



ATHEROGENICITY INDEX, «GOOD» LIPOPROTEINS AND THE RATIO OF TOTAL CHOLESTEROL AND PROTEIN OF BROILER CHICKENS IN THE HEALTH SYSTEM

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Relevance

Poultry meat contains all the nutrients, including proteins and lipids, that can meet the recommended daily allowance for humans in vitamins and minerals [1]. Low-density lipoprotein cholesterol (LDL-C), the most atherogenic lipoprotein obtained by humans through food, has a cytotoxic effect, promotes the formation of atherosclerotic plaques on the walls of blood vessels and the development of chronic atherosclerosis with the risk of coronary disease and myocardial infarction [2]. An integral indicator of the blood lipid spectrum is the atherogenic index (AI), which reflects the ratio of cholesterol of atherogenic lipoproteins (LDL-C) to anti-atherogenic (HDL-C) [2]. A high prognostic value of IA has been established in relation to the risk of death from diseases associated with atherosclerosis [2]. The ratio of LDL-cholesterol (LDL-C) to HDL-cholesterol (HDL-C), that is, LDL-C/HDL-C, has been proven to be the best predictor of the severity of atherosclerosis processes, coronary heart disease, compared with taking into account the concentration of LDL-C or HDL-C by separately [3, 4].

Purpose of the work

Determination of the atherogenic index, the ratio of atherogenic to antiatherogenic lipoproteins, total cholesterol and protein in the early postembryonic ontogenesis of broiler chickens to characterize the health-saving qualities of meat poultry products.

Methodology of work

Blood was taken from *Hubbard ISA F15* broiler chickens grown by an industrial herd at «Chebarkulskaya Ptitsa» LLC (Chebarkulsky district of the Chelyabinsk region, Russia). Of which 4 groups were formed (n=40): 1-day; 7 days; 23 days; 42 days. Total protein (TP), g/l, was determined in blood serum by electrophoresis. High-density lipoprotein cholesterol (HDL-C) in mmol/l was determined in blood plasma using the «Vector-Best» kit by the enzymatic method; using the «Olvex Diagnosticum» kit, total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) were determined in mmol/l. The atherogenic index (AI) was calculated in conventional units (c.u.); ratios were calculated: LDL-C/HDL-C, c.u., (TC/TP)×100%, in % and (LDL-C/TC)×100%, %. The average daily weight gain A_{sp} in g/day was determined. The normality of the distribution of values was determined by the *Shapiro-Wilk*, *Kolmogorov-Smirnov* and *Lilliefors tests*. *Student's t-test* was used; for HDL-C, a sign test was used. $p \leq 0.05$ was taken as the critical level of significance of differences in values when testing statistical hypotheses.

Results

According to the results of comparing the criteria for the normality of the distribution of HDL-C, mmol/l in broiler chickens *Hubbard ISA F15* according to the *Kolmogorov-Smirnov test*, the significance level was more than two tenths $p > 0.20$, $d = 0.21282$. Similarly, according to the *Lilliefors test*, the significance level of HDL-C concentrations: $p > 0.20$; therefore, according to these criteria, the hypothesis of normal distribution is confirmed. At the same time, according to the results of the *Shapiro-Wilk test*, the concentration of HDL-C had a significance level of $p = 0.02041$, $W = 0.81224$ (Fig. 1: 1.1). Also, according to the graph of the normal probability distribution of values, systemic deviations from the theoretical straight line of the normal distribution of HDL-C values were established (Fig. 1: 1.2).

Therefore, the combined application of the *Shapiro-Wilk test* with the calculation of the plot of the normal probability distribution of values received a proven advantage in efficiency compared to using the *Kolmogorov-Smirnov* and *Lilliefors tests* to test the distribution of HDL-C concentration, mmol/l in *Hubbard ISA F15* broiler chickens for compliance Gauss's law on the normal distribution of quantities (Fig. 1).

By 7 days, AI significantly decreased by 56.38% $p \leq 0.001$ (Fig. 2), the LDL-C/HDL-C ratio significantly decreased by 62.78% $p \leq 0.001$ (Fig. 2). At 23 days and 42 days age period, the physiological dynamics of IA and LDL-C/HDL-C stabilized, so although by the 23rd day age compared to 7 days. period, the AI value increased by 47.95%, LDL-C/HDL-C increased by 13.55%, the difference was not significant (Fig. 2). The ratio of LDL-C/TC by the 7th day age significantly decreased by 36.62% $p \leq 0.05$ and stabilized without significant change in the period of 23–42 days in relation to the age of 7 days within 41.77% - 31.0% (Fig. 3). The dynamics of TC/TP corresponded to the average daily weight gain and the physiological characteristics of broiler birds; TC/TP by the 7th day. age significantly decreased by 65.45% $p \leq 0.001$ (Fig. 4). Further to the 23rd day age, TC/TP volume slightly increased by 36.34% $p \leq 0.05$ (Fig. 4). Significant change in TC/TP by day 42- period was not recorded.

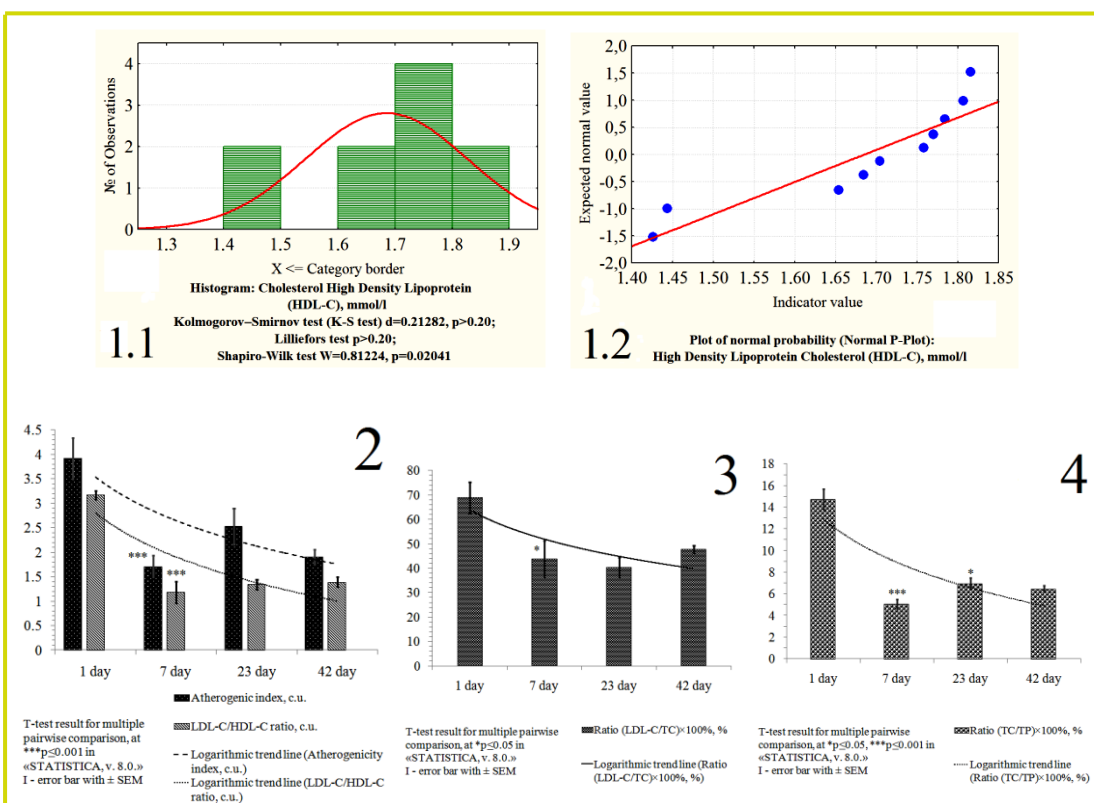


Figure 1. Checking the normal distribution of high-density lipoprotein cholesterol (HDL-C), mmol/l in broiler chickens according to the results: 1.1 - Kolmogorov-Smirnov test, Lilliefors test and Shapiro-Wilk test; 1.2 - Plot of normal probability
Figure 2. The values of the atherogenic index and the ratio of low-density lipoprotein cholesterol (LDL-C) to high-density lipoprotein cholesterol (HDL-C) (in conventional units) in the peripheral blood of broiler chickens in early postembryonic ontogenesis. SEM - standard error of the mean

Figure 3. The ratio of low-density lipoprotein cholesterol (LDL-C) to total cholesterol (TC) (in%) in the peripheral blood of broiler chickens in early postembryonic ontogenesis. SEM - standard error of the mean

Figure 4. Values of the ratio of total cholesterol (TC) to total protein (TP) (in%) in the peripheral blood of broiler chickens in early postembryonic ontogenesis. SEM - standard error of the mean

Conclusions

Thus, the dynamics of the atherogenic index, the ratio of lipoproteins, total cholesterol and protein in the early postembryonic period of broiler chickens, that is, in the technological period of poultry meat production, showed a tendency to stabilize the effective concentration of high-density lipoprotein cholesterol, a moderate concentration of low-density lipoprotein cholesterol, in the process intensive growth and development of skeletal muscles.

List of sources used

- Wu, X.L., Zou, X.Y., Zhang, M., Hu, H.Q., Wei, X.L., Jin, M.L. et al. (2021). Osteocalcin prevents insulin resistance, hepatic inflammation, and activates autophagy associated with high-fat diet-induced fatty liver hemorrhagic syndrome in aged laying hens. *Poultry Science*, 100(1), 73-83. <https://doi.org/10.1016/j.psj.2020.10.022>.
- Kudaeva, I.V., Dyakovich, O.A., Masnavieva, L.B., Dyakovich, M.P., Shayakhmetov, S.F. (2017). Prediction of atherogenic index values in workers exposed to mercury. *Occupational Medicine and Industrial Ecology*, 10, 34-38.
- Sun, T., Chen, M., Shen, H., Yin, P., Fan, L., Chen X. et al. (2022). Predictive value of LDL/HDL ratio in coronary atherosclerotic heart disease. *BMC Cardiovascular Disorders*, 22, Article 273, 2-11. <https://doi.org/10.1186/s12872-022-02706-6>.
- Di Taranto, M.D., de Falco, R., Guardamagna, O., Massini, G., Giacobbe, C., Auricchio R. et al. (2019). Lipid profile and genetic status in a familial hypercholesterolemia pediatric population: exploring the LDL/HDL ratio. *Clinical Chemistry and Laboratory Medicine (CCLM)*, 57(7), 1102-1110. <https://doi.org/10.1515/cclm-2018-1037>.