

EXPERIMENTAL BIOLOGY

Dynamics of Growth and Nonspecific Resistance of Productive Animals under Biogeochemical Conditions of the Sura and Trans-Sura Regions in Chuvashia

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Complex evaluation of the effects of biogenic compounds Permamic, Combiolax, DAFS-25, Selenopyrane, and Trepel on pigs and young boars with consideration for the biogeochemical characteristics of the Sura and Trans-Sura regions in Chuvashia demonstrated their pronounced neuroimmunoendocrine effect.

Key Words: *young pigs; young boars; blood; nonspecific resistance*

Development, trials, and introduction of Russian new generation immunocorrectors stimulating human and animal neuroimmunoendocrine reactions under conditions of their natural habitation is an important problem of modern biology and biotechnology [1-4].

We studied the growth and factors of cellular and humoral resistance in young boars and pigs (under 1 year of age) treated by Permamic, Combiolax, DAFS-25, Selenopyrane, and Trepel in the Sura and Alatyr Trans-Sura regions of the Chuvash Republic.

MATERIALS AND METHODS

Four series of experiments were carried out in 60 young boars and 60 young pigs aged under 1 year. The animals were selected by clinical physiological status, breed, age, gender, and weight.

Each group consisted of 10 animals. Group 1 animals (control) received basal rations (BR) on days 60-300 of life (duration of experiments) in all series of the study. In experimental series I (before the age

of 240 days), young boars fed BR supplemented by daily Permamic (1.25 g/kg) in group 2 and by Combiolax (1 ml/kg) in group 3. In series II, young boars of groups 2 and 3 received, in addition to BR, daily Combiolax in the above dose and were intramuscularly injected with DAFS-25 and Selenopyrane (0.1 mg Se/kg), respectively, at the age of 60, 180, and 240 days.

In experimental series III and IV, the pigs received, in addition to BR, daily Trepel (1.25 g/kg) in groups 2 and daily Combiolax (1 ml/kg) in groups 3 by 20-day courses with 10-day intervals until the age of 240 days and Combiolax in combination with Trepel in the above doses.

Body weight gain and growth dynamics and hematological and immunological profiles were studied in 5 animals of each group on days 60, 120, 180, 240, and 300 of life.

RESULTS

In series I, body weights of young boars in groups 2 and 3 were higher than in controls throughout the entire study. On days 180, 240, and 300 of life, their body weights were 9.7-24.6% higher than in the con-

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trol ($p<0.05-0.001$). By the age of 300 days, body weight of group 3 boars receiving Combiolax was 12 kg ($p<0.001$) higher than in group 2 young boars receiving Permamic.

The dynamics of the mean daily body weight gain in young boars in these groups was similar to changes in their live weights.

Blood erythrocyte counts varied in the course of the study from $5.98\pm0.10-6.02\pm0.10$ to $6.64\pm0.06-7.22\pm0.17\times10^6/\mu\text{l}$. In group 3 young boars, this parameter surpassed the control values by 5.4-8.6% ($p<0.05-0.005$) on days 120, 180, 240, and 300 of life.

Changes in the blood hemoglobin concentrations in general corresponded to the dynamics of erythrocyte counts.

The percentage of autoplague-forming cells (APFC) increased with age in young boars of all groups in a wave-like pattern from $3.60\pm0.07-3.60\pm0.09$ to $4.70\pm0.38-5.10\pm0.16$. The difference in this parameter in different experimental groups was negligible.

The content of γ -globulins steadily increased with age in young boars of all groups (from $10.00\pm0.15-10.10\pm0.47$ to $15.30\pm0.92-18.20\pm0.16$ g/liter), this parameter surpassing the control values by 3.8-20.6% ($p<0.05$) in group 3 young boars (treated by Combiolax) at the age of 120, 180, 240, and 300 days.

Serum immunoglobulin levels in young boars gradually increased with age (from $11.60\pm0.27-11.70\pm0.43$ to $20.70\pm0.13-21.70\pm0.05$ mg/ml), the level of this immunocompetent factor in group 3 young boars surpassed the control by 4.6-13.7% at the age of 120 and 300 days ($p<0.05-0.005$).

Blood peroxidase level in young boars changed in a wave-like manner from $25.20\pm0.14-25.60\pm0.87$ to $27.60\pm1.45-29.2\pm1.4$ arb. units ($p>0.05$).

Alkaline phosphatase concentration decreased smoothly by the end of experiment ($2.70\pm0.05-2.70\pm0.11$ vs. $1.00\pm0.12-1.50\pm0.15$ mmol/h \times liter); the differences were negligible, except the age of 240 days, when activity of the enzyme in group 2 boars significantly surpassed that in group 3 animals ($p<0.005$).

In series II, body weights of young boars receiving Combiolax in combination with DAFS-25 or Selenopyrane significantly surpassed the control. The difference was 10.9-37.7 kg ($p<0.05-0.001$) on days 120, 180, 240, 300 of life.

A similar regularity was revealed for the dynamics of the mean daily live weight gain.

Blood erythrocyte counts in young boars steadily increased from day 60 to 300 of life (from $5.18\pm0.05-5.23\pm0.06$ to $5.39\pm0.08-5.47\pm0.07\times10^6/\mu\text{l}$; $p>0.05$).

The dynamics of hemoglobin concentration in general corresponded to changes in erythrocyte counts. This parameter was 1.9-6.8% higher than in the con-

trol in groups 2 and 3 at the age of 120, 180, 240, and 300 days ($p<0.050-0.001$).

Blood APFC activity in young boars of the compared groups decreased in a wave-like mode with age from $2.47\pm0.18-2.68\pm0.17$ to $2.21\pm0.03-2.25\pm0.07\%$, the differences between the groups were negligible.

The content of γ -globulins in young boars increased smoothly with aging (from $12.80\pm0.66-13.50\pm0.89$ to $14.0\pm0.4-16.20\pm0.65$ g/liter), group 2 animals aged 120, 180, 240, and 300 days surpassing the controls by this immunocompetent factor by 10.8-13.6% ($p<0.05$).

Immunoglobulin concentrations in young boars steadily increased with age from $13.80\pm0.13-14.6\pm0.1$ to $16.70\pm0.21-19.10\pm0.23$ mg/ml and surpassed the control values by 12.6-14.8 and 8.2-9.9% ($p<0.005-0.001$) in groups 2 and 3, respectively, at the age of 120, 180, 240, and 300 days.

Blood levels of peroxidase decreased from the age of 60 to 300 days ($43.00\pm0.75-43.4\pm1.7$ vs. $20.60\pm0.68-22.60\pm0.95$ arb. units), but were lower in groups 2 and 3 young boars than in the control during all periods of the study ($p>0.05$).

Alkaline phosphatase activity gradually increased from the age of 60 to 120 and 180 days in experimental and control boars ($1.50\pm0.03-1.50\pm0.04$ vs. $2.29\pm0.03-2.38\pm0.05$ mmol/h \times liter and 1.52 ± 0.04 vs. 2.38 ± 0.08 mmol/h \times liter, respectively), but by the end of the study decreased to $2.22\pm0.02-2.29\pm0.07$ mmol/h \times liter ($p>0.05$).

Hence, addition of Combiolax, DAFS-25, and Selenopyrane to BR had a positive impact on pig growth and nonspecific resistance. The growth stimulation was more pronounced in animals receiving Combiolax and Selenopyrane, while the immunostimulatory effect was higher in animals receiving Combiolax with DAFS-25.

In experimental series III, body weights in groups 2 and 3 young boars were higher than in the controls. At the age of 120 days, this parameter was 19.4 and 12.9% higher than in the control, respectively, at the age of 180 days 25.7 and 19.4% higher, at the age of 240 days 24.6 and 20.0% higher, and at the age of 300 days 24.4 and 20.7% higher than in the control ($p<0.05-0.005$).

The dynamics of mean daily body weight gain in animals was similar to that of live weight gain.

Blood erythrocyte count in the pigs of compared groups gradually increased throughout the study from $5.97\pm0.04-6.04\pm0.04$ to $6.60\pm0.17-7.20\pm0.25\times10^6/\mu\text{l}$, the parameter surpassing the control values by 3.8-8.3% ($p<0.05$) in pigs receiving Trepel (group 2) and Combiolax (group 3) at the age of 120, 180, 240, and 300 days.

Hemoglobin concentrations in experimental groups surpassed the control levels by 8.3-15.2%

($p < 0.05$ - 0.005) and in general was in line with the dynamics of erythrocyte counts.

The percentage of APFC increased in pigs of all ages from day 60 until day 180 of life (3.40 ± 0.07 - 3.60 ± 0.12 vs. 4.30 ± 0.09 - $4.90 \pm 0.07\%$) with a trend to subsequent reduction to 4.00 ± 0.65 - $4.40 \pm 0.10\%$ ($p > 0.05$) by the end of the study.

The dynamics of γ -globulin concentrations in general conformed to changes in albumin levels. The parameter surpassed the levels in the control by 8.3-26.1% ($p < 0.05$) in pigs aged 120, 180, 240, and 300 days in groups 2 and 3 receiving Trepel and Combiolax, respectively.

Immunoglobulin levels in the pigs increased steadily with aging from day 60 to day 300 (11.40 ± 0.16 - 11.60 ± 0.12 vs. 14.00 ± 0.17 - 14.90 ± 0.17 mg/ml, respectively). The levels of this immunocompetent factor were higher than in the control ($p < 0.05$) in pigs aged 120, 180, 240, and 300 days.

Blood peroxidase and alkaline phosphatase activities in pigs aged 120, 180, 240, and 300 days in groups 2 and 3 were lower than in the control ($p > 0.05$); this fact attests to lower anxiety of animals.

Animal body weights in groups 2 and 3, receiving Trepel and Trepel+Combiolax, respectively, were significantly higher than in the control during series IV of the study. The difference for the ages of 120, 180, 240, and 300 days was 17.2-28.4% ($p < 0.005$). On the other hand, the differences between experimental groups were negligible over the course of experiment.

Similar regularities were detected for the dynamics of the mean daily body weight gain. The parameter was 125-267 g higher than in the control ($p < 0.005$) in animals aged 120, 180, 240, and 300 days.

Blood erythrocyte levels in pigs steadily increased from day 60 to day 300 of age (5.99 ± 0.05 - 6.03 ± 0.04 vs. 6.58 ± 0.06 - $7.15 \pm 0.04 \times 10^6/\mu\text{l}$). Erythrocyte counts in animals aged 120, 180, 240, and 300 days in groups 2 and 3 were 4.7-8.0% higher than in the control ($p < 0.05$).

The dynamics of hemoglobin concentration in general was in line with changes in erythrocyte counts.

Activity of APFC in the pigs of the studied groups increased significantly from 60 to 180 days of age (3.40 ± 0.13 - 3.50 ± 0.09 vs. 4.40 ± 0.12 - $4.70 \pm 0.05\%$) and exhibited a trend to reduction to 3.90 ± 0.35 - 4.20 ± 0.03 ($p < 0.05$) by the end of the study.

The dynamics of γ -globulin concentrations in general conformed to changes in total protein level. Experimental animals aged 120, 180, 240, and 300 days had higher values (by 10.9-25.9%; $p < 0.05$) than the controls.

Serum immunoglobulin levels steadily increased from the age of 60 to 300 days (11.40 ± 0.21 - 11.60 ± 0.16 vs. 14.10 ± 0.12 - 15.40 ± 0.12 mg/ml) and were significantly higher in pigs aged 120, 180, 240, and 300 days than in the control.

Blood concentration of peroxidase gradually increased until the age of 180 days from 25.20 ± 0.18 - 25.50 ± 0.18 to 27.20 ± 0.75 - 28.90 ± 0.26 arb. units and then decreased to 26.30 ± 0.09 - 26.90 ± 0.15 arb units by the end of observation.

A different regularity was detected for the dynamics of alkaline phosphatase. Its level steadily decreased in the pigs from day 60 to day 300 of age (2.30 ± 0.18 - 2.50 ± 0.11 vs. 1.30 ± 0.11 - 1.80 ± 0.67 mmol/h \times liter).

Leukocyte counts in the animals of all groups in all series of experiments decreased in a wave-like manner from the start to the end of the experiment (21.60 ± 0.29 - 21.90 ± 0.34 vs. 17.30 ± 0.91 - $20.00 \pm 0.14 \times 10^3/\mu\text{l}$; $p > 0.05$).

Hence, Trepel and Combiolax had a positive impact for pig growth, hematological, biochemical, and immunological profiles. The growth-stimulating and immunophysiological effects were virtually equivalent in the groups receiving Trepel and Combiolax.

Our data indicate that breeding of young boars and pigs under biogeochemical conditions of the Sura and Trans-Sura regions of the Chuvash Republic on BR supplemented by Permamic, Combiolax, DAFS-25, Selenopyrane, and Trepel was associated with stimulation of their growth and nonspecific resistance and with improvement of their neuroimmunoendocrine parameters.

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