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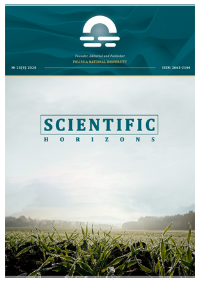

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Increased lactation in females due to the use of probiotic-based feed additives

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Abstract. The transition of females from childbirth to lactation is a physiologically complex period characterised by metabolic, endocrine and immunological changes. In addition, difficult labour drains the female and can lead to hypolactia. The purpose of the study was to determine the effect of probiotics on lactation recovery and metabolic changes in the body of females. Among the methods used are: the determination of lactation level, the physiological method for determining live weight, the biochemical method for blood testing; and the statistical method. The application of *Bacillus subtilis* AX 20, *Bacillus licheniformis* EA 22 contributes to an increase in milk productivity in cows on

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day 7-9 of the study by 12.9%, on day 10-12 – by 15.03%, on day 13-15 – by 13.93%, on day 16-18 – by 13.5% and on day 19-21 – by 21.35% compared to the control. The total protein content in experimental cows increased by 18.92%, globulins – by 37.26 ($p \leq 0.05$), compared to the initial indicators. The activity of alanine aminotransferase, urea, and urea nitrogen in animals of the control and experimental groups was within the normal range during the experiment. The application of *Bacillus megaterium* NCH 55 to sows with hypolactation contributes to lactation recovery in sows. In the experimental group, piglets showed a lag in growth of 18.5% on the third day and 11.39% on the tenth day due to hypolactation. Starting from day 15, there was an increase in the live weight of suckling piglets due to the restoration of lactation in sows by 20.56%, on day 20 – by 20.43%, on day 25 – by 30.56%, on day 30 – by 31.91%, compared to the control. In the blood serum of experimental sows, the content of total protein increased by 10%, globulins – by 19.13%, total cholesterol – by 40.11%, urea by 48.0%, compared to the beginning of studies ($p \leq 0.05$). The activity of alanine aminotransferase in the experiment increased by 8.95% ($p \leq 0.05$), alkaline phosphatase decreased by 27.46% ($p \leq 0.05$), compared to the beginning of the study. In the blood of experimental sows, the level of circulating immune complexes increased by 42.85% and a decrease in seromucoids by 30.43%. The practical value of the study lies in the use of probiotics to restore the milk productivity of cows and sows after childbirth

Keywords: milk productivity; hypolactia; live weight gain; protein metabolism; metabolic adaptation

INTRODUCTION

The profitability of a dairy farm directly depends on the milk production of each cow. If for some reason milk yields decrease or the quality of milk worsens, the farm loses money and becomes unprofitable. Therefore, each farmer evaluates the capabilities of his herd and decides on the balance between the cost of keeping animals and making a profit from them. Increased milk production encourages dry matter consumption due to increased energy and nutrient requirements in animals. Studies (Ledda *et al.,* 2023) showed a link between dry matter consumption and productivity. The experiment was conducted on sheep, so it is necessary to clarify this hypothesis on cattle.

The consequence of high milk productivity is the appearance of a negative energy balance, which is manifested in cows by lipolysis, ketogenesis, and endocrine changes. Researchers S. Krnjaić *et al.* (2022) examined the relationship between energy balance, lipolysis, and ketogenesis in cows that were milked two and three times a day. The results showed that cows that were milked three times a day showed more pronounced signs of lipolysis and ketogenesis, and lower energy balance levels. Therefore, an increase in milk productivity affects metabolic disorders in the body of dairy cows. In the study, the question of how reducing the amount of milking will affect the mammary gland remained unresolved. A study by O. Shkromada *et al.* (2022) proved that the use of probiotics helps restore milk productivity and normalise the metabolic processes associated with ketosis. However, the effect of probiotics on lactation recovery remains unclear. Adding probiotics to the main diet improves growth productivity, meat quality, and humoral immunity, reducing the release of pathogenic microbes. Researchers I. Kwoji *et al.* (2021) addressed the possibility of using multicomponent probiotics to improve metabolism in animals.

A paper by J. Babot *et al.* (2018) proves that probiotics effectively protect the intestinal epithelial cells of broilers from food intoxication. In addition, the authors substantiate the effectiveness of the antimicrobial action of probiotics in relation to *Salmonella enterica* in broiler chickens. The question of the mechanism of influence on the metabolism of chickens remains unidentified. M. Tian *et al. (*2023) established that probiotic and prebiotic supplements of the mother during pregnancy have a positive effect on the regulation of the development of the nervous system and fetal immunity. However, detailed studies are needed on microbial metabolites that are involved in regulating fetal organ development.

In the paper by T. Bruun *et al. (*2023), the problem of long-term use of lactating sows and their subsequent productivity for re-breeding was examined. However, the paper does not offer solutions that would help restore lactation and reproductive capacity of the sow. A production study of the effectiveness of using a probiotic based on viable *Bacillus subtilis* C-3102 spores was conducted on the health and productivity of sows and their piglets (Kritas *et al.,* 2015) showed an improvement in the sow's condition during pregnancy. An increase in feed intake, improved health during lactation, and a reduction in the period of weaning a sow before estrus was also noted. The issue of the effect of probiotics on lactation recovery in sows diagnosed with hypolactia remained unresolved.

H. Liu *et al.* (2020) focused on determining the effects of a probiotic based on *Pediococcus acidilactici* ZPA017 on reproductive capacity, restoration of the gut microbiome and metabolism in sows during late pregnancy and lactation. The experiment did not investigate the direct effect of a probiotic on the lactation capacity of sows. Researchers N. Nam *et al.* (2022) determined that the use of probiotics in late pregnancy in sows has a positive effect on reproductive ability. However, the paper did not analyse the effect on piglet growth. Q. Zhu *et al.* (2023) showed that the addition of 4.0×10^8 CFU/kg of *B. subtilis* PB6 to the feed of sows during late pregnancy and lactation helps to reduce the intervals between the birth of piglets, improves live weight gain in suckling piglets. However, there are no studies on the effect of probiotics on the milk production of sows.

The purpose of the study was a restoration of lactation and the development of metabolic adaptation of cows and sows using probiotics. The objectives of the study were: determination of milk productivity in females, examination of metabolic processes in the body of cows and sows using probiotics.

MATERIALS AND METHODS

The study was conducted in September 2022 at the State Enterprise "Experimental Economy of the Institute of Agriculture of the North-East" of the National Academy of Agrarian Sciences of Ukraine, located in Sad, Sumy district, Sumy region. Sows with hypolactation (5 individuals in the experimental group) were provided with mixed feed supplemented with *Bacillus megaterium* NCH 55(1×10^9 CFU/g) at a dose of 5 g per animal. In the control group (5 heads), regular mixed feed was given for 30 days. Weight gain in suckling piglets from birth to 30 days was examined to determine the level of lactation in sows. The average weight of piglets in each nest (8-10 heads) was determined.

In addition, this farm conducted a similar study with Holstein cows. The study involved a total of 20 animals from the post-calving milking group. The effectiveness of the feed additive was determined based on experimental samples of strains *Bacillus subtilis* AH 20, *Bacillus licheniformis* EA 22 at a concentration of 1×10^9, colony-forming units per gram (CFU/G). The probiotic dosage in the experimental group of post-calving milking was 35 grams per animal. Probiotic strains of microorganisms *Bacillus megaterium* NCH 55, *Bacillus subtilis* AH 20, *Bacillus licheniformis* EA 22 were manufactured and refilled in the company PE "Kronos Agro". All cows received a diet according to the production group. Milk productivity was determined in cows in the morning and evening from 4 to 21 days in the control and experimental groups.

Examination of biochemical parameters of cow blood serum. Biochemical parameters of cow blood were determined in cows and sows at the beginning and end of the study. The content of total protein (SOP-BP-02-2017), urea (SOP-BP-03-2017), albumin (SOP-BP-25-2018), urea nitrogen, CA/R, and globulins was examined by calculation, total cholesterol (SOP-BP-07-2017), aspartate aminotransferase AST (SOP-BP-09-2017), alanine aminotransferase alt (SOP-BP-08-2017), total Ca (SOP-BP-05-2017), inorganic P (SOP-BP-04-2017), magnesium (SOP-BP-06-2017), creatinine levels were determined by Jaffe method, CIC (circulating immune complexes were determined by enzyme immunoassay, Seromucoids were examined spectrophotometrically (SHIMADZU UV-1800, Japan).

Biological ethics. All experimental studies were conducted in accordance with modern methodological approaches and in compliance with the relevant requirements and standards, in particular, they comply with the requirements of DSTU ISO/IEC 17025:2005 (2006), in accordance with directive 2010/63/EU (Hartung, 2010), which were approved by the conclusion of the commission on ethics and bioethics of the Faculty of Veterinary Medicine of Sumy National Agrarian University dated 05.03.2022. The keep of animals and all manipulations were conducted in accordance with the provisions of the procedure for conducting experiments and experiments on animals by scientific institutions (Law of Ukraine No. 249, 2012), the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (European convention…, 1986).

Statistical analysis. Statistical data were calculated using the Fischer-Student method, considering statistical errors and the probability of comparable similar indicators. Indicators with a level of probability of more than 95% were considered ($p<0.05$).

RESULTS AND DISCUSSION

Results of a study of the productivity and metabolism of cows using a probiotic. Milk productivity of cows was determined from 4 to 21 days of lactation after calving (Fig. 1).

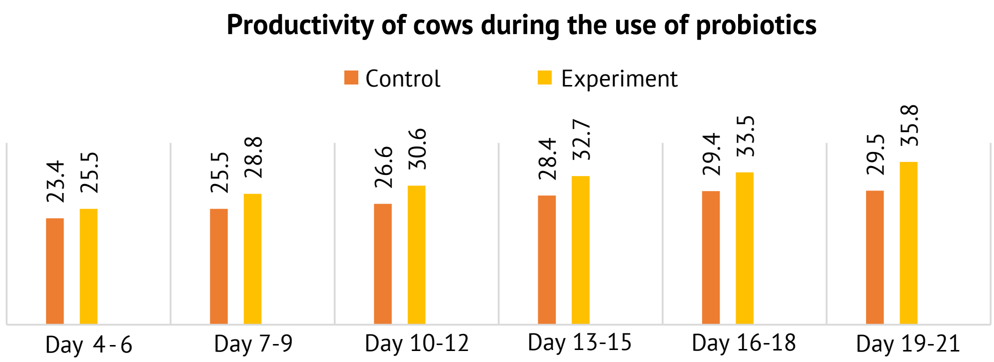

Figure 1*. Productivity of cows during the use of probiotics in the period of 4-21 days of lactation*

Source*: compiled by the authors of this study*

From the results obtained, it follows that at the beginning of the study, 4-6 days in the control and experimental groups of animals the milking levels were almost at the same level. On the 7th-9th day of the experiment, cows of the experimental group showed an increase in milk yield by 12.9% compared to the control group. On the tenth or twelfth day, the use of a probiotic in the experimental group contributed to an increase in milk yield by 15.03%. After two weeks of the study, an increase in milk productivity in the experimental cows was established by 13.93%, compared to the control. In the period of 16-18 days in the study group, milking output increased by 13.5% in the group with the use of probiotics. At the end of the study (19-21 days), a 21.35% increase in milk productivity was recorded in cows that received a probiotic based on experimental samples of *Bacillus subtilis* AH 20, *Bacillus licheniformis* EA 22 strains. The conducted study proves the positive effect of probiotics on the milk productivity of cows in the period of the first 21 days after calving. During the experiment, the effect of a probiotic on the metabolism of lactating cows was determined. Biochemical parameters of blood were examined at the beginning and at the end of the experiment (Table 1-2).

Table 1. *Results of biochemical studies of cow blood serum, M±m, n=5*

No.	Name of the parameters to be defined, units of measurement							
research methods	total protein, g/L	Albumines, g/L	*Globulines, g/L	*Albumines, %	*Globulines, %	*(A/G), units	Urea mmol/L	*Urea nitrogen, mg/dL
	SOP-BP-02-2017	SOP-BP-25-2018	Calculation				SOP-BP-03-2017	Calculation
Control group (start of the study)								
1	75.104 ±4.26	30.63 ±1.25	46.96 ±2.82	39.42 ±1.09	55.99 ± 2.15	0.66 ±0.052	5.46 ±0.42	13.67 ±1.31
Control group (end of the study)								
2	70.48 ±4.92	31.39 ±1.55	37.68 ±2.82	42.34 ±2.09	58.28 ±0.91	0.76 ±0.04	4.38 ±0.42	13.32 ±1.19
Research group (start of the study)								
3	71.95 ±2.94	32.98 ±1.25	41.00 ±3.43	44.24 ±2.57	53.54 ±2.27	0.85 ±0.07	6.47 ±0.46	18.18 ±1.28
Research group (end of the study)								
4	85.57 ±3.44*	28.95 ±1.88	56.28 ±5.39*	34.07 ±3.33*	65.15 ±3.71*	0.50 ±0.07*	5.46 ±0.57	16.83 ±1.36
Reference values for cows	59-85[2] 70-90[3]	27-43[2]	25-45[2] 33-55[3]	38-50[1]	50-62[1]	0.6-1.1	3.30-6.70	8-20[4]

Note: ** – p≤0.05, compared to the start of the study*
Source*: compiled by the authors of this study*

Studies have shown that the total protein content of cows in the experimental group was substantially higher by 18.92% (p≤0.05) at the end of the study, compared to the initial indicators. Notably, the total protein was increased in experimental animals due to an increase in globulins by 37.26 (p≤0.05). The calculation of the percentage of globulins was also substantially higher by 11.61% compared to the beginning of probiotic use. The content of urea and urea nitrogen in cows of the experimental groups during the study period was within the physiological norm and did not substantially decrease at the time of completion of the experiment.

Table 2. *Results of biochemical studies of cow blood serum, M±m, n=5*

No.	Name of the parameters to be defined, units of measurement						
	Total cholesterol, mmol/L	AST, units/L	ALT, units/L	*(AST/ALT), units	Total Ca, mmol/L	Inorganic P, mmol/L	*Ca/P, units
research methods	SOP-BP-07-2017	SOP-BP-09-2017	SOP-BP-08-2017	Calculation	SOP-BP-05-2017	SOP-BP-04-2017	Calculation
Control group (start of the study)							
1	3.34 ±0.59	68.81 ±9.25	17.31 ±0.54	3.97 ±0.23	2.39 ±0.18	1.88 ±0.66	0.51 ±0.03

Table 2, Continued

No.	Name of the parameters to be defined, units of measurement						
	Total cholesterol, mmol/L	**AST, units/L**	**ALT, units/L**	***(AST/ALT), units**	**Total Ca, mmol/L**	**Inorganic P, mmol/L**	***Ca/P, units**
Control group (end of the study)							
2	3.63 ±0.60	70.62 ±4.25	18.08 ±0.58	3.56 ±0.2	2.70 ±0.17	2.10 ±0.14	0.90 ±0.03
Research group (start of the study)							
3	2.80 ±0.69	108.51 ±10.44	20.36 ±4.03	4.58 ±0.73	2.35 ±0.19	2.17 ±0.63	1.01 ±0.05
Research group (end of the study)							
4	4.02 ±0.78	77.28 ±3.04*	20.89 ±3.11	3.75 ±0.52	2.36 ±0.15	2.10 ±0.04	1.17 ±0.23
Reference values for cows	2.20-6.60[2]	48-108[2]	17-40[2] 20-45[3]	1.0-3.4	1.98-3.12[1,2] 2.2-2.6[3]	1.50-2.90[1,2] 1.2-2.4[3]	1.1-1.6

Note: ** – p≤0.05, compared to the start of the study*
Source*: compiled by the authors of this study*

The total cholesterol content in cows of the experimental and control groups during the research period did not exceed the physiological norm. However, in cows of the experimental group, the AST enzyme at the beginning of the study was higher than the permissible reference values and substantially decreased by 71.22% at the end of the experiment due to the use of a probiotic (p≤0.05). The level of the alt enzyme in animals of the control and experimental groups was within the control level during the entire study period. The mineral content, namely total Ca and inorganic P, was within the normal range, which indicates a properly balanced diet for cows during lactation. During the study, there were no negative effects on the organism of experimental animals from probiotics based on *Bacillus subtilis* AH 20, *Bacillus licheniformis* EA 22.

Results of the study of the effect of probiotics on the productivity and metabolism of pigs. Sows were prescribed a probiotic *Bacillus megaterium* NCH 55 to improve lactation. Weight gain in piglets from birth to 30 days was determined to establish the therapeutic effect (Fig. 2).

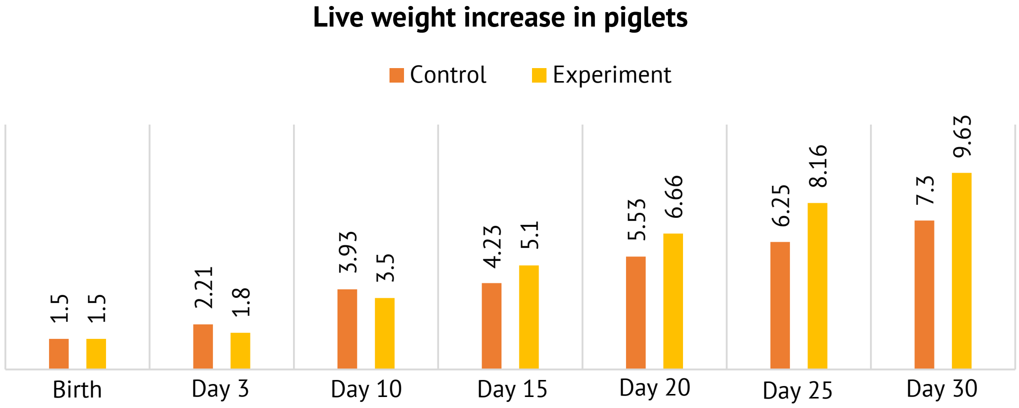

Figure 2*. Live weight gain in piglets when using a probiotic in the period from birth to 30 days*
Source*: compiled by the authors of this study*

At birth, piglets on average in the nest had a weight of 1.5 kg in the control and experimental groups. The number of suckling piglets in the nest ranged from 8 to 10 heads, so the calculation of the average live weight in the nest was considered. On the third day of the study, the piglets of the experimental group lagged behind in weight by 18.5%, compared to the control group due to a lack of milk in sows. On the 10th day of the experiment, the growth lag in suckling piglets of the experimental group decreased to 11.39%. Weighing of piglets on day 15 showed an increase in live weight in the experimental group by 20.56%, compared to the control group. This indicates an increase in lactation in experimental sows treated with the probiotic *Bacillus megaterium* NCH 55. On day 20 of the study, the trend continued and the piglets had a larger live weight by 20.43% compared to the control group. The difference in the weight of piglets of the experimental and control groups persists for 25 days and amounts to 30.56%. At the end of the experiment, the live weight of piglets in the experimental group was 31.91% higher than in the control group. During the entire trial period of using a probiotic based on *Bacillus megaterium* NCH 55, a positive effect on the milk productivity of sows was determined. The presence of possible metabolic shifts in the body of sows was determined by biochemical parameters in blood serum samples (Table 3-4).

Table 3. *Results of biochemical studies of cow blood serum, M±m, n=5*

No.	total protein, g/L	Albumin g/L	Total globulines, g/L	Glucose mmol/L	Total cholesterol, mmol/L
Control group (start of the study)					
1	80.97±0.56	31.59±1.90	40.33±2.21	4.67±0.36	1.99±0.20
Control group (end of the study)					
2	79.01±1.22	31.72±0.99	40.16±0.88	4.42±0.41	2.13 ±0.19
Research group (start of the study)					
3	72.90±2.30	33.40±0.77	39.32±1.94	4.48±0.30	1.67±0.05
Research group (end of the study)					
4	80.19±0.63*	33.37±1.97	46.84±2.53*	4.94±0.22	2.34±0.05*
Norm*	70-80	28.0-44.0	32.9-52.0	3.33-5.55	1.56-2.86

Note: ** – p⩽0.05, compared to the start of the study*
Source*: compiled by the authors of this study*

The total protein content in pigs of the experimental group was substantially higher by 10% compared to the beginning of the studies (p⩽0.05). The level of total globulins increased by 19.13% (p⩽0.05) and did not exceed the reference level. The total cholesterol content increased by 40.11% compared to the start of the probiotic in sows.

Table 4. *Results of biochemical studies of cow blood serum, M±m, n=5*

No.	ALT, mmol/h L	AST, mmol/h L	Alkaline phosphatase, nmol/Ls	CIC, mg/mL	Seromucoids, mg/mL	Urea wine, mmol/L	Creatinine, μmol/L
Control group (start of the study)							
1	0.65±0.09	0.83±0.07	665.2±33.95	0.14±0.02	0.14±0.01	4.69±0.46	140.78±3.55
Control group (end of the study)							
2	0.63±0.12	0.75±0.05	731.8±23.6	0.15±0.02	0.15±0.01	4.71±0.42	151.32±4.64
Research group (start of the study)							
3	1.06±0.04	0.67±0.02	1595.2±110.9	0.07±0.01	0.23±0.02	4.54±0.15	127.92±5.40
Research group (end of the study)							
4	1.15±0.01	0.73±0.02*	1157.0±104.0*	0.10±0.01*	0.16±0.01*	6.72±0.2*	127.94±1.77
Norm*	0.3-1.2	0.60-2.10	500-2500	0.1-0.3	0.11-0.19	3.3-7.0	100.0-200.0

Note: ** – p⩽0.05, compared to the start of the study*
Source*: compiled by the authors of this study*

The level of alt enzyme in sows of the experimental and control groups was within the normal range, which indicates the absence of intoxication of the body and the integrity of internal organs. The AST enzyme in experimental sows increased by 8.95% (p⩽0.05) compared to the start of the study but within the reference level. The level of alkaline phosphatase in experimental animals substantially decreased by 27.46% (p⩽0.05), compared with the initial data. At the end of the experiment, the number of circulating immune complexes in experimental sows increased by 42.85% and the level of seromucoids decreased by 30.43%. The sows of the experimental group increased their urea levels by 48.0% compared to the beginning of the experiment.

Creatinine levels in the experimental and control groups of animals remained within the physiological norm throughout the experiment. According to the results of the study, it was established that all sows that took part in the experiment after a month of feeding *Bacillus megaterium* NCH 55 with the main diet, an increase in lactation and an improvement in appetite were observed.

Studies have shown an increase in lactation in cows that received the probiotic. Specifically, on days 7-9 of the experiment, there was a 12.9% increase, on days 10-12 – a 15.03% increase, on days 13-15 – a 13.93% increase, on days 16-18 – a 13.5% increase, and on days 19-21 – a 21.35% increase, compared to the control group (Figure 1). Researchers Z. Várhidi *et al.* (2022) proved that the use of probiotic microorganisms contributes to an increase in milk productivity and live weight gain in cattle. This mechanism is explained by the stimulation of active microorganisms in the rumen. C. Ma *et al.* (2020) proved the positive effects of probiotic feed additives on milk consumption, productivity, and intestinal microecology.

When determining the effect of probiotic microorganisms on the metabolism of lactating cows, an increase in the total protein content was established due to an increase in the level of globulins (Table 1). The results obtained indicate an increase in the activity of the immune response in the animal body, which coincides with the data of Y. Zhao *et al.* (2023). The study showed that the content of urea and urea nitrogen in cows of the experimental groups during the study period was within the physiological norm (Table 2). Researchers C. Chang *et al.* (2019) established restoration of normal metabolism, namely urea, ALT, and AST levels in the serum of cows treated with the probiotic. The mineral content, namely total Ca and inorganic P, was within the normal range, which is consistent with the study by T. Larsen & K. Moyes (2015).

Sows were prescribed a probiotic *Bacillus megaterium* NCH 55 to restore lactation. It was established that suckling piglets increased their live weight in the period from 10 to 30 days of probiotic use in sows (Fig. 2). A study by O. Shkromada *et al.* (2022) proved the recovery of milk productivity in cows by using *Bacillus megaterium* as a feed additive. An increase in the content of total protein and globulins in the blood serum of pigs of the experimental group was established by S. Liao & M. Nyachoti (2017). The total cholesterol content increased in the blood of experimental pigs after the use of a probiotic (Table 3), which is confirmed by the study by M. Zommiti *et al.* (2020). Q. Zhu *et al.* (2023) prove that adding probiotics to the diet of sows and piglets promoted feed growth and consumption and improved meat quality.

In experimental sows, the number of circulating immune complexes increased and the level of seromucoids decreased after the use of a probiotic (Table 4). A study by C. Ma *et al.* (2022) confirms the positive effect of probiotics on restoring immunity in pigs. According to the results of the conducted studies, normalisation of the level of AST, ALT, and alkaline phosphatase enzymes in the blood of sows after the use of a probiotic was established. Researchers M. Saladrigas-García *et al.* (2022) established that long-term use of two strains of *Bacillus* in pigs helped to improve their metabolism by restoring the intestinal microbiome. The authors also confirm that feeding probiotics to lactating sows does not cause any changes in their reproductive capacity, metabolic and health status, and in the concentration of immunoglobulins and nutrients in colostrum and milk. Therewith, a high level of cellular immunity and the concentration of haptoglobin in plasma were noted in suckling piglets after weaning.

The general conclusion from the conducted studies is that the use of probiotic microorganisms in feeding cattle and pigs has a positive effect on their productivity, health, and immunity. The researchers confirmed an increase in milk production and weight gain in animals, and a recovery in metabolic parameters after the use of probiotics in the diet. According to the results of studies, probiotics helped to improve the immune response, the state of intestinal microecology, and metabolism. An important factor is the ability of probiotics to normalise the level of enzymes and immune complexes, contributing to the overall health and productivity of animals.

CONCLUSIONS

The research has established that the use of a probiotic supplement based on *Bacillus subtilis* AH 20 and *Bacillus licheniformis* EA 22 leads to an increase in lactation in cows. Specifically, on days 7-9 of the experiment, there was a 12.9% increase, on days 10-12 – a 15.03% increase, on days 13-15 – a 13.93% increase, on days 16-18 – a 13.5% increase, and on days 19-21 – a 21.35% increase, compared to the control group. In cows of the experimental group, the total protein content increased by 18.92%, globulins – by 37.26 ($p \leq 0.05$), compared to the initial indicators. The level of the AST enzyme at the beginning of the study was higher than normal and substantially decreased by 71.22% at the end of the experiment ($p \leq 0.05$). Levels of the enzyme ALT, urea, total Ca, and inorganic P were within the control levels in the control animals during the study.

The use of a probiotic supplement based on *Bacillus megaterium* NCH 55 increases lactation in sows with hypolactia, which is directly related to live weight gain in suckling piglets. At birth, the piglets had the same weight, but due to hypolactia in sows of the experimental group, they lagged behind in growth on the third day from the control group by 18.5%, on the tenth – by 11.39%. Starting from the 15th day of the experiment, there was an increase in the live weight of suckling piglets due to the restoration of lactation in sows of experimental groups by 20.56%, on the 20th day – by 20.43%, on the 25th day – by 30.56%, on the 30th day – by 31.91%, compared to the control ones.

The effect of probiotics on the body of sows affected an increase in the content of total protein by 10%, globulins – by 19.13%, total cholesterol – by 40.11%, and urea – by 48.0%, compared to the beginning of studies ($p \leqslant 0.05$). The level of AST in experimental sows increased by 8.95% ($p \leqslant 0.05$), alkaline phosphatase decreased by 27.46% ($p \leqslant 0.05$) compared to the beginning of the study. The immune system is activated by increasing the CIC by 42.85% and reducing the level of seromucoids by 30.43% within the physiological norm. The prospect of further research is to determine the dependence of the frequency of hypolactia in cows and sows depending on the number of lactation.

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CONFLICT OF INTEREST

None.

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Збільшення лактації у самок за використання кормових добавок на основі пробіотиків

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Анотація. Перехід самок від пологів до лактації є фізіологічно складним періодом, який характеризується метаболічними, ендокринними та імунологічними змінами. Також важкі пологи виснажують самку і можуть призводити до гіполактії. Метою дослідження було визначення впливу пробіотиків на відновлення лактації та метаболічні зрушення в організмі самок. Використані методи: визначення рівня лактації, фізіологічний метод визначення живої маси, біохімічний метод дослідження крові; статистичний метод. Застосування *Bacillus subtilis* АХ 20, *Bacillus licheniformis* ЕА 22 сприяє збільшенню молочної продуктивності у корів на 7-9 добу дослідження на 12,9 %, на 10-12 добу – на 15,03 %, на 13-15 добу – на 13,93 %, на 16-18 добу – на 13,5 % та на 19-21 добу – на 21,35 %, порівняно з контролем. Вміст загального білка у дослідних корів збільшився на 18,92 %, глобулінів – на 37,26 ($p \leq 0,05$), порівняно з початковими показниками. Активність аланінамінотрансферази, сечовини та азоту сечовини у тварин контрольної та дослідної груп був у межах норми протягом експерименту. Застосування свиноматкам з гіполактією *Bacillus megaterium* NCH 55 сприяє відновленню лактаці через гіполактію у свиноматок поросята дослідної групи відставали у прирості на третю добу на 18,5 %, на десяту – на 11,39 %. Починаючи з 15 доби відбувалось збільшення живої маси поросят-сисунів за рахунок відновлення лактації у свиноматок на 20,56 %, на 20 добу – на 20,43 %, на 25 добу – на 30,56 % на 30 добу – на 31,91 %, порівняно з контрольними. В сироватці крові дослідних свиноматок збільшився вмісту загального білка на 10 %, глобулінів – на 19,13 %, загального холестеролу – на 40,11 %, сечовини на 48,0 %, порівняно з початком досліджень ($p \leq 0,05$). Активність аланінамінотрансферази у досліді збільшився, на 8,95 % ($p \leq 0,05$), лужної фосфатази зменшився на 27,46 % ($p \leq 0,05$), порівняно з початком дослідження. В крові дослідних свиноматок збільшився рівень циркулюючих імунних комплексів на 42,85 % та зниження серомукоїдів на 30,43 %. Практична цінність дослідження полягає у застосуванні пробіотиків для відновлення молочної продуктивності корів та свиноматок після пологів

Ключові слова: молочна продуктивність; гіполактія; приріст живої ваги; обмін білка; метаболічна адаптація