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EVALUATION OF SOME ANTIOXIDANTS' EFFECTS IN KIDNEY HISTOLOGICAL STRUCTURE OF WEANED PIGS, INTOXICATED WITH DEOXYNIVALENOL (DON)

EVALUAREA EFECTELOR UNOR ANTIOXIDANŢI ASUPRA STRUCTURII HISTOLOGICE A RINICHIULUI LA PURCEII ÎNŢĂRCAŢI ŞI INTOXICAŢI CU DEOXYNIVALENOL (DON)

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Deoxynivalenol is a mycotoxin produced by fungi of the Fusarium genera, which are abundant in various cereal crops and processed grains. In order to protect cell structure within the tissues studied, we tried various experimental variants by incorporating some selenium and boron sources into the combined fodder, and also in mixture with DON with different concentrations. To determine the morpho-physiological changes induced by the mycotoxin DON upon kidney histological structure, and also the antioxidants' effects, we took samples from 9 piglets belonging to three groups: group 1 (fed with fodder added with DON), group 2 (fed with fodder added with selenium) and group 3 (fed with fodder added with selenium and DON). At renal parenchyma level, DON determines a series of changes in the renal corpuscles and also in the uriniferous tubes. These changes are represented by glomerular atrophies and nephrocyte epithelial dystrophies. The epithelial dystrophic processes occur in the renal medullar, too, where numerous ectasied capillaries and hemorrhagic areas are present. In the case of groups 2 and 3 consisted of piglets fed with fodder added with selenium, respectively fodder added with DON and selenium, the renal vascular network becomes hypertrophic associated with leukocyte infiltrative processes.

Key words: *Fusarium*, deoxynivalenol, antioxidant, selenium, kidney, histology modifications, pig

Introduction

Deoxynivalenol is a mycotoxin produced by fungi belonging to the genus *Fusarium* (*Fusarium culmorum* and *Fusarium graminearum),* abundantly met in various cereal crops (wheat, maize, barley, rye) and in products made of processed cereals (malt, beer and bread). This toxin is very thermally stabile and it does not degrade at high temperatures (Rotter, B.A. et al., 1996, Ehling, G. Et al., 1997, Eriksen, G.S. and Alexander, J., 1998). Pigs are exposed to DON contamination due to their diet rich in cereal grains, because they are much sensible than poultry

or ruminants to the action caused by this toxin (Rotter, B.A. et al., 1996). Moreover, piglets sensitivity to DON action increases during the weaning period, a critical period that includes the adaptation to a new environment (shelter and temperature), diet changes, association with other pigs, removal from their mother, alteration of their intestinal micro-environment (pH, microflora) and loss of mother milk (immune protection). At cell level, DON inhibit AND, ANR and protein synthesis. After the acute intoxication, some necroses appear in various tissues of the digestive tract, bone marrow, lymph tissue and kidney (Eriksen and Alexander, 1998).

Selenium is known for its antioxidant effect, contributing dramatically to body protection against the action exerted by free radicals and to their removal from cell, saving in this way, for the moment, the cell from death. This chemical element intervenes upon the immune system by stimulating the immunoglobulin production, and also in the evolution of the leukocyte cell line, assuring vitality and maturation for leukocytes, which mean optimal functioning. So, by stimulating the immune system, selenium reduces inflammations and fights against infections (Gueguen, L., Pointillart, A., 1995).

Materials and Methods

To determine the morpho-physiological changes induced by the mycotoxin DON upon kidney histological structure, and also the effects induced by the antioxidant used, we took samples from 9 piglets from three groups: group 1 (administered with NC-02 + 1.04 ppm DON), group 2 (administered with NC-02 + 0.3 ppm Selplex) and group 3 (administered with NC – 02 + 1.04 ppm DON + 0.3 ppm Selplex).

Fragments taken were fixed in solution of ethylic alcohol 80^0 and in neuter formalin 10%, were submitted to dehydration, clearing, then they were soaked and inclusioned in histological paraffin and sectioned at the width of 5μ with the rotating microtome Leyca and colored for an optical differentiation between the tissue and cell structures. We applied two staining methods: HE and the Mallory trichromic staining method (Mureşan E. et al., 1976). The microscopic study was performed with an optical microscope Olympus with objectives of 10x and 40x and the field glass of 10x.

Results and Discussions

Group 1 (fodder with addition of DON)

Cortical kidney area is characterized by a reduced frequency of compressed vascular glomerules. On the contrary, an aspect much observed is represented by parenchymatous tubulonephritis (Fig. 1, 2), generalized in the medullar area of the renal parenchyma (Fig. 2). Parenchymatous tubulonephritis occur morphologically through the detachment of nephrocyte epithelium from the sub-epithelial basal

membrane, and the peritubular areas become very wide, with and oedema aspect. At nephrocyte level, dystrophic processes occur, followed by cell necrosis, and these lead, on large areas, to partial or total epithelium disappearance and tube reduction to basal membrane. On some areas, in the peritubular interstice, slight capillary cstasies occur, sometimes associated with reduced hemorrhagic processes.

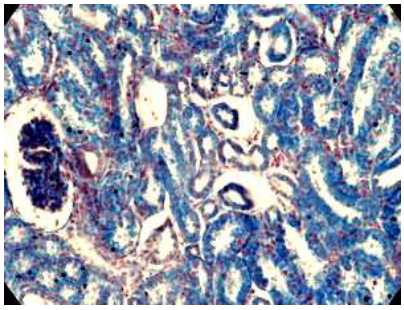

Figure. 1. *Kidneys L1 – 3(124) – cortical area – parenchymatous tubulonephritis, peritubular ectasies (400x: Mallory trichromic staining)*

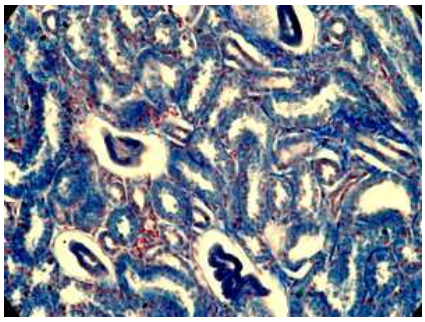

Figure 2. *Kidneys L1 -3(124) – cortical area – parenchymatous tubulonephritis, peritubular ectasies with local hemorrhages (400x: Mallory trichromic staining)*

Group 2 - (fodder with addition of selenium)

In the case of the individuals 1(165) and 2(169), microscopical sections in kidneys reveal the presence of the conjunctival-fibrous renal capsule, which adheres intimately to parenchyma and from which a series of conjunctival septa detach, forming the intrarenal stroma. The cortical area comprises renal corpuscles with normal aspect, consisted of vascular glomerule, Bowman capsule and the capsular area slightly enlarged in a small number of corpuscles, with content. In the case of the individual 3 (090), microscopical images reveal the presence of many renal corpuscles with periglomerular oedema (fig. 3, 4), light peritubular oedema and small areas in which nephrocyte atrophic processes occur. In all cases, the peritubular vascular network is very evident, and there are vascular ectasies with leukocytary fields on some territories (fig. 5).

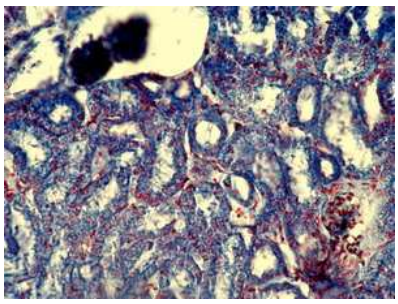

Figure 3. *Kidneys L2 -1-(165) – cortical area- renal corpuscles with compressed vascular glomerules and wide capsular areas (400x; Mallory trichromic staining)*

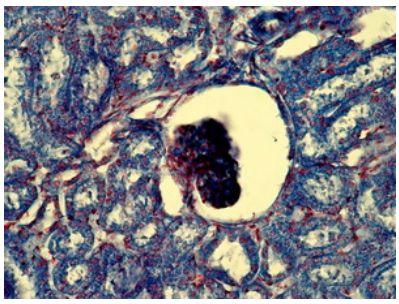

Figure 4. *Kidneys L2-3-(090) cortical area- periglomerular oedema, vascular network and leukocytary fields (400x; Mallory trichromic staining)*

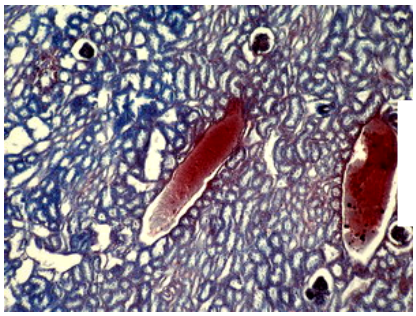

Figure 5. *Kidneys L2-3(090) – cortical area – vascular ectasies (100x; Mallory trichromic staining)*

Group 3 - (fodder with addition of DON and selenium)

Within the renal parenchyma of the individuals in this experimental variant, we may observe a series of morphologic changes, compared with the individuals in the control variants. Morphological changes affect the corpuscles and the uriniferous tubes as well. So, at renal corpuscles level, vascular glomerules are compressed, the capsular area slightly enlarged and, on small areas, the Bowman capsule's external layer changes (fig. 7, 8). On small areas, we may see changes at uriniferous tubes level. So, nephrocytes are slightly hypertrophic, their cytoplasms become acidophil, and some of them degenerate (fig. 6). On very small areas, the nephrocytary epithelium is completely atrophied.

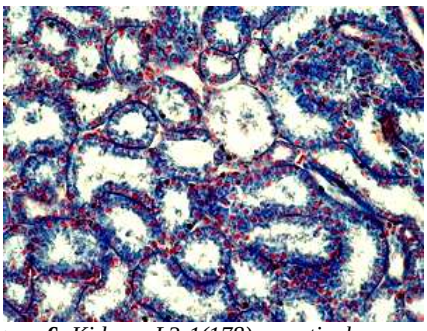

Figure 6. *Kidneys L3-1(178) – cortical area - nephrocytary epithelial atrophies (400x; Mallory trichromic staining)*

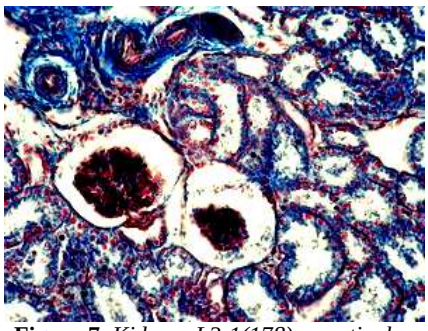

Figure 7. *Kidneys L3-1(178) – cortical area - vascular glomerules changed (400x; Mallory trichromic staining)*

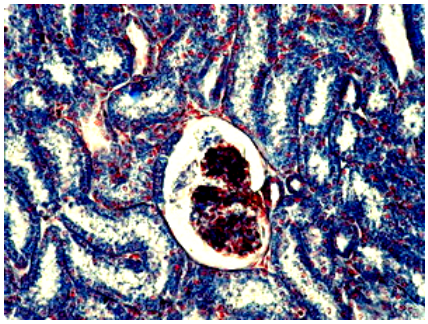

Figure 8. *Kidneys L3-3(185) – cortical area - capsular epithelium metaplasia (400x; Mallory trichromic staining)*

The results obtained in this microscopic study are concordant with the results obtained by Fioramenti et al., 1993 in mice and rats, as cited in Eriksen and Alexander, 1998 and Gueguen, L., Pointillart, A., 1995, and represent an important characteristic in selenium with antioxidant.

Conclusions

1. In the case of group 1, kidney's cortical area is characterized by a smaller frequency of compressed vascular glomerules, on the contrary, a frequently observed aspect is represented by the parenchymatous tubulonephritis, this aspect being generalized in the medullar area of the renal parenchyma. On some areas, within the peritubular interstice, some capillary ectasies occur associated sometimes with reduced hemorrhagic processes.

2. In the individuals from group 2, renal parenchyma presents a reduced number of renal corpuscles with periglomerular oedema, slight peritubular oedema and small areas in which nephrocytary epithelial atrophies occur. In all cases, the peritubular vascular network is very evident, and vascular ectasies with leukocytary fields are present in some territories.

3. The vascular glomerules are compressed in the individuals from group 3, the capsular areas are slightly enlarged and, on small areas, the Bowman capsule's

external layer changes. On small areas, nephrocytes are slightly hypertrophic, their cytoplasms become acidophil, and some of them degenerate.

4. As common characteristic for the individuals in the experimental groups 2 and 3, fed with fodder added with selenium, respectively with fodder added with DON and selenium, the renal vascular network becomes hypertrophic, associated with leukocytary infiltrative processes. These aspects reveal the selenium involvement in the immune system stimulation through the reduction of local inflammations and infections.

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