The efficiency of using of Alfasorb in piglets feeding

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Mycotoxins cause severe diseases in organisms of human and animals. They are difficult to diagnose, cause great economic damage. Sorbents are able to effectively bind and remove from the body through the digestive tract with a therapeutic or prophylactic purpose various endogenous and exogenous substances, microorganisms and they toxins, supermolecular structures and cells. The aim of the work is to study the effectiveness of use of Alfasorb for the neutralization of mixed fodders affected by mycotoxins and they impact on blood’s indexes and productive qualities of piglets of Large White Breed. Experience was conducted on 30 ty piglets. Animals of the control group received mixed feed that was produced in the conditions of the farm. The pigs of experimental group in addition to the basic diet received Alfasorb. We determined blood’s indexes for study the effect of feed additive Alfasorb on the physiological state of animals at 4 months of age. A morphological and histological study of liver was carried out. The analysis of the average daily weight gain of piglets showed that it was higher in period of growth in the animals of experimental group. In the animals of the experimental groups there was an increase in the number of red blood cells in comparison with the control. An unreliable decrease in blood serum levels which characterize the level of intermediate metabolism of proteins in the body (content of urea, creatinine and common bilirubin) was established in the animals of the experimental group as compared to the control group respectively by 22.83% (td = 0.98, P ≤ 0.05), 7.12% (td = 1.92, P ≤ 0.05) and by 20.54% (td = 0.86, P ≤ 0.05). Most hepatocytes had large nucleus and intense color of the cytoplasm. This indicates the absence of alterative impact on blood’s indexes and productive qualities of piglets of Large White Breed. Experience was conducted on 30 ty piglets. Animals of the control group received mixed feed that was produced in the conditions of the farm. The pigs of experimental group in addition to the basic diet received Alfasorb. We determined blood’s indexes for study the effect of feed additive Alfasorb on the physiological state of animals at 4 months of age. A morphological and histological study of liver was carried out. The analysis of the average daily weight gain of piglets showed that it was higher in period of growth in the animals of experimental group. In the animals of the experimental groups there was an increase in the number of red blood cells in comparison with the control. An unreliable decrease in blood serum levels which characterize the level of intermediate metabolism of proteins in the body (content of urea, creatinine and common bilirubin) was established in the animals of the experimental group as compared to the control group respectively by 22.83% (td = 0.98, P ≤ 0.05), 7.12% (td = 1.92, P ≤ 0.05) and by 20.54% (td = 0.86, P ≤ 0.05). Most hepatocytes had large nucleus and intense color of the cytoplasm. This indicates the absence of alterative processes in the body. The results of the studies make it possible to assert that the inclusion of 0.2% Alfasorb to the compound of feed which contaminated with mycotoxins significantly reduces their negative effect on the pigs organism, has a positive effect on the growth rate, on the course of metabolic processes, also it promotes an increase in the liver of medium-sized hepatocyte nuclei, stimulates biosynthetic processes in that cells and ensures the formation of a full structure of histohepatological barriers in the organism.

Key words: Alfasorb, blood’s indexes, living weight, liver, mycotoxines, piglets.

Eфективність застосування альфасорбу у голодлі поросят

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Мікотоксини спричиняють різні захворювання в організмі людини та тварин. Вони важко діагностуються та призводять до великих економічних збитків. Середні ефективно зв’язувати та виходити з організму через травний тракт з профілактичною чи терапевтичною метою різні ендогенні та екзогенні субстанції, мікроорганізми та їх токсини,
Various toxic substances and mycotoxins can come to the organism with food. It must be remembered when organizing a high-grade feeding of animals.

Mycotoxins are secondary metabolites. They are formed in the process of life of moldy fungus (Trufanov, 2011; Brezvyn et al., 2018). Most mycotoxins are classified as first-class of toxicity compounds. They show the tendency to enter the body through the digestive tract with a therapeutic or prophylactic purpose various endogenous and exogenous substances, microorganisms and they toxins, supermolecular structures and cells (Gusejnov, 2012). So the method of sorption is considered the most effective and safe for animals (Kondrahin, 1987; Antipov et al., 2007).

Awade range of feed additives of sorbents of foreign and domestic production is presented today on the market of veterinary drugs in Ukraine. They are recommended to be used for neutralization of fodder from mycotoxins and to increase the productivity of animals. They can be divided into three groups: inorganic, organic and combined (Kotsiumbas et al., 2010).

Alfasorb is one of the detoxicant feeds which has organic origin. It produces by LLC SPE “Ariadna” (Odessa). Alfasorb was obtained on the basis of isolation of cellulose biopolimers with a number of active centers from plant fodder. Such raw materials are dietary fibers of brain which subjected to multilevel processing. Due to this transformation of polymeric carbohydrate chains occurs and many active binding sites are formed with mycotoxins.

Efficiency of use Alfasorb is confirmed when it is infected in the diet of repairing pigs in the amount of 0.02% by the weight of the compound feed by previous studies. It positively influenced the digestibility of nutrients and productive qualities. The use of Alfasorb to detoxify fodder when raising young pigs was not performed (Kajsin et al., 2012).

Therefore the aim of the work is to study the effectiveness of the use of Alfasorb for the neutralization of mixed fodders affected by mycotoxins and they impact on blood’s indexes and productive qualities of piglets of Large White Breed.

To achieve the goal next tasks were set: to carry out the analysis of live weight of pigs after application of Alfasorb; to study morphological and biochemical parameters of blood after application of Alfasorb; to conduct a histological examination of the liver.

Matherial and methods

Experience was conducted in conditions of the farm of Shiryaevsky district of Odessa region. 30 pigs of Large White Breed were used in the experiment. They were divided into two groups according to the principle of analogs, taking into account the live weight, age and previous energy of growth. During the experiment the animals of the control and experimental groups were kept under the same conditions. The experience lasted 60 days.

Animals of the control group received mixed feed (basic diet) that was produced in the conditions of the farm (corn, barley, wheat, soybean meal, fish flour, premix, salt). The pigs of experimental group in addition to the basic diet received Alfasorb (LLC SPE “Ariadna”, Odessa, Ukraine) in quantities of 1 kg per ton of feed.
The presence of mycotoxins in feeds was determined on an immune-enzyme analyzer StatFax 2100 using test-system Ridascreen (Germany).

Dynamics of changes in live weight and the growth rate of piglets were studied on the basis of monthly individual weighting data and the calculation of the average daily growth.

We determined hematologic (number of erythrocytes and leukocytes) and biochemic (the content of hemoglobin, total protein, urea, creatinine, activity of alaninaminotransferase, aspartataminotransferase and lactatdehydrogenase, total calcium and inorganic phosphorus) blood’s indexes for study the effect of feed additive Alfasorb on the physiological state of animals at 4 months of age (Kondrahin, 1987). Blood samples for studies were taken in the morning before feeding from the ear vein.

The slaughter was carried out for three animals from the control and experimental groups in order to determine the degree of the negative effect of mycotoxins on the organism of piglets and the effectiveness of decontamination of feeds by Alfasorb. A morphological and histological study of some internal organs was carried out (Merkulov, 1969).

Statistical processing of data was carried out on a personal computer. We used computer program “Microsoft Excel”. The criteria for the reliability of differences between groups were determined by the Student’s table (Lakin, 1980).

**Results and discussion**

Animals of control and experimental groups on live weight practically didn’t differ at the beginning of the experiment (Tab. 1). The introduction of Alfasorb in the compound feed contributed to an increase in the live weight of the piglets of the experimental group. The live weight has increased in comparison with the animals of the experimental group at the end of the first month of growing on 0.95 kg (or on 3.24%) and at the end of the second month on 2.26 kg (or on 5.32%). While the pigs of the experimental group significantly exceeded the animals of control group by live weight at the end of the second month of growing (td = 3.79, P ≤ 0.01).

The analysis of the average daily weight gain of piglets showed that it was higher in period of growth in the animals of experimental group. It composed 456.33 g. It’s 36.83 g more (or on 8.76%) than in animals of control group (td = 7.37, P ≤ 0.001).

| Group          | At the beginning of the experiment, kg | At the end of the first months, kg | At the end of the second months, kg | Average daily growth for the period, g |
|----------------|--------------------------------------|-----------------------------------|------------------------------------|--------------------------------------|
| Control        | 17.30 ± 0.23                         | 29.30 ± 0.31                      | 42.50 ± 0.39                       | 420.00 ± 3.47                       |
| Experimental   | 17.35 ± 0.36                         | 30.25 ± 0.37                      | 44.76 ± 0.45*                     | 456.83 ± 3.74***                   |

**Table 1**

Live weight of experienced piglets (M ± m, n = 15)

Blood is one of the most important tissues of the body. It plays an important role in vital activity and fully reveals the picture of metabolic processes. It closely contacts all cells and organs due to the widely branched network of vessels and capillaries. Thus the blood provides the possibility of trofic and respiratory

A study of the blood composition of piglets at the end of the experiment showed that the blood indexes of animals of the control and experimental group were within the physiological norm (Kondrahin, 1987) (Tab. 2).

Alfasorb in the diet significantly reduced the negative effect of mycotoxins on the body of piglets. It contributed to some improvement in their morphological and biochemical blood indexes.

| Indexes                                      | Control                  | Experimental             |
|----------------------------------------------|--------------------------|--------------------------|
| Erythrocytes, million/liter                  | 7.17 ± 0.17              | 7.47 ± 0.29              |
| Leukocytes, thousand/liter                   | 5.27 ± 0.69              | 14.25 ± 1.45             |
| Hemoglobin, g/l                              | 95.27 ± 2.15             | 102.93 ± 1.97*           |
| Total protein, g/l                           | 67.30 ± 2.56             | 57.85 ± 2.39*            |
| Urea, mmol/l                                 | 5.81 ± 0.71              | 4.73 ± 0.85              |
| Creatinine, mcмол/l                          | 76.43 ± 1.45             | 72.35 ± 1.58             |
| Common bilirubin, micromole/l                | 2.23 ± 0.27              | 1.85 ± 0.35              |
| Alaminaminotransferase, U/l                  | 55.73 ± 2.58             | 45.3 ± 3.51              |
| Aspartataminotransferase, U/l                | 67.45 ± 2.86             | 57.53 ± 3.86             |
| Laktatdehydrogenase, U/l                    | 633.80 ± 13.86           | 697.55 ± 23.35           |
| Total calcium, mmol/l                        | 2.57 ± 0.37              | 2.70 ± 0.25              |
| Inorganic phosphorus, mmol/l                 | 1.87 ± 0.23              | 2.35 ± 0.17              |

**Table 2**

Blood’s indexes of piglets of experimental groups ( M ± m, n = 5)

**Remark:** * – P < 0.05 in comparison with the control group
In the animals of the experimental groups there was an increase in the number of red blood cells by 4.18%, hemoglobin by 7.52% and total protein by 9.73% in comparison with the control. The piglets of the experimental group respectively td = 2.62 and td = 2.44 (P < 0.05) for protein metabolism parameters (hemoglobin, total protein).

The content of total protein in the serum of pigs is an important diagnostic parameter. It is associated with changes in metabolism in the body. The increased content of total protein in the experimental group in comparison with the control indicates an increase in oxidation-reduction and plastic processes in the organism of animals in connection with the use of Alfasorb. Decrease in the total protein content in the blood serum of piglets from the control group is due to the fact that the mycotoxins were introduced into the body of the pigs. They caused inhibition of protein synthesis in the liver.

An unreliable decrease in blood serum levels which characterize the level of intermediate metabolism of proteins in the body (content of urea, creatinine and common bilirubin) was established in the animals of the experimental group as compared to the control group respectively by 22.83% (td = 0.98, P ≤ 0.05), 7.12% (td = 1.92, P ≤ 0.05) and by 20.54% (td = 0.86, P ≤ 0.05).

A decrease in the activity of transamination enzymes revealed in animals from experimental group by 16.43% (td = 1.93, P > 0.05) and by 17.24% (td = 2.26, P ≤ 0.05). This indicates a favorable effect of Alfasorb on the functional activity of the liver. An increase in the activity of these enzymes is observed in hepatitis, muscular dystrophies, injuries of animals. But these enzymes are not strictly specific.

The activity of lactatehydrogenase in pigs from experimental group increase by 10.05% (td = 2.36, P > 0.05) relative to control. It indicates the intensification of glycolytic way of catabolism of glucose. This is indirect evidence of activation of bioenergetics processes in organism of pigs with the use of Alfasorb.

The study of mineral metabolism showed that the content of total calcium in blood serum in the animals of the control group was on 5.06% (td = 0.52, P > 0.05) higher in comparison with the animals in the control group. The animals of the control group were inferior to the pigs of the experimental group by 25.67% (td = 1.68, P > 0.05) by the content of inorganic phosphorus at the same time.

Histological examination is the only and decisive method of diagnosis in many cases regardless of the etiology (Ivanytskyi, 2004). A well-defined lobular girdle structure of the liver was established in experimental group of piglets. Most hepatocytes had large nucleus and intense color of the cytoplasm. Cells of the mononuclear phagocyte system showed less activity. This indicates the absence of alterative processes in the body.

The signs of hemodynamic disorders were less pronounced in the vessels of the microcirculatory organ in experienced piglets with a sharp decrease in the permeability of the vascular wall. This was evidenced by low parasinusoidal spaces and practically complete absence of perivascular edema along the portal tract.

Congestive hyperemia, discomplexation of beams and hepatocytes, granular and fatty dystrophy, necrosis of some hepatocytes were observed in the liver of piglets of the control group. The liver was characterized by a large variety of volumes of hepatocyte nuclei, the presence of a large number of light cells that had a reduced level of glycogen content and small foci of macrophage proliferation.

Conclusions

The results of the studies make it possible to assert that the inclusion the 0.2% Alfasorb to the compound of feed which contaminated with mycotoxins significantly reduces their negative effect on the piglets organism, has a positive effect on the growth rate, on the course of metabolic processes, also it promotes an increase in the liver of medium-sized hepatocyte nuclei, stimulates biosynthetic processes in that cells and ensures the formation of a full structure of histohematological barriers in the organism.

Prospects for further research. In the future it is planned to conduct a study of the effect of Alfasorb on the organism of chicken.

References

Antipov, V.A., Semenenko, M.P., & Matjushkevskij, A.S. (2007). Perspektivy primeneniya prirodnih aljumosilikatnyh mineralov v veterinarii. Veterinarija, 8, 54–58 (in Russian).

Brezvyn, O.M., Rudyk, G.V., & Guta, Z.A. (2018). Influence of HammecoTox and Zeolitis on morphological and biochemical indicators of rat's blood under conditions of experimental fumonisin toxicosis. Ukrainian Journal of Veterinary and Agricultural Sciences, 1(1), 23–29. doi: 10.32718/ujvas1-1.04.

Dukhnytskyi, V.B., Khmelnitskyi, H.O., Boiko, H.V., Ivashchenko, V.D. (2011). Veterynarna mikotoksykolohiia: navch. posibn. K.: Ahramaovsitva. https://nupib.edu.ua/node/19867 (in Ukrainian).

Gusejnov, M.M. (2012). Jenterosorbcija pri ostryh kishechnyh infekcijah molodnjaka krupnogo rogatogo skota. Veterinarnaja medicina, 3(4), 70–71. http://www.veterinarymedicine.ru/num3-4-2012.html#29 (in Russian).

Ivanytskyi, M.Ye. (2004). Histolohichna kharakterystyka mikotoksykiziv svynyi. Visnyk ahrarnoi nauky. 8, 33–35 (in Ukrainian).

Kajsin, L.G., Bivol, L.V., & Kovalenko, A.V. (2012). Vlijanie adsorbenta “Prajmiks-Alpha sorb” na perevarimost pitatelnyh veshhestv i produktivnye kachestva remontnyh svinok. Zhitvovodstvo i veterinarnaja medicina, 3(6), 33–38. http://moynivner.net/vlijanie-adsorbenta-prajmiks-alfasorb-na-perevarimost-pitatelnyh-veshhestv-i-produktivnye-kachestva-remontnyh-svinok/ (in Russian).

Kondratin, I.P. (1987). Klinicheskaja laboratornaja diagnostika v veterinarii: sprav. Izdanie. M.: Agropromizdat (in Russian).

Korzunenko, O.F., Obrazhei, A.F., & Vasinovych, O.M. (2005). Mikromitsety kormiv u period zberihannia ta...
yikhnii toksyennyi potentsial. Veterynarna biotehnolohiia, 6, 68–73 (in Ukrainian).
Kotsiumbas, I.Ia., Avdosieva, I.K., & Brezvyn, O.M. (2010). Efektyvnist vaktsynatsii pro ty virusnykh zakhvorivtykh ptytsi u raizi zastosuvannya detoksykantiv mikotoksyniv. Naukovyi visnyk veterynarnoi medytsyny: zb. nauk. prats. Bila Tserkva, 6(79), 63–69 (in Ukrainian).
Kotsyumbas, I., Brezvyn, O., Rudyk, G., Guta, Z., & Gutyj, B. (2016). Effect of fumonisin toxicosis on rats. Pasze przemysłowe. Lublin, 3/4, 108–115. http://www.paszeprzemysłowe.pl/index.php/33-artykuly-2016a/3-4-2016/424-effect-of-fumonisin-toxicosis-on-rats.
Kryukov, V.S. (2011). Opasnost mikotoksinov v molochnom skotovodstve. RacVetInform, 12(124), 33–43 (in Russian).
Lakin, G.F. (1980). Biometrija. M.: Vysshaja shkola (in Russian).
Merkulov, G.A. (1969). Kurs patologogistologicheskoj tehnik. M., Leningradskoe otdelenie (in Russian).
Tremasov, M.Ja. (2005). Profilaktika mikotoksikozov zhivotnych v Rossii. Veterinarija sel'skohozajstvennyh zhivotnych, 1, 45–51 (in Russian).
Trufanov, O.V. (2011). Monitoring zagruzannosti mikotokinam zerna i kormov v Ukraine v 2005–2010 gg. Suchasni problemy toksykolohii, 1(2), 35–39. http://www.medved.kiev.ua/web_journals/arhiv/toxicology/2011/1-2_2011/str35.pdf (in Russian).