

The influence of diets containing proteins of different origins on the level of faecal *Streptococcus spp.*

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Abstract

The work aimed to study the influence of proteins of different origins on the level of faecal *Streptococcus*. Three series of experiments were performed on 45 model animals (Guinea pigs). The optimal level of *Streptococcus* is best maintained with diets containing a predominance of proteins of animal origins, primarily fish protein. These proteins contribute to a substantial decrease in conditionally pathogenic *Streptococcus*, for example, *Enterococcus fecalis* (per average with 48.32%, 46.65%, and 44.45% in conformity with the concentration of protein of 10%, 14%, and 16%).

Keywords: streptococci, level, component, protein, diet.

1. Introduction

Analysis of existing information has shown that streptococci constantly inhabit the human and animal digestive tract and are represented by various bacteria of the genera with beneficial, opportunistic and pathogenic properties (Velciu *et al.*, 2014; Khursa *et al.*, 2017; Dzitstsoyeva & Andreyevna, 2016; Antsiferova & Tedder, 2001; Todar, 2020). At the same time, it is noted that some of the main components of diets are proteins, which are constantly required for the normal growth and development of the human and animal organism (Antsiferov *et al.*, 2011; Wang *et al.*, 2017; Barko *et al.*, 2018).

Microorganisms inhabiting the digestive tract play an important role in protein assimilation because some of their genera are actively involved in the process of breaking them down into amino acids. In contrast, others can synthesize biologically active substances such as vitamins, enzymes, and amino acids, which also take part in the metabolic processes of the body. The amino acids are the basis of body health (Gentile & Weir, 2018; Kinross *et al.*, 2011; Blaut & Clavel, 2007).

With this in mind, many researchers believe that increasing the functionality and health effects of proteins requires close attention to the source of proteins in the diet (Blaut & Clavel, 2007; Boehm *et al.*, 2003).

Some studies have shown that quantitative indicators of individual gut bacterial species can be used to determine the prebiotic properties of food supplements (Markowiak & Ślizewska, 2018; Strutinschi et al., 2012).

The above information substantiated the objective of the present research, which envisaged revealing the dependence of the level of streptococci in the intestine on the nature of specific dietary components using proteins as an example.

2. Methodology

Three experiments were conducted on 45 model animals (Guinea pigs), divided into nine groups, with five animals in each group. Three groups formed one series.

In all the experiments, the animals received the same diet. The difference was in the first series, where the animals received predominantly meat (poultry) protein. The second series received fish proteins, and the third received vegetable proteins. In all series, groups with No. I received 10% protein, No II - 14% and No III - 16%.

The quantitative level of streptococci in 1 g, expressed in decimal logarithms, was determined in samples from rectal contents at the beginning and the end of each experiment.

3. Results and discussion

The results obtained in all experiments are shown in Figures 1, 2 and 3.

The data in Figure 1 show that a diet containing poultry meat protein suppressed the growth of streptococci. The result is confirmed by a reduction in their levels in the intestines of animals of groups I, II and III by an average of 11.09%, 8.85%, and 12.43%.

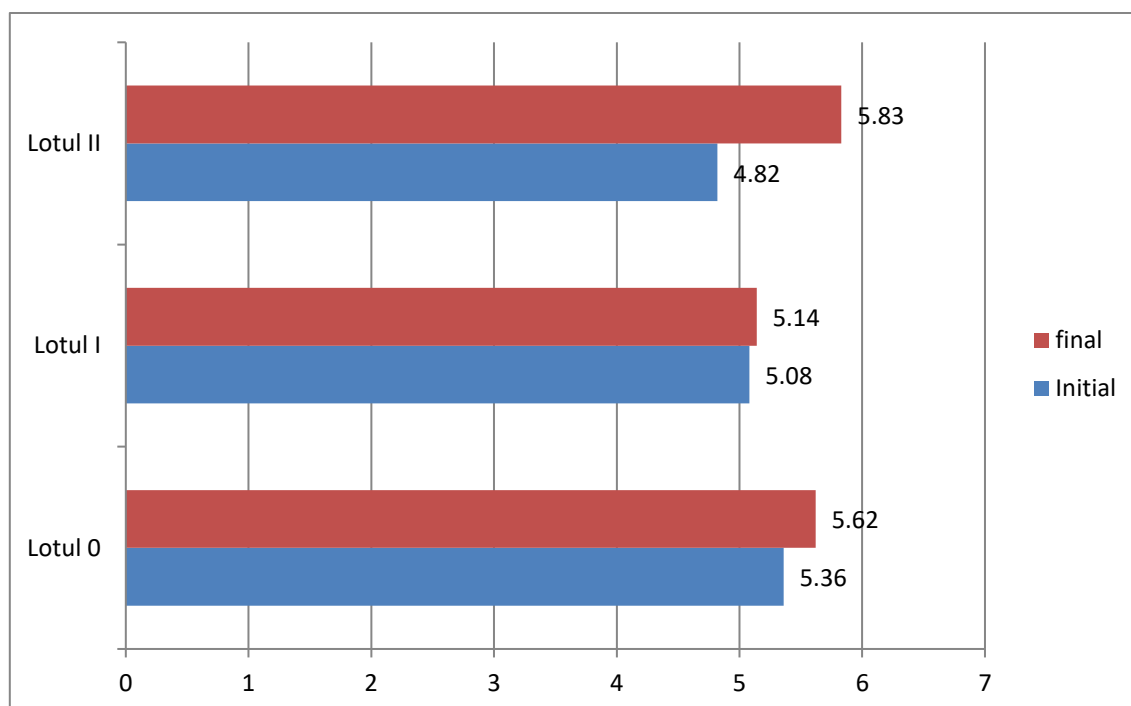


Figure 1. Quantitative levels of streptococci in the intestines of guinea pigs on a diet predominantly containing poultry meat protein. Animal groups, I, II, and III are given in the text.

Thus, in the first series of experiments, a complete dependence of the level of streptococci in the intestine on the concentration of protein in the diet was established. The highest suppression was found in group III, where 16% protein was applied. In comparison, a lower suppression was found in group II (at 14%) and an average suppression in group I, where the protein concentration in the diet was only 10%.

Analysis of the data obtained in the second series of experiments (Fig. 2) revealed the same trend in the level of streptococci. The only difference was that their numbers decreased more intensively. An average reduction in streptococci by 48.32%, 46.65%, and 44.45% in groups I, II, and III was obtained at the end of the experiment compared to zero moments.

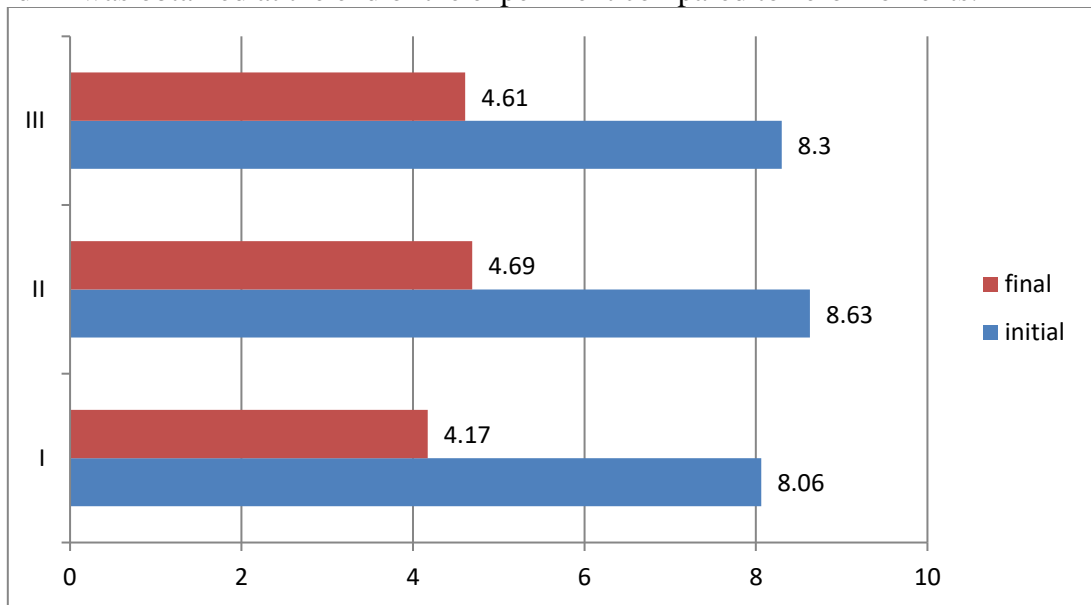


Figure 2. Quantitative level of streptococci in the intestines of guinea pigs on a diet predominantly containing fish protein.

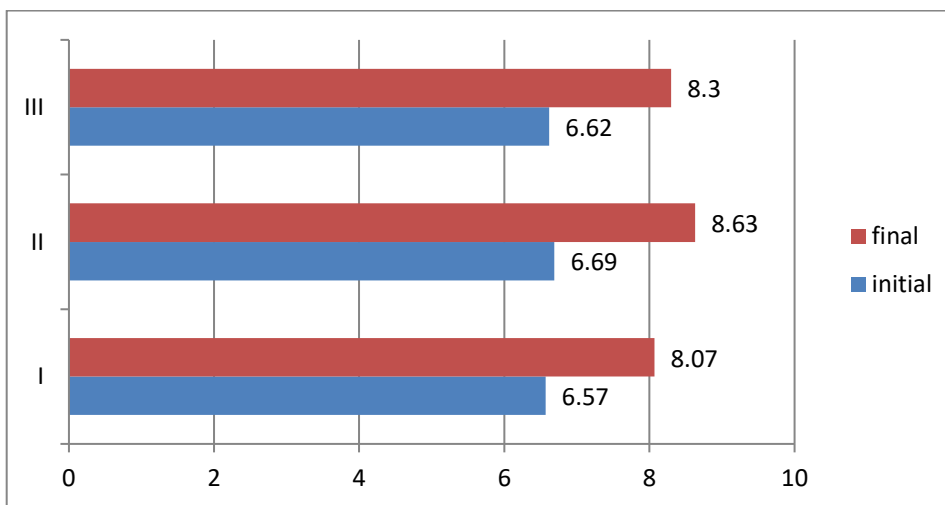


Figure 3. Quantitative level of streptococci in the intestines of guinea pigs on a diet containing vegetable protein.

Thus, it was found that the results of the second series of experiments also confirmed the dependence of the level of streptococci in the intestine on the nature of protein in the diet because the diet with fish protein had a positive effect on their abundance in the intestines of model animals. The degree of growth suppression depended on the concentration of protein in the diet. The level of such bacteria in the intestinal contents of group I animals decreased by 48.32%, whereas in groups III and II, the level of such bacteria decreased by 45.65% and 44.45%, respectively. Consequently, when a diet containing fish protein was used, streptococci were found in higher numbers than the data obtained in series I. This result led to the conclusion that the number of streptococci population influences the process of protein assimilation.

The next series of experiments focused on the number of streptococci in the intestines of the same animals when a diet containing plant-based protein was used. The results proved to be significantly different from those of the previous series. This result is confirmed by figure 3, which was negative, as it exceeded the baseline by an average of 22.83%, 28.99%, and 25.37%. Since intestinal streptococci also include opportunistic species, the increase in such microorganisms must be considered a negative phenomenon for the organism.

Consequently, this series of experiments also revealed a complete dependence of the quantitative level of intestinal streptococci on the nature of the protein in the diet. At the same time, it should be pointed out that the protein of plant origin throughout the experimental period contributed to disrupting the microbial streptococcal equilibrium in the intestine. Moreover, such a diet provoked an intensification of the emergence of a pathological state of digestive health (dysbacteriosis or disorder in the form of diarrhoea).

4. Conclusions

Thus, in all three sets of experiments, the dependence of the level of streptococci in the intestine on the nature of the protein used in diet and its concentrations was proved. In conclusion, based on the results obtained, it is advisable to recommend using diets containing proteins, mainly of fish origin, to maintain optimum levels of streptococci in the intestine because it contributed to the intensive reduction of opportunistic streptococci in the example of *Enterococcus faecal*.

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