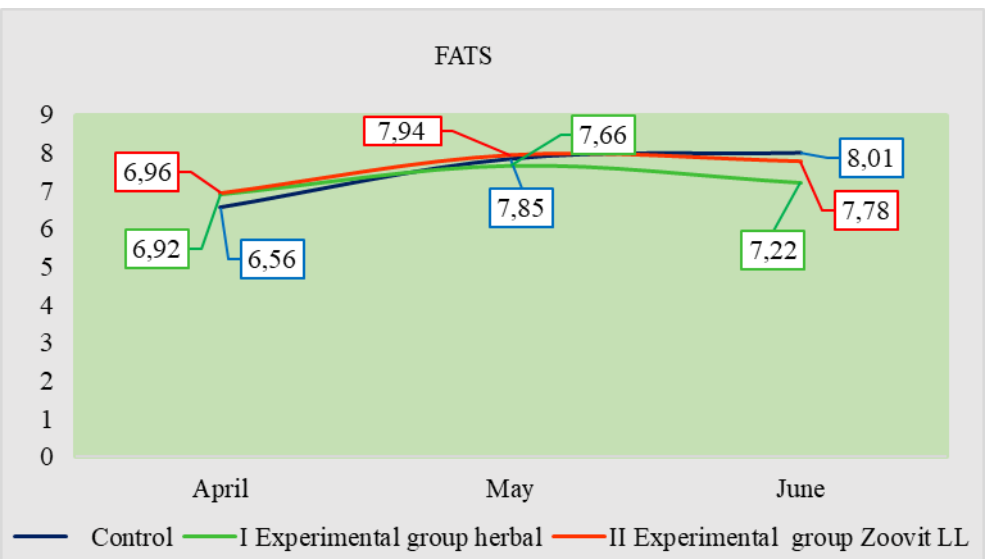


Figure 2. Fat in milk for the period April-June, %

a; b – different letters indicate statistically significant differences at P<0.05

Source: Authors' own elaboration

ment *Zoovit* LL, with a value of 12.00% compared to the control group of 11.52%.

In the third month, the indicator did not register significant differences between the three groups, with variations being minimal, although we report the highest level of 11.88% in the second experimental group compared to the other groups.

Figure 4 presents the results of the protein content in milk during the period April-June. In the first month of the experiment, the values of the indicator are similar and statistically insig-

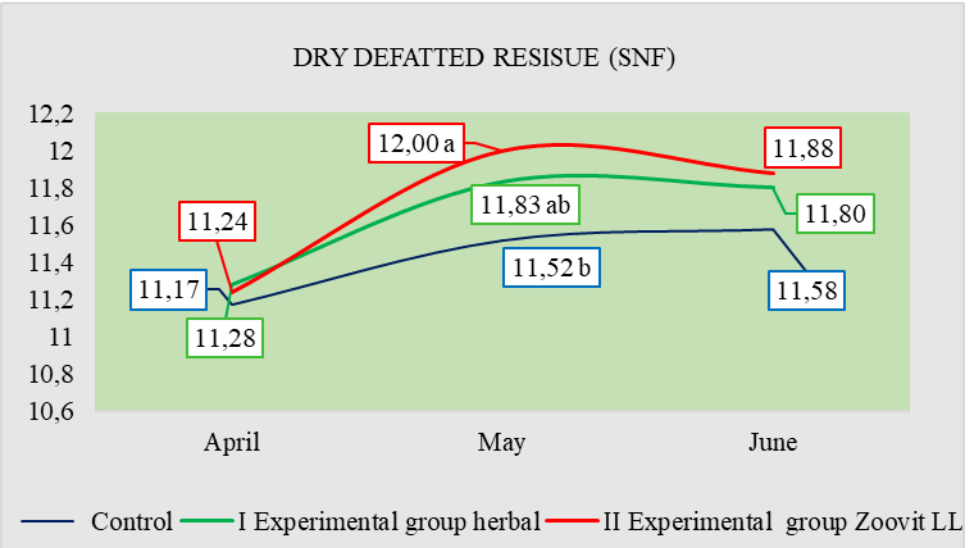


Figure 3. Dry defatted residue (SNF) for the period April-June, %

a; b – different letters indicate statistically significant differences at P<0.05

Source: Authors' own elaboration

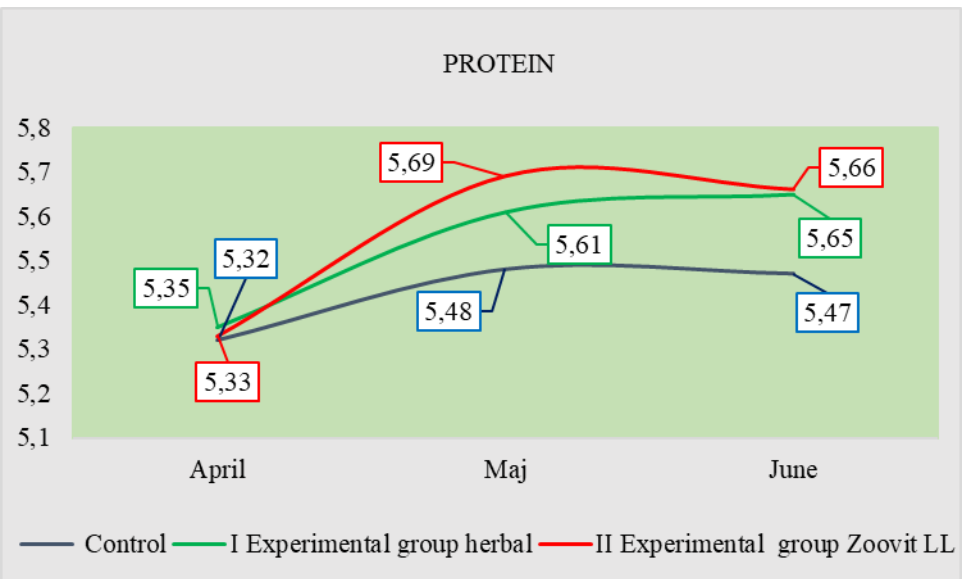


Figure 4. Protein in milk during the period April-June, %

a; b – different letters indicate statistically significant differences at P<0.05

Source: Authors' own elaboration

nificant. We report protein values of 5.35% in the group that received a probiotic supplement *Zoovit* LL, followed by the group that added a complex of herbs of 5.33% and the control of 5.32%.

During the second month of the experiment, a minimal, insignificant increase in protein was observed in three groups, with the highest percentage content in the group that received the probiotic supplement (5.69%), compared to the other two.

During the third month of the experimental period, the values of the indicator did not change significantly, with the differences being minimal and statistically unproven.

The results of the percentage of lactose in milk during the period April-June are presented in Figure 5.

During the first month of the experimental period, lactose showed similar values in all three groups, with the differences being statistically unproven. In the control and experimental groups I, the values of the indicator were the same – 5.08% and, respectively, very close compared to the experimental group II – 5.07%. The difference between the groups was only 0.20%. During the second month of the experimental period, a statistically significant ($P<0.05$) higher level of lactose content was observed in the group receiving the probiotic *Zoovit* LL of 5.41% compared to the control group of 5.19% with a difference of 4.24%. Azzaz et al. (2023) reported a higher lactose content in milk in sheep fed with a probiotic supplement, as well as an increase in milk yield. During the third month of the experimental period, no statistically significant differences were found between the three groups, both in the group receiving the probiotic *Zoovit* LL, and in the one to which the herbal combination was added. The difference in the values of the indicator between the groups is very close.

Figure 6 presents the results of the average number of somatic cells in milk in mL.

During the first month of the experimental period, no significant differences were found between the experimental groups receiving the supplements and the control group.

During the second month, we found a statistical significance ($P<0.01$) of a higher level of the indicator in the II experimental group receiving a supplement of the probiotic preparation *Zoovit* LL of 394681.10, compared to the group consuming the herbal complex of 210985.87. We found a

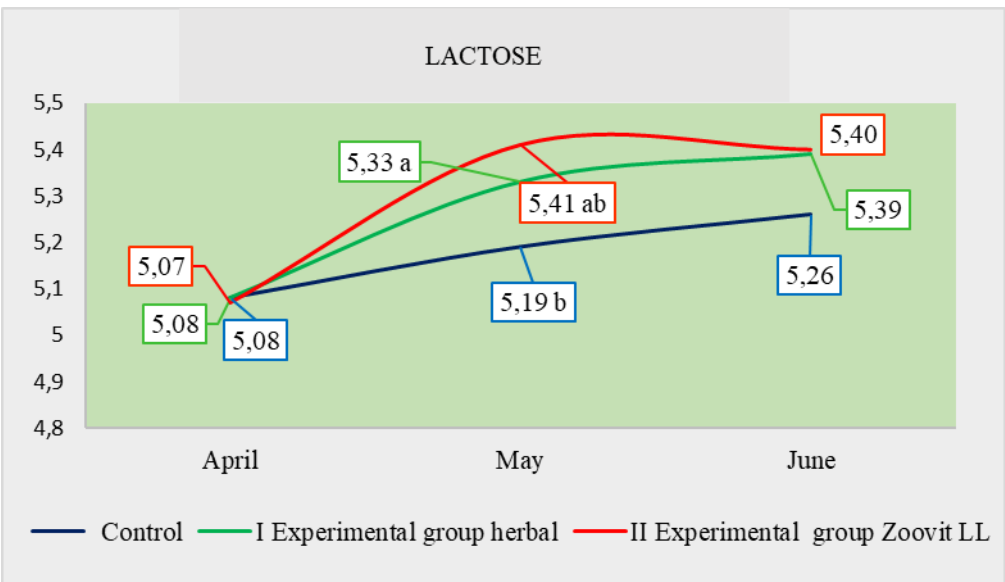


Figure 5. Lactose in milk during the period April-June, %

a; b – different letters indicate statistically significant differences at P<0.05

Source: Authors' own elaboration

higher level of the indicator of 454407.83 in the control group, compared to the lower value in the group receiving the herbal supplement. Ahmed et al. (2019) and Gabr et al. (2023) reported a decrease in somatic cells in milk, when adding a herbal mixture to the daily ration of lactating goats. In the third month, we report an increase in somatic cells in milk, which follows the normal trend as lactation progresses.

In the first experimental group consuming the herbal supplement, we found the lowest level of somatic cells of 574508.47, followed by the second experimental group with the addition of the probiotic *Zoovit* LL of 704441.53. The control group noted the highest level of somatic cells of 880753.87. No statistical significance was found between the groups.

Table 4 presents the results of the biochemical analysis of blood in sheep from the Bulgarian Dairy Synthetic Population at the end of the experimental period in the control, experimental group I, receiving a herbal supplement, and experimental group II, consuming the probiotic supplement *Zoovit* LL. All indicators are within the reference limits.

For the parameter albumin, we found a higher level of 32.98 g/L in the group consuming the herbal complex of nettle and chamomile and the control group of 32.53 g/L compared to the lower level of 28.49 g/L of the parameter in the second experimental group that received the probiotic *Zoovit* LL. The differences are significant at P<0.001. For globulin, we found a higher concentration of the parameter in the control group of 44.85 g/L, compared to the group receiving the probiotic supplement of 39.47 at P<0.01. Mehboob et al. (2018) reported a significant increase in albumin and globulin after intake of probiotic and herbal complex supplements in sheep.

For Gamma-Glutamyl Transferase (GGT), we registered an unproven trend (P=0.076) of a lower level of 44.33 U/L in the control group compared to the higher concentration in experimental group I (53.33 U/L) and experimental group II (45.21 U/L).

The liver enzyme alanine aminotransferase registered very similar values in the control group and the group taking the herbal complex (34.27 and 34.20 U/L, respectively) compared to the reported decrease in the probiotic group

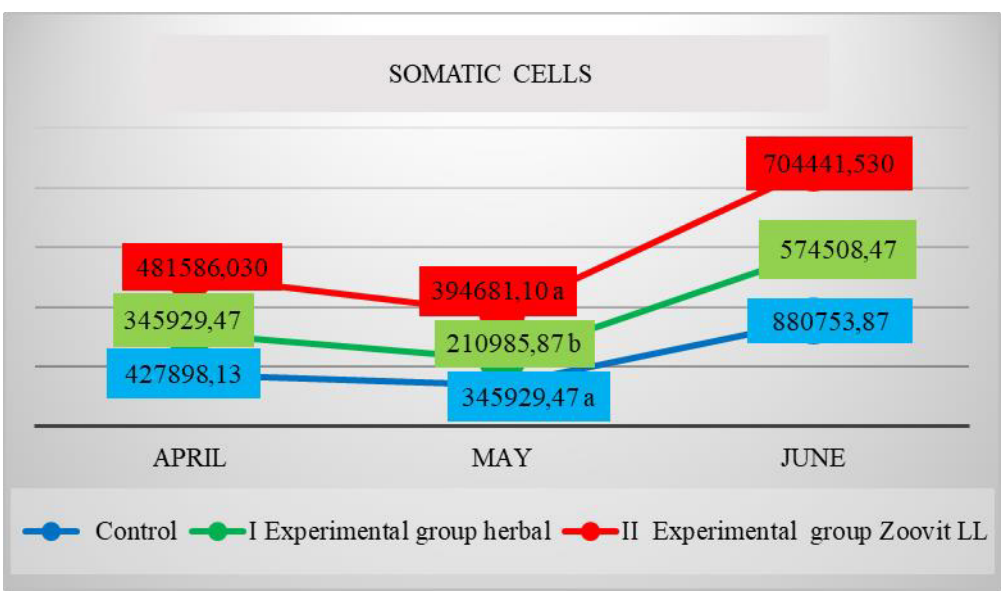


Figure 6. Somatic cells in milk the period April-June, mL

a; b – different letters indicate statistically significant differences at P<0.05

Source: Authors' own elaboration

Table 4. Biochemical parameters in blood in the control, I and II experimental groups, n=15

	Control group		Experimental group I - herbs		Experimental group II - probiotic		P-value
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	
ALB	32.53[a]	2.44	32.98[a]	2.27	28.49[b]	3.18	0.000
GLOB	44.85[a]	4.37	43.04[ab]	4.37	39.47[b]	3.69	0.004
A/G	0.73	0.07	0.77	0.10	0.73	0.11	0.310
GGT	44.33	11.69	53.33	11.76	45.21	11.20	0.076
AST	162.53	39.80	170.87	39.00	164.07	41.63	0.763
ALT	34.27[a]	5.60	34.20[a]	4.33	27.57[b]	4.69	0.001
ALP	129.47	82.94	128.67	54.91	103.71	63.04	0.462
LPS	32.60	5.50	31.33	6.76	31.86	5.10	0.783
CRE	76.58	18.83	76.40	9.63	78.47	9.34	0.650
GLU	3.42	0.54	3.35	0.54	3.04	0.33	0.054
TC	1.90[a]	0.28	1.91[a]	0.31	1.54[b]	0.27	0.002
Ca	2.48[a]	0.20	2.49[a]	0.26	2.23[b]	0.23	0.005
P	2.38[b]	0.30	2.96[a]	0.76	2.59[ab]	0.45	0.031

a; b – different letters in the row mark statistically significant differences at P<0.05
ab – P>0.05 – no significant
Legend: ALB g/L /Albumin/; GLO g/L /Globulin/; AG /Albumin/Globulin ratio/; GGT U/L /Gammaglutamyltransferase/; AST U/L /Aspartate aminotransferase/; ALT U/L /Alanine aminotransferase/; ALP U/L /Alkaline phosphatase/; LPS U/L /Lipase/; CRE µmol/L /Creatine/; GLU mmol/L /Glucose/; TC mmol/L /Cholesterol/; Ca mmol/L /Calcium/; P mmol/L /Phosphorus/
Source: Authors' own elaboration

of 27.57 U/L. The differences were proven at P=0.001.

Cholesterol is one of the most important indicators in the animal body. It is part of many hormones and is involved in metabolic processes. In the control group and the group consuming the herbal combination, the values were almost identical (1.90 and 1.91 mmol/L), compared to a decrease of the parameter in the group taking the probiotic supplement by 1.54 mmol/L. The differences were significant at (P<0.01).

For calcium, we found similar values in the control group and the one that received the herbal combination, 2.48 mmol/L and 2.49 mmol/L, respectively, compared to a lower level of 2.23 mmol/L in the probiotic group, with the differences being significant at P<0.01.

For phosphorus, we reported a higher level in the group that received the herbal supplement, 2.96 mmol/L, compared to a lower serum concentration of 2.38 mmol/L in the control group (P<0.05). In their study, Abulaiti et al. (2024) reported lower levels of Ca and P in the blood serum of cows that received the herbal supplement, compared to the control group of animals.

For the glucose parameter, a trend (P=0.054) of a lower serum concentration of 3.04 mmol/L was found in the group receiving the probiotic supplement *Zoovit* LL, compared to the higher level in the control group (3.42 mmol/L) and in the first experimental group (of 3.35 mmol/L).

For the other serum parameters studied – albumin/globulin ratio, aspartate aminotransferase, alkaline phosphatase, lipase and creatinine, we did not report statistically significant differences between the groups (P>0.05).

CONCLUSIONS

As a result of the research conducted, we found:

•Significantly higher (P<0.05) daily milk yield in the group receiving the herbal supplement nettle + chamomile and the probiotic group (P<0.01).

•Higher level of dry non-fat residue (P<0.05), higher lactose content (P<0.05), as well as higher somatic cell count in the probiotic group (P<0.01).

•In the group receiving the probiotic *Zoovit* LL, a decrease in albumin (P<0.001), alanine aminotransferase (P=0.001), cholesterol (P<0.01), calcium (P<0.05), globulin and a higher concentration of phosphorus (P<0.05) were observed in the group consuming the herbal supplement.

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REFERENCES

Abulaiti, A., Ahsan, U., Naseer, Z., Ahmed, Z., Liu, W., Ruan, C., Pang, X. & Wang, S. (2024). Effect of dietary Chinese herbal preparation on dry matter intake, milk yield and milk composition, serum biochemistry, hematological profile, and reproductive efficiency of Holstein dairy cows in early postpartum period. *Front Vet. Sci*., *11*, 1434548. https://doi:10.3389/fvets.2024.1434548.

Ahmed, M. I., Mahdy, T. M. M., Mansour, A. M., Alzahar, H & Sadek, W. M. A. (2019). Effect of chamomile flower addition to diets of lactating zaraibi goats on its productive performance. *Egyptian J. Nutrition and Feeds*, *22*(3), 479 – 489. https://10.21608/ejnf.2019.79441.

Al-Shaar, N. M., Al-Juwari, M. F., Saadi, A. M. & Almallah, O. D. (2023). Impact of some enzymes and probiotic mixture on milk production, components and some blood traits in Awassi ewes. *Bulg. J. Agric. Sci*., *29*(6), 1137 - 1142.

Andualem, D., Negesse, T. & Tolera, A. (2016). Milk Yield and Composition of Grazing Arsi-Bale Does Supplemented with Dried Stinging Nettle (Urtica simensis) Leaf Meal and Growth Rate of Their Suckling Kids. *Advances in Biological Research, 10*(3), 191 – 199. https://10.5829/idosi.abr.2016.10.3.102187.

Azzaz, H. H., Awad, A. A., Murad, H. A. & Hassaan, N. A. (2023). Performance responses of lactating Rahmani ewes fed diet supplemented with Enterococcus faecium NRC-3 or Lactobacillus rhamnosus. *Anim. Biotechnol*., *34*(8), 4032 - 4040. https://dx.doi.org/10.1080/10495398.2023.2252013.

Borys, B. & Jarzynowska, A. (2016). The effect of an herb mixture supplement on the performance of milking sheep during the summer feeding period. *Scientific Annals of Polish Society of Animal Production*, *12*(2), 31 - 435.

Claire, C. B., Supangco, E. P., Vega, R. S. A., Elegado, F. B. & Rayos, A. A. (2015). Effect of probiotic feeding on milk yield and components of crossbred dairy goats. *Philipp. J. Vet. Anim. Sci*., *41*(1), 21 - 30.

EL-Ghousein, S. S. (2010). Effect of some medicinal plants as feed additives on lactating awassi ewe performance, milk composition, lamb growth and relevant blood items. *Egyptian J. Anim. Prod*., *47*(1), 37 - 49.

El-Hawy, A. S., El-Bassiony, M. F., Bakr, S. A., Gawish, H. A. A., Badawy, M. T. & Gado, H. M. (2019). Productive and Reproductive Performance and Metabolic Profile of Barki Ewes Supplemented with Two Forms of Probiotics as Feed Additives. *World's Veterinary Journal*, *9*(2), 135 – 145. https://dx.doi.org/10.36380/scil.2019.wvj18.

Fanta, Y, Kechero, Y. & Yemane, N. (2024). Nutritional response to water hyacinth (Eichhornia crassipes) challenges via blood biochemical profiles in goats and sheep. *Heliyon*, *10*(7). https://doi.org/10.1016/j.heliyon.2024.e28424 (En).

Fiol, C., Prado, D., Mora, M. & Alava, J. I. (2016). Nettle cheese: Using nettle leaves (Urtica dioica) to coagulate milk in the fresh cheese making process. *International Journal of Gastronomy and Food Science, 4*, 19 – 24. https://doi.org/10.1016/j.ijgfs.2016.05.001.

Gabr, A. A., Ahmed, M. I., Shaheen, G. F., Abdel-Gawad, A. G. M., Abdelsalam, O. M. & Farag, M. E. (2023). Improving Productivity and Health Status of Lactating Zaraibi Goats with Echinacea Purpurea or/and Chamomile Flower Supplementation. *J. of Animal and Poultry Production*, *14*(12), 157 – 165. https://10.21608/jappmu.2024.258055.1099.

Gülhan, B. & Yangilar, F. (2024). Effects of Nettle (Urtica dioica) Extract on Versus Pathogenic Microorganisms in Yogurt Production. *Journal of Tekirdag Agricultural Faculty*, *21*(3), 759 – 770. https://10.33462/jotaf.1368617 (En).

Haiyan, X., Huang, W., Hou, Q., Kwok, L-Y., Sun, Z., Ma, H., Zhao, F., Lee, Y-K & Zhang. (2017). The effects of probiotics administration on the milk production, milk components and fecal bacteria microbiota of dairy cows. *Sci. Bull. (Beijing), 62*(11), 767 – 774. https://doi: 10.1016/j.scib.2017.04.019.

Humphries, D. G. & Reynolds, C. K. (2014). The effect of adding stinging nettle (Urtica dioica) haylage to a total mixed ration on performance and rumen func-

tion of lactating dairy cows. *Animal Feed Science and Technology*, *189*, 72 - 81. https://doi.org/10.1016/j.anifeedsci.2014.01.006.

Karageorgou, A., Tsafou, M., Goliomytis, M., Hager-Theodorides, A., Politi, K. & Simitzis, P. (2023). Effect of Dietary Supplementation with a Mixture of Natural Antioxidants on Milk Yield, Composition, Oxidation Stability and Udder Health in Dairy Ewes. *Antioxidants*, *12*(8), 1571. https://doi.org/10.3390/antiox12081571.

Khamisabadi, H. & Fazaeli, H. (2021). Effect of Thymus vulgaris or Peppermint on Lactating Sanjabi Ewe Performance, Milk Composition, Lamb Growing and Relevant Blood Metabolites. *Journal of Medicinal Plants and By-products*, *1*, 95 - 101. https://10.22092/jmpb.2020.351950.1258.

Khanal, D. R., Tiwari, I., Bastola, R. & Upreti, C. R. (2017). Beneficial effects of stinging nettle supplementation on milk production. *Nepalese. Vet. J*., *34*, 60 - 68.

Khattab, A. R., Saleh, A. A. & El Sayed, F. A. (2018). Effect of feeding the medicinal herb, chamomile flower, on productive performance of frafra ewes and their born lambs. *Egyptian Journal of Sheep & Goat Sciences*, *13*(2), 38 - 46.

Khattab, I. M., Abdel-Wahed, A. M., Khattab, A. S. & Anele, U. Y., El-Keredy, A. & Zaher, M. (2020). Effect of dietary probiotics supplementation on intake and production performance of ewes fed Atriplex hay-based diet. *Livestock Science, 237*(13), 104065. https://doi.org/10.1016/j.livsci.2020.104065.

Khayyal, A. A, El-Badawy, M. M. & Sakr, H. S. (2022). Effect of some medical herbs on productive performance of lactating zaraibi goats. *Egyptian Journal of Nutrition and Feeds*, *25*(3), 303 - 321.

Ma, Z-Z., Cheng, Y-Y., Wang, S-Q., Ge, J-Z., Shi, H-P. & Kou, J-C. (2020). Positive effects of dietary supplementation of three probiotics on milk yield, milk composition and intestinal flora in Sannan dairy goats varied in kind of probiotics. *Journal of animal physiology and animal nutrition*, *104*(1), 44 - 55.

Mehboob, S., Ganai, A. M, Bhat, M. A., Sheikh, G. G., Qureshi, A., Shubeena, S., Shubeena S. & Nisa, S. (2018). Effect of yeast and herb supplemented paddy straw on haemato: Biochemical and rumen fermentation parameters in sheep. *Journal of Entomology and Zoology Studies*, *6*(5), 942 - 946.

Miteva, D., Laleva, S., Angelova, T., Krastanov, Zh., Yordanova, D., Kalaydzhiev, G. & Ivanov, N. (2023). Phenotypic characteristics of milk yield of sheep from the Synthetic Bulgarian Dairy Population (SPBM) depending on the sequence of lactation and control. *Journal of Mountain Agriculture on the Balkans (JMAB), 26*(3), 1 – 13 (Bg).

Miteva, D., Laleva, S., Angelova, T., Yordanova, D., Slavova, P., Ivanov, N. & Kalaydzhiev, G. (2021). Factors Influencing Milk Yield in Bulgarian Dairy Synthetic Population Sheep. *Journal of Mountain Agriculture on the Balkans*, *24*(1), 64 - 77 (Bg).

Moghazy, M. M., Ahmed, M. A. & Ghaly, M. T. (2018). Effect of dietary supplementation with chamomile flowers on production of lactating Zaraibi goats. *Egyptian Journal of Sheep and Goat Sciences*, *13*(3), 49 - 61.

Nalla, K., Manda, N. K., Dhillon, H. S., Kanade, S. R., Rokana, N., Hess, M. & Puniya, A. K. (2022). Impact of Probiotics on Dairy Production Efficiency. *Front. Microbiol., 13*, 805963. https://doi: 10.3389/fmicb.2022.805963.

Ordinance No 40 of 2 December 2008 on the conditions for raising of agricultural animals, considering their physiological and behavioural characteristics – https://lex.bg/laws/ldoc/2135609448 (Bg).

Payandeh, S. & Kafilzadeh, F. (2017). The effect of feeding a commercial bacterial probiotic on milk production and blood metabolites in Mehraban ewes. *Journal of Animal Production*, *19*(3), 285 - 599.

Stancheva, N. & Dimitrova, I. (2024). Influence of production year on the milk productivity in ewes from the Bulgarian dairy synthetic population. *Scientific Papers. Series D. Animal Science*, *67*(2) (Bg).

Stancheva, N., Angelova, T., Yordanova, D. & Krastanov, Y. (2022). The influence of some factors (parity, type of birth and litter size) on milk productivity in sheep from the Bulgarian dairy synthetic population. *Bulgarian Journal of Animal Husbandry, 59*(6), 3 - 12 (Bg).

Stobiecka, M., Król, J., Brodziak, A., Klebaniuk, A. & Kowalczuk-Vasilev, E. (2023) Effects of Supplementation with an Herbal Mixture on the Antioxidant Capacity of Milk**.** *Animals*, *13*(12), https://doi.org/10.3390/ani13122013.

Wójtowski, J. A., Pikul, J., Mikołajczak, P., Czopowicz, M., Kaba, J., Foksowicz-Flaczyk, J., Antkowiak, I., Pytlewski, J., Markiewicz-Kęszycka, M. & Stanisławski, D. (2025). Effect of herbal feed additives on milk performance and health status of dairy goats. *J. Vet. Res., 69*(2), 263 - 272 (En). https://10.2478/jvetres-2025-0021.

Zaleska, B., Milewski, S. & Ząbek, K. (2015). Impact of Saccharomyces cerevisiae supplementation on reproductive performance, milk yield in ewes and offspring growth. *Archives Animal Breeding, 58*(1), 79 - 83, https://doi.org/10.5194/aab-58-79-2015.

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