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Influence of additive components with separate introduction of antagonistic components on gastrointestinal micro organization and micro elements content in mouse blood serum

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ABSTRACT

Taking into account the data on higher biological availability of chelate compounds of microelements in comparison with their inorganic salts, a liquid feed additive for cattle with the content of fat-soluble vitamins A, D, E and diacetophenonyl selenide (DAFS 25) in the form of stable microemulsion and chelates of manganese, iron, cobalt, and zinc was developed. The biochemical and physiologically antagonistic components of the additive are divided into two separate liquid mixtures for separate, alternating ingestion on white laboratory mice, histological methods evaluated the effect of different doses of the additive on the micro organization of the components of the stomach wall, small and large intestine in different terms of the experiment. The additive was introduced into animals individually daily per o s during one month in doses of 0.06, 0.12, 0.3, 0.6 and 1.2 g/kg. The control animals received an equivalent amount of physiological solution. The availability of trace elements of the developed product is estimated by analysis of blood serum on the zinc, iron, manganese, cobalt content by atomic-adsorption spectrometry. Examination bodies and blood for analysis were selected at the time of slaughter in accordance with generally accepted requirements. The dosage of the additive, which has the most effective influence on the growth of the concentration of injected micronutrients in the serum of mice in comparison with the control, was determined. It was found that the components of the additive have the most pronounced effect on zinc and iron content in the dose of 0.3 g/kg.

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INTRODUCTION

It is known that obtaining a large quantity of quality livestock products at an acceptable cost requires the use of animals with the appropriate genetic potential (Yakobson *et al.*, 1998). The intensity and metabolic needs of such organisms are significantly higher than those of their wild ancestors. This in turn makes it impossible to achieve outstanding productivity without the use of additives in the huge variety of the veterinary market (Schetters *et al.*, 1990a). A number of difficulties arise in the formulation of additives due to the potential chemical, biochemical and physiological antagonism of the components, for example, trace elements

included in additives can cause redox reactions that reduce the stability of vitamins. Some micronutrients can impair the flow of others (Khudhair *et al.*, 2016). Producers are trying to solve the problem by developing new approaches, including the use of nanocarriers, increasing the availability of fat-soluble vitamins through emulsifiers, but according to the literature, they are not always effective (Mammerickx *et al.*, 2010). In addition, the data itself on the mutual influence of the same elements are sometimes contradictory, for example, in the works, which suggests the need for comprehensive testing of each new formulation (Ruggiero and Bartlett, 2019).

At the same time in human and veterinary medicine for many years there have been disputes about the feasibility of separate introduction of various components of additives due to their potential chemical and physiological antagonism (Ungar-Waron *et al.*, 1992, 1999; Konishi *et al.*, 2018). There is no unanimous opinion among specialists on this issue, and in this connection it seems interesting to study this issue, especially in the context of micro organization of animal organs and tissues, as there are few publications considering the influence of different doses of food and feed additives components directly on histological organization of gastrointestinal organs (Schetters *et al.*, 1990b; Khudhair *et al.*, 2016). In this regard, the purpose of this study was to evaluate in laboratory conditions the microstructure of internal organs of mice against the background of different doses of additive with separation of potentially antagonistic components.

MATERIALS AND METHODS

In the experiment the liquid additive was investigated, the components of which are divided into two mixtures for separate introduction after a day. The composition of the dietary additive includes fat-soluble vitamins (A, D, E), DAFS-25 in the form of a stable microemulsion, trace elements Mn, Fe, Co, Zn, as part of chelate complexes to improve bioavailability by facilitating absorption in the gastrointestinal tract of animals.

The study was conducted on 92 semi-mature white male mice divided into experimental and control groups. The additive was administered orally daily and individually to each animal. The mice in the control group received an equivalent amount of physiological solution. Different doses of additives were administered in equal amounts. In 7, 14 and 30 days the animals were withdrawn from the experiment by 5 heads at each term. The killing of mice was carried out in accordance with generally accepted recommendations. In neutral buffered formalin samples of the stomach wall, small and large intestine were taken, after which histological preparations with coloring of hematoxylin eosin and further descriptive microscopic analysis were made.

One week after the start of administration, the blood serum content of zinc, iron, copper, manganese, cobalt was assessed by atomic absorption spectrometry. Blood for examination was taken at the moment of slaughter, serum for examination was received by the usual method.

RESULTS AND DISCUSSION

In the organs of animals of the control group, a typical micro organization, taking into account species peculiarities of mice, with single random findings, not related to the conducted experiment, was established at all times.

Microcartina of the stomach wall during the experiment. In 7 and 14 days from the beginning of the experiment in all experimental groups the stomach wall structure corresponded to the control (Figure 1). In one case, the signs of marginal standing of leukocytes in the venous vessels of the esophageal segment were found, and in the preparation of the stomach of one animal an increased number of fat cells in the muscular shell and submucosal base was also detected.

After 1 month in the experimental group in the fundic of the stomach of one animal a single inflammation area with signs of sloughing of the epithelium above it was revealed. Clusters of fat cells were identified in the stomach wall of another animal of the same group in the submucosal base and connective tissue layers of the muscular shell.

In-depth picture of the small intestine wall in the experiment. At all stages of the study the wall structure corresponded to the control (Figure 2).

In a single case, a section of epithelium desquamation with an increase in the number of cells of mononuclear-macrophagous series in the connective tissue base of the lint as well as a moderate expansion of blood vessels was revealed. One drug revealed a center of lymphatic infiltration of the submucous tissue and clarification of the bottom of some dental crypts.

The in-depth picture of the wall of the large intestine in the experiment on all terms corresponded to the control one (Figure 3). In a single case, a month later the animal of the experimental group revealed the presence of enlarged beaker cells with a large amount of secretion in the epithelial plate of the mucous membrane.

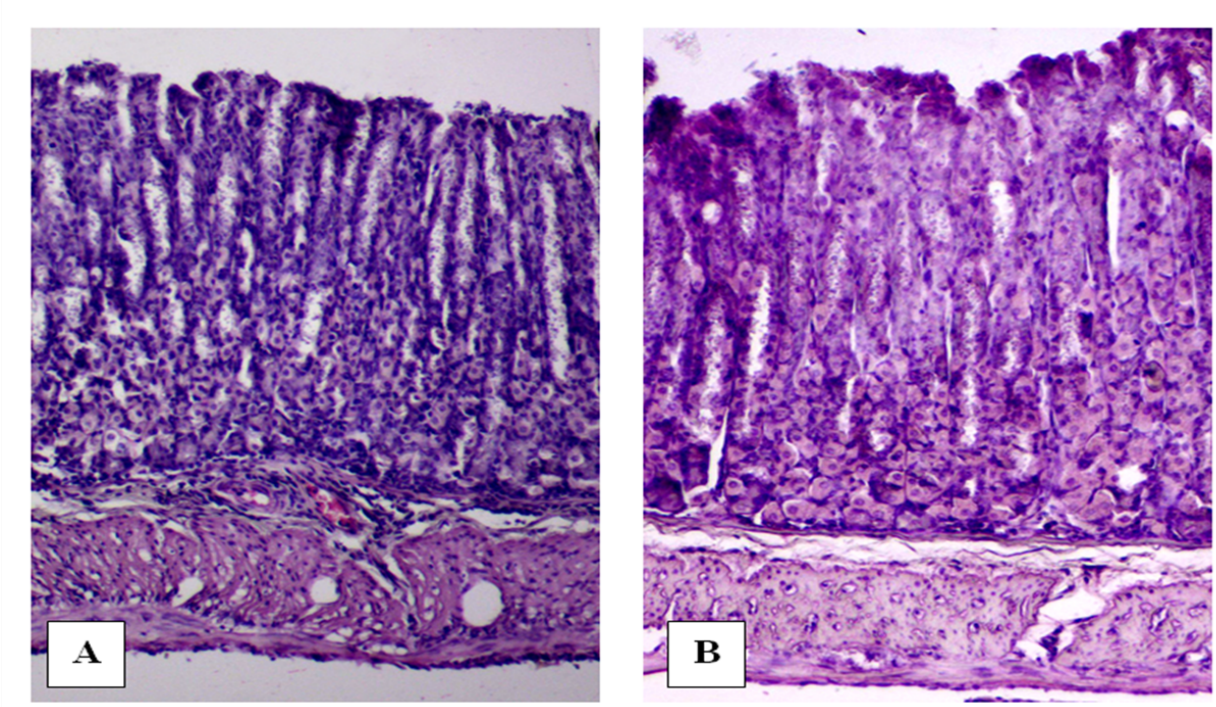

Figure 1: Stomach wall, 1 month after the beginning of introducing the additive. A - Control, B - an experienced group. Coloration with hematoxylin eosin

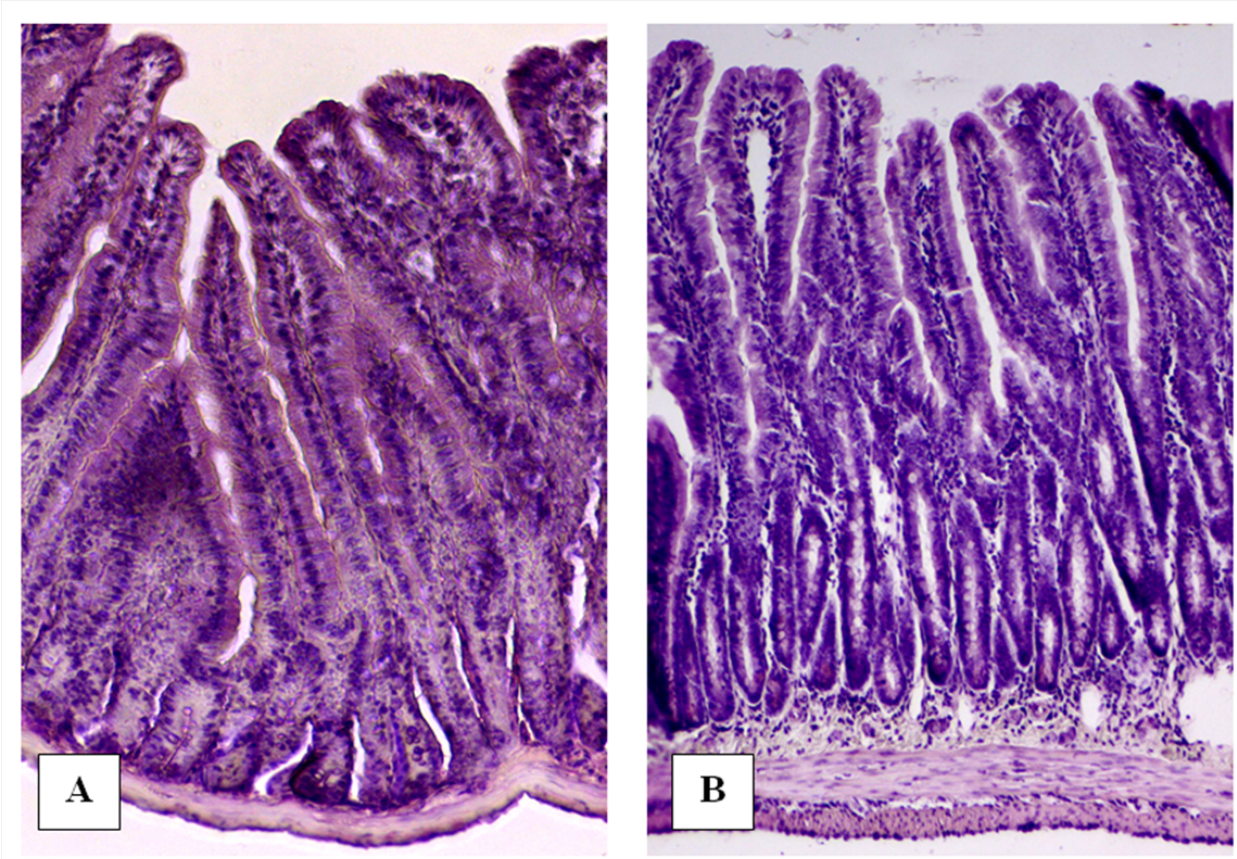

Figure 2: A fragment of the small intestine wall. 1 month after the beginning of the administration of the additive. A - Control, B - an experienced group. Coloration with hematoxylin eosin

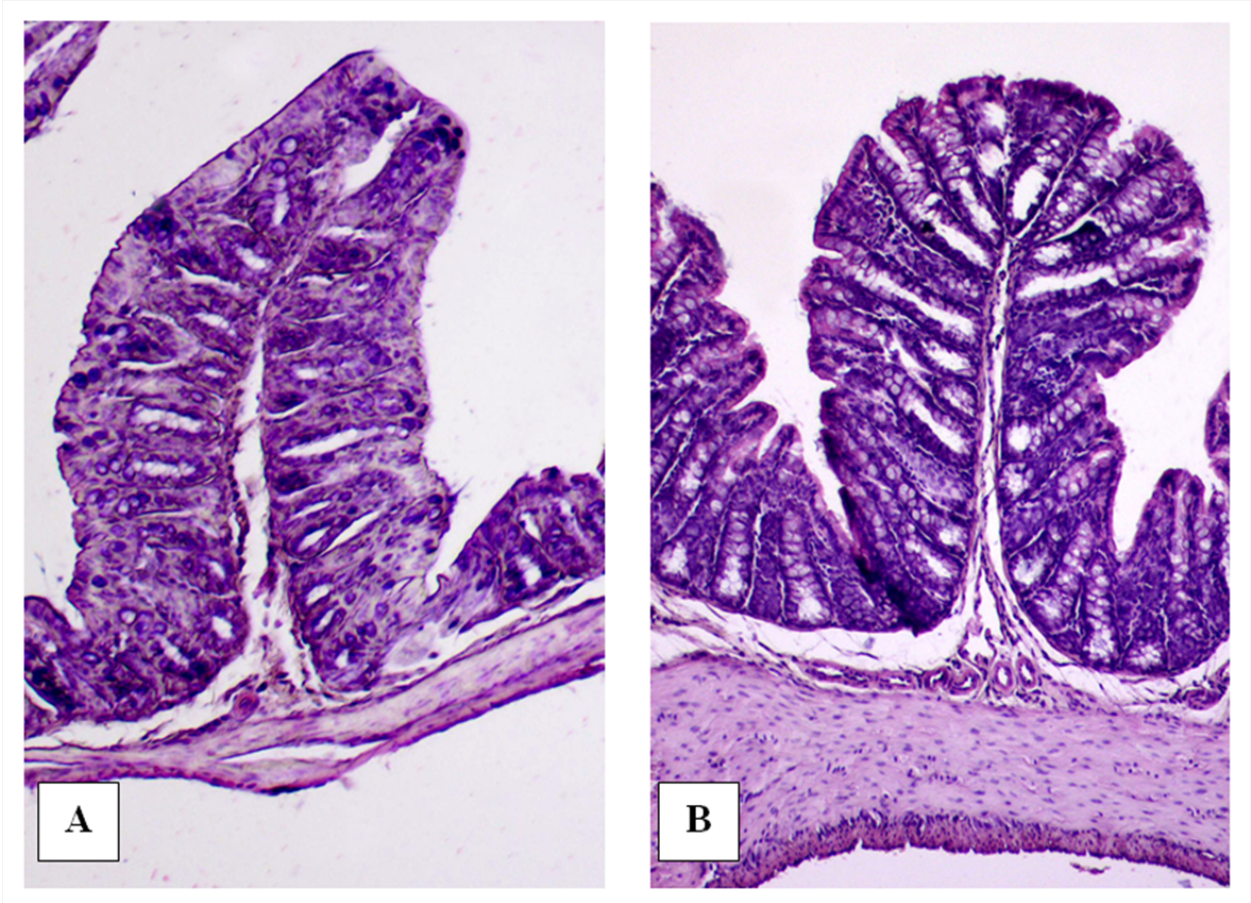

Figure 3: A fragment of the large intestine wall. 1 month after the administration of the additive. A - Control,B - an experienced group. Coloration with hematoxylin eosin

Micronutrient content in the serum. When assessing the micronutrient content, it was found that for the majority of micronutrients, the most effective was to administer a 0.3 g/kg live weight additive with the most pronounced effect on iron, copper and cobalt. It was found that the introduction of the additive in large doses does not lead to a significant increase in the concentration of trace elements in the serum.

CONCLUSIONS

The used additive does not cause any changes in the structure of the stomach wall, small and large intestines of mice in doses up to 1.2 g/kg of live weight inclusive. The revealed single cases of pathology of microscopic organization of the considered organs are the consequence of sporadic influence of pathogenic factors not connected with the main experiment, as in other animals of these groups similar changes have not been established. The use of the additive increases the concentration of zinc, iron, copper, cobalt in the serum of mice. The greatest effect with respect to the effect on the concentration of trace elements in serum is achieved with the addition of 0.3 g/kg of live weight.

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Conflict of Interest

None.

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