Intensity of relations in biological objects influenced by various factors

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Abstract. The study of intensity of relations in a biological object under the influence of external factors showed that the live weight of goslings and its age dynamics had a significant impact on morphological blood parameters and natural resistance. A decrease in values of biochemical parameters (the content of total serum protein) was observed. The correlation of live weight and fractional composition of the protein in goslings was rather weak, and the level of relations with leukogram indices varied. It was impossible to determine any patterns.

1. Introduction
The main task of biological system simulation is construction of models for predicting the development of biological systems (from physical and biochemical processes in the cell to the changes in ecosystems) [1-2].

Evaluation of statistical properties of the criteria used for modeling biological systems is a nontrivial problem which cannot be solved using only analytical approaches. Statistical properties of the biological system can be studied using statistical modeling methods whose results allow for assessment of statistical properties of the criterion and identification of factors influencing the formation of reference samples required for obtaining sustainable estimates.

In biological objects, the connection between the signs is not clear. Several features can correspond to one value [3-8]. Since values of the features are distributed in correlation relationships, the dependence of one feature on another one is not exact; the correlation can have different degrees of severity.

The aim of the research is to determine the correlation of live weight and hematological parameters when using various supplements in the diet of goslings: bentonite, Stimulus, potassium iodide, Iodcasein, sodium selenite, Sel-Plex, Vetosel E forte, Avizyma 1200 (in wheat and in wheat-barley feed mixture), Natufos, Liv 52 Vet, LeviselSB plus, Agrimos, Vetom and Lactobifadol [3-7].

2. Materials and methods
The correlation of live weight and hematological indicators was studied on goslings of the Italian white breed in the conditions of the Breeding Plant “Makhalov”, Kurgan Region. The primary material was processed using correlation relations. The range of permissible values of the linear correlation coefficient was calculated from -1 to +1: strong at \( r > 0.60 \), medium at \( 0.40 \leq r < 0.60 \), weak at \( r < 0.20 \), absent at \( r < 0.20 \).

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Feeding factors influence the blood composition and its physicochemical properties which can be used to assess the degree of intensity of oxidative processes and the level of metabolism that determine the level of food activity. One of the important integrating indicators of homeostasis is clinical blood analysis reflecting qualitative and quantitative compensatory reactions.

3. Results and discussion

It was established that when using various feed supplements, the correlation between the body weight and the number of erythrocytes was negative. A strong negative relation was observed when using potassium iodide \( r = -0.76 \); all selenium-containing addisupplements: sodium selenite \( r = -0.97 \); Sel-Pleksa \( r = -0.78 \); Vetosel E forte \( r = -0.79 \); Agrimos \( r = -0.82 \). A strong positive relation between body weight and the number of erythrocytes was observed when using bentonite \( r = 0.86 \), Vetom and Lactobifadol \( r = 0.70 \) and 0.81. In other cases, the relation is weak or absent.

The correlation between body weight and the number of leukocytes was negative when using enzyme supplements: Avisym 1200 (wheat-barley feed mixture) \( r = -0.88 \); Avizim 1200 (wheat feed mixture) \( r = -0.84 \); Natufos \( r = -0.94 \); sodium selenite \( r = -0.87 \) and phytobiotic Liv 52 Vet \( r = -0.91 \). A strong positive relation was observed when feeding goose broilers with bentonite, Iodkazeinomi and Laktobifadol \( r = 0.86 \); 0.99; 0.92. In other cases, the relation was weak or absent.

A strong positive relation between the body weight and the hemoglobin content, between the body weight and the color index was observed when using Sel-Plex \( r = 1.00 \) and 0.96; Liv 52 Vet \( r = 0.91 \) and 0.83; Levisel SB plus \( r = 0.96 \) and 0.96; Agrimos \( r = 0.95 \) and 0.91. A strong negative relation was observed when using Iodkazein \( r = -1.00 \) and \( -0.94 \), respectively.

When using different feed supplements, the relationships between the body weight and the hemoglobin content and between the body weight and the color index were positive (strong, medium and weak): \( r = 0.69 \) and 0.51 for Stimulus; \( r = 0.53 \) and 0.94 for potassium iodide; \( r = 0.28 \) and 0.72 for Vetom; \( r = 0.32 \) and 0.98 for Lactobifadol.

The studies on the relationship between the body weight and the morphological blood indicators of the blood of goose broilers identified that the relationship was strong positive (36.67%) and strong negative (25.00%); the relationship was absent in 11.67%, weak positive – in 13.33%, weak negative - in 6.67%; the average positive relationship was observed in 5.00% of cases, and the average negative relationship was completely absent. In general, the positive relationship was in 55.00% of cases, the negative relationship was in 31.67% of cases. The change in the live weight had a significant impact on the morphological blood parameters.

The increase in the live weight is directly related to the physiological status of the bird. These indicators depend on the health status which can be assessed by biochemical blood parameters. Values of these parameters are widely used for diagnostic and prognostic purposes.

Bentonite and Stimulus influence on the body weight and the protein content (\( r = -0.93 \) and \( -0.85 \), respectively). The relationship between the body weight and the alkaline reserve content is strong positive when using bentonite (\( r = 0.99 \)) and weak positive when using Stimulus (\( r = 0.28 \)). The relationship between the body weight and the content of mineral components was positive. When using iodine-containing supplements, the relationship between the body weight and alkaline reserves was negative: potassium iodide \( r = -0.33 \) and \( -0.59 \); Iodkazeina \( r = -0.04 \) and \( -0.42 \). Potassium iodide had a positive effect on the relationship between the body weight and the mineral blood components. The relationship with calcium and inorganic phosphorus was strong positive: \( r = 0.85 \) and \( -0.89 \), respectively.

When using sodium selenite, the relationship between the body weight and blood biochemical parameters was negative: alkaline reserve \( r = -0.67 \); total protein \( r = -0.90 \); calcium \( r = -0.16 \) and inorganic phosphorus \( r = -0.02 \). When using Sel-Plex, the relationship between the body weight and calcium and inorganic phosphorus was positive: \( r = 0.92 \) and 0.79, respectively.

The use of enzyme preparations had a negative effect on the relationship between the body weight and the total protein content: Avisim 1200 (wheat feed mixture) \( r = -0.98 \); Avizim 1200 (wheat-barley feed mixture) \( r = -0.95 \); Natufos \( r = -0.50 \).
When using phytobiotics Liv 52 Vet, the increase in the total weight decreased the body weight, calcium and inorganic phosphorus content; the correlations were $r = -0.99; -0.92$ and $-0.68$.

Lewisel SB Plus, Vetom and Laktobifadol had a negative effect on the relationship between the body weight and total protein content ($r = -0.95; -0.89$ and $-0.99$) and a strong positive effect on the relationship between the body weight and the content of inorganic phosphorus ($r = 1.00; 0.94$ and $0.98$). Vetom and Laktobifadol had a negative effect on the relationship between the live weight and the alkaline reserve ($r = -0.82$ and $-0.89$) and calcium content ($r = -0.83$ and $-0.75$). Agrimos had a negative effect on the relationship between the body weight and alkaline reserve ($r = -0.80$); total protein ($r = -0.68$) and calcium ($r = -1.00$); and a positive effect on the relationship with inorganic phosphorus ($r = 1.00$).

When studying the relationship between the body weight and biochemical parameters of blood, it was determined that in most cases, the relationship was strong negative (38.33%) and strong positive (23.33%); the relationship was absent in 10.00% of cases and was weak (both positive and negative) in 10.00% of cases. In general, a positive relationship was in 36.67% of cases, a negative one $-1$ in 53.33% of cases. The increase in the live weight decreased the values of biochemical indicators, especially the content of total serum protein.

A uniform distribution of correlations was observed between the body weight and albumin and globulin fractions. Strong positive relations were observed between the body weight and the albumin fraction when using Levisel SB plus, Vetom and Laktobifadol = 0.66; 0.74 and 0.61, respectively, and Liv 52 Vet $r = 0.64$; the relationship was strong negative when using sodium Selenite, Avizim 1200 (wheat feed mixture), Avizim 1200 (wheat-barley feed mixture) and Agrimos $r = -0.98; -0.97; -0.94$ and $-0.96$ respectively. In other cases, the relationship was weak or absent. The relationship between the body weight and the content of e globulin fraction was inverse.

When assessing the relationship between the body weight and the fractional composition of globulin proteins, it was noted that the relationship was either absent or weak. This was noted when using bentonite, stimulus, Liv 52 Vet, B-tom and Laktobifadol. The relationship varied from $r = -0.28$ to $r = 0.37$.

A strong negative relationship was observed between the body weight and the content of α-globulins when using potassium iodide $r = -1.00$, Sel-Plex $r = -0.86$, Levisel SB plus $r = -0.88$ and Agrimos $r = -0.87$. A strong negative relationship was observed between the body weight and β-globulins, when using Sel-Plex $r = -0.67$; Avizim 1200 (wheat feed mixture) $r = -0.67$; Natufos $r = -0.67$ Levisel SB plus $r = -0.67$. A strong positive relationship was observed between the body weight and γ-globulins when using sodium selenite $r = 1.00$; Avizim 1200 (wheat feed mixture) $r = 0.91$; Avizim 1200 (wheat-barley feed mixture) $r = 0.78$ and Agrimos $r = 0.90$.

Thus, it was found that in most cases the relationship was negative (40.00%), including strong 22.67%; average 4.00% and weak 13.33%. In 26.67% of cases, the relationship between the indicators was absent. The share of positive relations accounted for 33.33%, including the strong one 18.67%. In general, the correlation between the live weight and the protein fractional composition was weak.

A relationship between the body weight and natural resistance was positive and negative strong. A positive relationship between the body weight and natural resistance was observed when using organic feed supplements (Iodkazeini Sel-Plex), Avizim 1200 enzyme additives (wheat feed mixture), Avizim 1200 (wheat-barley feed mixture), Natuphos and phytobiotic Liv 52 Vet.

When using Stimulus, the correlation between the body weight and natural resistance increased from a weak positive ($r = 0.29$) to a strong positive one ($r = 0.98$).

When using Iodkazeini Sel-Plex, all the indicators of natural recurrence increased, the correlation relationships were as follows: for phagocytic activity $r = 0.79$ and 0.91; for the phagocytic number $r = 0.82$ and 0.61; for the phagocytic index $r = 0.75$ and 0.95; for the phagocytic capacity $r = 1.00$ and 0.94, respectively.

Enzyme preparations had a positive effect on the relationship between the body weight and natural resistance. When using Avizim 1200 (wheat feed mixture), the relationship was $r = 0.95$; when using Avizim 1200 (wheat-barley feed mixture) $r = 0.73$ and when using Natuphos $r = 0.68$. 
When using Liv 52 Vet, the relationship between the body weight and the phagocytic activity, number and index was strong positive ($r = 0.87$; 0.84 and 0.59); between the body weight and the phagocytic capacity – weak positive ($r = 0.37$).

When using Lewisel SB Plus, Vetom, Laktobifadol and Agrimos, the relationship between the body weight and the phagocytic activity was strong negative: $r = -1.00$; $-0.79$; $-0.82$ and $-1.00$; the relationship between the body weight and the phagocytic number was strongly negative: $r = -0.70$; $-0.83$; $-0.74$ and $-0.97$. A strong negative correlation between the live weight and the phagocytic number, index and capacity was observed when using Vetrosel E forte ($r = -0.78$; $-0.83$; $-0.92$, respectively).

When using bentonite, potassium Iodine and sodium selenite, both positive and negative correlations were established.

Thus, when studying the relationship between the body weight and natural resistance positive (45.00%) or strong negative (28.33%) relationships were observed; the lack of relationships was observed in 33.3% of cases. Consequently, the change in the live weight had a significant impact on natural resistance of goslings.

When studying correlations between the body weight and leukogram indices, it was found that the level of relationship was not stable. It was not possible to determine any patterns. A strong positive relationship was observed in 24.45% of cases; a strong negative relationship was observed in 26.67% of cases. Mean and weak positive correlations were observed in 18.89%; mean and weak negative relationships were observed in 15.56% of cases. In 13.33% of cases, there was no relationship.

4. Conclusion

Thus, the studies on correlations between the live weight and hematological parameters when using various supplements showed that the live weight and its dynamics had a significant impact on morphological blood parameters and natural resistance of goose broilers and reduced $e$ values of biochemical parameters (especially the content of total serum protein). The correlation of live weight and fractional composition of protein was rather weak, and the level of relationships with leukogram indices was unstable. Therefore, it was impossible to determine any patterns.

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