

Effect of Feed Prepared from Industrial Waste (Apple + Tomato Pomace) on the Morphological and Biochemical Blood Parameters of Dairy Cows

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Annotation: This article investigates the physiological state, as well as the morphological and biochemical parameters of blood in dairy cows during the summer and winter seasons when different percentages of feed made from industrial by-products (apple + tomato pomace) were added to their diet. The main objective of this experiment was to determine the extent to which the physiological indicators of dairy cows respond positively when varying amounts of this feed are included in their ration. The obtained results were subjected to biometric analysis. According to the experimental outcomes, blood morphological and biochemical indicators were found to be significantly influenced by physiological conditions, feed type, and seasonal factors.

Keywords: Industrial by-products (apple + tomato), blood, morphological, biochemical, erythrocytes, leukocytes, hemoglobin, total protein, ALT, AST, glucose.

INTRODUCTION

Livestock farming is rapidly advancing across the world, with modern technological methods increasingly applied. This has led to a rise in the number of animals and their productivity. The production of quality livestock products to meet consumer demand has become a global priority. In obtaining quality animal products, the physiological status of animals, the type of feed used, environmental conditions, and other influencing factors play a crucial role in allowing the animal to realize its genetic potential. Assessing the physiological condition of animals through morphological and biochemical blood analysis is critical. In recent years, there has been a growing interest in utilizing non-traditional feed sources, such as fruit and vegetable processing residues. Specifically, apple and tomato pomace has been recommended as a cheap, energy-rich, and nutritionally valuable feed component (Ahmed et al., 2021; Kiselev et al., 2019). In this study, we evaluated the effects of feeding dairy cows with apple and tomato pomace obtained from canning factories. We assessed how this diet influenced the cows' physiological condition and its subsequent effect on milk productivity by examining morphological and biochemical blood parameters.

Materials and Methods: The experiment was conducted at the "Puri Milky" livestock-specialized farm located in Oqdaryo district, Samarkand region. Holstein breed dairy cows in their first lactation stage were selected for the study (n = 12 per group). The control group was fed the farm's standard ration. In the 1, 2 and 3 experimental groups, different percentages of apple + tomato pomace were added to the ration based on its nutritional value. The morphological and biochemical parameters of blood from the control and experimental cows were analyzed and compared.

Results and their analysis: To study the effect of apple and tomato pulp from non-traditional fruit and vegetable canning plants on the physiological state and milk productivity of dairy cows, morphological and biochemical blood parameters were examined in the laboratory and are presented in Table 1. These parameters are important in assessing the state of internal organs and organisms, determining physiological indicators and productivity.

In addition, we studied the above indicators during the summer and the data obtained are presented in the table below.

Table-1 Results of seasonal morphological examination of blood samples taken from experimental cows, ($X \pm S_x$), (summer)

Indicator	Groups(n=5)							
	Control		Group I		Group II		Group III	
	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$
Leukocytes ($\times 10^3/\text{mcl}$)	$7,2 \pm 0,27$	7,35	$7,3 \pm 0,19$	5,13	$7,8 \pm 0,33$	8,4	$7,7 \pm 0,4$	10,5
Lymphocytes (%)	$48,4 \pm 1,35$	5,57	$48,3 \pm 1,29$	5,34	$49,9 \pm 0,93$	3,71	$49,8 \pm 0,96$	3,86
Monocytes (%)	$4,3 \pm 0,15$	6,8	$4,6 \pm 0,22$	9,5	$4,7 \pm 0,18$	7,5	$4,6 \pm 0,19$	8,3
Granulocytes (%)	$46,9 \pm 0,71$	3,0	$46,8 \pm 0,97$	4,15	$45,4 \pm 0,93$	4,1	$45,3 \pm 0,81$	3,6
Hemoglobin (g/l)	$111,9 \pm 1,2$	2,21	$115,6 \pm 1,7$	2,98	$119,4 \pm 2,97$	4,98	$112,8 \pm 2,04$	3,63
Erythrocytes ($\times 10^6/\text{mcl}$)	$6 \pm 0,27$	8,89	$6,2 \pm 0,16$	6,14	$6,5 \pm 0,24$	7,5	$6,3 \pm 0,16$	5,02
Hematocrit (%)	$35,5 \pm 0,84$	4,71	$35,8 \pm 1,4$	7,82	$38,5 \pm 1,19$	6,2	$36,5 \pm 1,31$	7,17
Platelets ($\times 10^9/\text{l}$)	$260 \pm 1,87$	1,44	$267 \pm 2,89$	2,17	$310 \pm 7,52$	4,9	$295 \pm 2,74$	1,86
ESR (mm/s)	$0,9 \pm 0,15$	32,4	$0,8 \pm 0,17$	41,5	$0,6 \pm 0,1$	33,3	$0,7 \pm 0,13$	37,8

When analyzing the table data, it was observed that in the summer season, leukocyte levels in the control and experimental groups 1, 2 and 3 were lower compared to the winter season by 0.7 thousand/ μL , 1.1 thousand/ μL , 0.9 thousand/ μL , and 0.8 thousand/ μL , respectively. Similarly, the lymphocyte levels in summer were lower by 0.2%, 0.7%, and 0.3% in the control, 1, 2, and 3 groups respectively. No changes in monocyte levels were observed in the control group, whereas in the I experimental group it increased by 0.4%, and in the 2 and 3 groups by 0.1%. Regarding granulocytes, in summer compared to winter, the control group showed a decrease of 0.3%, no changes were observed in the 1 and 3 groups, while an increase of 0.2% was seen in the II group. Hemoglobin levels decreased in all groups during summer compared to winter by 5.5 g/L, 3.6 g/L, 1.4 g/L, and 6 g/L, respectively. Erythrocyte counts increased in the control and I groups by 0.1 million/ μL , and in the II and III groups by 0.4 million/ μL . No significant changes were observed in hematocrit in the control group, while increases of 0.3%, 0.4%, and 1.2% were observed in the 1, 2 and 3 groups, respectively. Platelet levels in the summer season were lower than in winter by $35 \times 10^9/\text{L}$, $44 \times 10^9/\text{L}$, $80 \times 10^9/\text{L}$, and $35 \times 10^9/\text{L}$ in the control, 1, 2 and 3 groups, respectively. The erythrocyte sedimentation rate in the same sequence of groups decreased by 0.3 mm/s, 0.4 mm/s, and 0.2 mm/s.

In the next table, biochemical blood indicators were studied during the summer season, and the obtained results were statistically processed.

Table 2 . Biochemical blood test results of cows in the experiment ($X \pm S_x$), (Summer)

Indicator	Groups(n=5)							
	Control		Group I		Group II		Group III	
	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$
Total protein (g/L)	$68,7 \pm 2,12$	6,2	$68,9 \pm 1,34$	3,89	$69,9 \pm 1,39$	3,9	$69,2 \pm 1,95$	5,7
Albumin (g/L)	$38,2 \pm 0,89$	4,7	$38,3 \pm 0,66$	3,4	$38,9 \pm 0,68$	3,51	$38,5 \pm 0,92$	4,9

ALT (U/L)	21,6±1,23	11,4	20,1±1,09	10,8	19,3±1,03	10,7	20,6±1,1	10,7
AST (U/L)	82,9±1,96	3,3	82,5±1,17	2,8	81,8±1,33	4,7	84,3±2,0	4,8
Glucose (mmol/L)	2,3±0,09	8,42	2,4±0,09	7,8	2,7±0,13	9,8	2,6±0,1	7,7
Total fat (mmol/L)	1,3±0,08	12,2	1,4±0,09	13,4	1,6±0,12	14,7	1,5±0,12	16,4

Upon analyzing this data, it was found that the total protein content in the control group in summer decreased by 1.4 g/L compared to winter. In the 1, 2 and 3 groups the decrease was 1.9 g/L, 2.7 g/L, and 2.5 g/L respectively. Albumin levels also decreased by 0.3 g/L, 0.4 g/L, 1.4 g/L, and 1.0 g/L, respectively. ALT levels decreased by 0.1 U/L in the control, by 0.6 U/L in 1 and 2 groups, and by 5 U/L in the group 3. AST levels dropped by 0.5 U/L, 7.2 U/L, and 7.5 U/L in the control, 1 and 2 groups respectively, and by 9.5 U/L in the group 3. Glucose levels slightly decreased in the summer compared to winter by 0.2, 0.3, and 0.1 mmol/L in the control, 1 and 2 groups respectively. Total fat decreased by 0.2 mmol/L in the control, 1 and 3 groups, and by 0.3 mmol/L in the group 2. The same indicators were studied during the winter season, and the results are shown below.

Table 3. Morphological blood test results of cows in the experiment ($X \pm S_x$), (Winter)

Indicator	Groups(n=5)							
	Control		Group I		Group II		Group III	
	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$	$X \pm S_x$	$C_v, \%$
Leukocytes ($\times 10^3/\text{mcl}$)	7,9±0,23	5,87	8,4±0,29	6,94	8,7±0,15	3,35	8,6±0,51	11,89
Lymphocytes (%)	48,6±2,4	9,9	49±3,1	12,6	50,2±1,1	4,5	50,1±0,9	3,6
Monocytes (%)	4,3±0,15	7,2	4,2±0,17	8,1	4,6±0,14	5,9	4,5±0,29	12,7
Granulocytes (%)	47,2±1,48	6,3	46,8±1,12	4,8	45,2±1,68	7,4	45,3±1,83	8,1
Hemoglobin (g/l)	117,4±1,35	2,3	119,2±2,53	4,25	120,8±1,8	3,1	118,8±2,27	3,8
Erythrocytes ($\times 10^6/\text{mcl}$)	6,2±0,23	7,5	6,4±0,22	6,7	6,9±0,2	5,8	6,7±0,15	4,4
Hematocrit (%)	35,5±0,55	3,12	36,1±1,12	6,19	38,9±1,76	9,04	37,7±1,24	6,57
Platelets ($\times 10^9/\text{l}$)	295±4,89	3,32	311±5,53	3,56	390±6,95	3,57	330±5,01	3,04
ESR (mm/s)	1,2±0,12	20,4	1,1±0,18	32,1	0,8±0,17	42,39	0,9±0,17	37,68

When analyzing the table data, it was observed that the leukocyte levels in winter were higher in the control, 1, 2 and 3 experimental groups compared to the summer season. In winter, the lymphocyte count was also higher in the control 1, 2 and 3 experimental groups compared to summer, corresponding to the same order. An increase in monocyte count was observed in the 2 and 3 experimental groups, while no significant difference was noted in the other groups. The granulocyte count was also higher in line with the above case. Hemoglobin levels showed an increase in winter compared to summer across all groups. The erythrocyte count was higher in the control 1, 2, and 3 experimental groups. No significant difference in hematocrit levels was observed in the control group, whereas the 1, 2 and 3 experimental groups showed higher values. Platelet counts were higher in winter than in summer in the control, 1, 2 and 3 experimental groups. The erythrocyte sedimentation rate was also higher in the control, 1, 2 and 3 experimental group.

The biochemical indicators of blood were also studied during the winter season, and the obtained results were processed using biometric analysis.

Table 4. Biochemical blood test results ($\bar{X} \pm S_x$), (Winter)

Indicators	Groups(n=5)							
	Control		Group I		Group II		Group III	
	$\bar{X} \pm S_x$	$C_v, \%$	$\bar{X} \pm S_x$	$C_v, \%$	$\bar{X} \pm S_x$	$C_v, \%$	$\bar{X} \pm S_x$	$C_v, \%$
Total protein (g/L)	70,1 $\pm$ 1,47	4,2	70,8 $\pm$ 2,26	6,4	72,6 $\pm$ 1,95	5,4	71,5 $\pm$ 1,90	5,4
Albumin (g/L)	38,5 $\pm$ 0,7	3,6	38,7 $\pm$ 0,76	3,9	40,3 $\pm$ 0,71	3,5	39,5 $\pm$ 1,32	6,7
ALT (U/L)	21,5 $\pm$ 0,99	9,3	20,7 $\pm$ 1,37	13,2	18,7 $\pm$ 0,80	8,6	25,6 $\pm$ 3,25	25,4
AST (U/L)	82,4 $\pm$ 1,71	4,2	75,3 $\pm$ 2,0	5,3	74,3 $\pm$ 2,56	6,9	93,8 $\pm$ 1,72	3,8
Glucose (mmol/L)	2,5 $\pm$ 0,16	12,7	2,6 $\pm$ 0,12	9,02	3 $\pm$ 0,14	9,7	2,7 $\pm$ 0,15	10,8
Total fat (mmol/L)	1,5 $\pm$ 0,1	13,3	1,6 $\pm$ 0,18	22,1	1,9 $\pm$ 0,29	30,7	1,7 $\pm$ 0,15	17,7

When analyzing the table data, it was observed that the total protein level in winter was higher in the control group compared to the summer season, as well as in the 1, 2 and 3 experimental groups. Similarly, the albumin levels were higher in the control, 1, 2 and 3 experimental groups. An increase in ALT levels was recorded in the control and all three experimental groups, and higher AST levels were also observed in the control 1, 2 and 3 groups. Glucose and total fat levels were slightly higher in winter compared to summer as well.

In the winter season, leukocyte levels were higher in all groups compared to summer. Lymphocyte and monocyte levels were also generally higher. Granulocyte and hemoglobin levels showed a similar trend. Erythrocytes, hematocrit, and platelets were higher in winter. ESR was also elevated in winter compared to summer.

Conclusion: The feed supplement prepared from apple and tomato pulp positively influenced the biochemical blood indicators of lactating cows. The observed changes in the morphological and biochemical indicators of blood are associated with various factors including the animal's age, physiological condition, stage of pregnancy, stress factors, nutrition, and other influences. These factors are crucial for the animal's body. The changes that occur in this cause various changes in the physiology of animals. Despite the drastic climatic differences between winter and summer, this type of feed had a positive impact on the cows' physiological activity, which supports the recommendation to include such supplements in the diet of cattle.

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