STUDY OF TOXICITY OF FEED ADDITIVES BASED ON BUCKWHEAT HULLS

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Introduction

Production of wholesome balanced animal feeds at comparatively low cost is among the most important tasks of Russia agriculture. One of the promising directions in the solution of this task is a wide use of the wastes of food industry. The wastes in th production of cereals are among them [4].

In the processing of grains for food purposes, for example in dehulling of seeds a large amount of inedible wastes is produced First of all these are a rice, millet and buckwheat shells. The presence of protein, raw vegetable fat, cellulose, lignin and minera components makes these wastes attractive for the production of animal feeds.

Buckwheat is traditionally grown in Russia in the production of which a large amount of buckwheat hulls is produced. As th preliminary investigations have shown they can be used in multicomponent feeds, especially in combination with the wastes of th meat industry. Such complex feed products containing all the main mineral and nutrient substances have good prospects for use in th feeds of agricultural animals and birds.

Objectives

The purpose of this work is to test the recipe of feed additives with the use of buckwheat hulls, subjected to water hydrolysi on laboratory animals, in the amount from 10 to 20% on the weight of dry feeds as well as addition 15% of unhydrolyzed buckwhea hulls into the feeds.

Materials and methods

The recipe of feed additives is created on the basis of mathematical planning and computer calculation of optimum mixture o the diet on the contents of moisture, fat, protein, cellulose and ash mineral components.

Experiments on testing of feed additives based on buckwheat shells and meat-bone meal with regards to the presence of acut and chronic toxicity in laboratory animals were carried out on white undescript male rats of type Vistar, obtained from the centra nursery of laboratory animals, department "Krukovo". All the animals were kept under standard conditions of the vivarium i VNIIMP in accordance with sanitary norms at free access to water and balanced standard and experimental feed. The animals wer previously kept at the isolation ward. Each control and experimental group contained 10 male rats of similar weight taken at random The initial live weight of the rats in the "chronic" experiment was 50-55 g. According to classification the animals were related to th category – conventional kept in the open system. The temperature in the vivarium was $23^0C \pm 1^0C$, relative humidity – 60-70%.

To study the acute toxicity a method of intraabdominal incorporation of the water extract of tested substances was used. Th amount of the substance for injection was a ten-fold dose, as received by the animal with feeds daily. Feeding with experimenta diets, containing buckwheat shells as water hydrolyzate in the amount from 10 to 20% and as non-hydrolyzed shells in the amoun 15% from total weight of the feed ration went during 4 weeks (chronic experiment).

In carrying out the investigation of the chronic toxicity all feed mixtures were prepared by a simple mixing of the component at calculated proportions ex tempore. Each animal received 50 g of the feed without limitations of water. In the course of th experiment behavior responses of rats, their appearance, the weight and their daily gain were analyzed. The slaughter of the rats fo blood drawing, weighing of internal organs and histological investigations of parenchymial organs (heart, kidneys, liver, spleen) wa carried out by decapitation under Rauch-anaesthesia. After slaughter of the animals their pathalogoanatomical examination wa carried out. During blood investigation the contents of hemoglobin, erythrocytes, leucocytes, trombocytes as well as erythrocyt sedimentation rate were determined [2].

The material for histological investigation was fixed in a 10% neutral aqueous solution of formalin during 48 hours at a room temperature. After end of fixation and washing of the organs in cold running water they were embedded into paraffine, and th sections with the thickness 7-10 μm were made on the rotor microtome. The sections were stained with Sudan and further stained with hematoxilin-eosin. The preparations were studied and photographed at a light microscope "Jenaval" (Germany).

Results and discussion

In the course of the whole experiment the animals of the control and experimental series did not exhibit any differences in behavioural responses. The visual examination showed general good condition of the animals, normal hairiness and absence of evidences of inflammation reactions of mucosas. There were no losses of experimental animals in all the experimental and control groups (100% preservation).

Pathologoanatomical examination of the animals after slaughter did not reveal any outward signs of inflammation or other pathological processes in internal organs – gastrointestinal tract, pancreas and liver, respiratory system, organs of blood formation and blood-making, urinary system.

For the determination of possibile cumulative effect of the investigated amounts of the added buckwheat hulls into the feeds of laboratory animals the body weight of the animals and several internal organs (liver, spleen, kidney and heart) (1) were measured. Based on these findings an integral index of chronic intoxication (IICI) was calculated presenting a relative weight of the organ in % to the total weight of the body. Results are presented in Table 1.

Table 1

Characteristics of state of rats obtaining control and experimental diet

Characteristics	Buckwheat hulls, 10%, hydrolyzed	Buckwheat hulls, 15%, hydrolyzed	Buckwheat hulls, 20%, hydrolyzed	Buckwheat hulls, 20% unhydrolyzed	Control diet
IICI of liver	4.88	4.09	4.91	4.55	4.23
IICI of spleen	0.76	0.98	1.51	1.14	1.28
IICI of kidney	0.52	0.44	0.40	0.43	0.42
IICI of heart	0.52	0.47	0.51	0.57	0.52

Relative weight of the organ % - IICI

Microstructural investigations of liver, kidneys, spleen and heart did not reveal any changes in the architectonics of organs, tissue and cell formations of experimental animals of all the analyzed series of animals as compared to the rats of the control series and agree with literature data (3,5).

Use of experimental feed additives based on different amounts of hydrolyzed and non-hydrolyzed buckwheat hulls gives a steady daily weight gain with the maximum in case of the addition of the hydrolyzed hulls at 15 and 20%.

The clinical analysis of blood of animals which received feed additives based on different amount of hydrolyzed and non-hydrolyzed buckwheat hulls has revealed that the content of hemoglobin (g/%), erythrocytes (mln/μl), leucocytes (thous./μl), thrombocytes (thous./μl) and erythrocyte sedimentation rate (mm/h) did not differ from those of the rats receiving the common diet of vivarium, and were within the norm (1,2). These data are presented in Table 2.

Table 2

Clinical blood analysis of rats of control and experimental groups

Group	Hemoglobin g/l	Erythrocytes 10^{12}/l	Leucocytes 10^{9}/l	Thrombocytes 10^{8}/l	Erythrocytes sedimentation rate mm/h
Hydrolyzed 10%	141.0±7.1	8.4±0.4	11.2±0.6	42.8±2.1	2.6±0.1
Hydrolyzed 15%	150.0±7.5	8.9±0.5	10.2±0.5	42.0±2.1	3.0±0.2
Hydrolyzed 20%	142.1±7.1	8.2±0.4	11.3±0.6	44.0±2.2	3.2±0.2
Unhydrolyzed 20%	143.2±7.2	8.3±0.4	10.8±0.5	42.5±2.1	3.5±0.1
Vivarium diet	148.0±7.4	8.9±0.5	11.2±0.6	43.0±2.2	3.0±0.1

The obtained data show the absence of cumulative toxic effect in the tested diets added with buckwheat hulls that allows to recommend it as an additive to feeds for further testing of their feeding and zootechnical qualities on slaughter animals, primarily pigs. And the cumulation coefficient for all the groups of animals was 10, which means suitability of all the tested samples for feeding laboratory animals and absence of toxic properties in the tested amounts of buckwheat hulls.

Conclusion

Thus, our investigations of physiological, clinical, biochemical and microstructural characteristics of laboratory animals in the acute and chronic experiment with feed additives based on buckwheat hulls show the possibility and suitability of its use in the diets of animals.

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