Effect of supplemental Sangrovit on some biochemical indices and leukocytes phagocytic activity in growing pigs

D. Gudev¹, S. Popova-Ralcheva¹, P. Moneva¹, M. Bonovska², G. Valchev¹, A. Valcheva¹
¹Institute of Animal Science, BG – 2232 Kostinbrod, Bulgaria
²National Diagnostic Research Veterinary Institute, BG – 1606 Sofia, Bulgaria

Abstract

We evaluated the effects of the phytogenic feed additive Sangrovit (30 g/t) on some biochemical parameters in growing pigs and compared the result with those in untreated (control) or treated with the antibiotic Flavomicin (5 g/t) pigs. The treatment period started immediately after weaning (at 7 kg live weight) and finished when the pigs reached 50 kg live weight. Blood was taken from ophthalmic vein immediately before the treatment period (pretreatment period), at the end of starter (20 kg) and grower (50 kg) periods. Sangrovit resulted in a sharp decline in cholesterol level during the starter period in comparison with control (P<0.001) and Flavomicin treated (P<0.01) pigs, but had no effect on plasma indol and urea levels. Sangrovit increased serum lysozyme concentration (P<0.05) both during starter and grower period and stimulated the phagocytic index during the starter period.

Keywords: growing pigs, Sangrovit, biochemical parameters

Introduction

Sangrovit is a commercial product derived from the root of the plant Sanguinaria Canadensis. This plant occurs in North America. It contains benzophenanthridine alkaloids, predominantly sanguinarine. The alkaloid sanguinarine inhibits the multiplication of bacteria, fungi and viruses (Schmeller, 1997; Meller, 2001), and enhances appetite and feed intake (Mellor, 2001). The exposure of neutrophils to very low concentrations of sanguinarine inhibits neutrophils chemotaxis, oxidative metabolism and degranulation within 5 min, but causes no lytic damages to neutrophils from peripheral blood (Agarwal et al., 1997). Sanguinarine inhibits the growth of some bacteria that cause gastrointestinal upset (Mahadria et al., 2003). The goal of the present experiment is to investigate the effect of Sangrovit, added in the concentrate mix on plasma levels of indol, urea, cholesterol, lysozyme as well as on leukocytes phagocytic index and phagocytic number in growing pigs which are more susceptible to exogenous microorganisms.
Material and methods

Fifteen pigs of the Bulgarian hybrid Danube white, were allocated to 3 groups as follow: I
st – control, without supplementation; II nd-supplemented with the antibiotic Flavomicin (5 g/ t of diet) and III rd – supplemented with Sangrovit (30 g/t of diet). The experiment was conducted at the experimental unit of the Institute of Animal Science – Kostinbrod. It started immediately after weaning. During the milk period the pigs were offered a prestarter diet, without any growth promoter. The treatment period comprised both starter period (7-20 kg live weight) and grower period (20-50 kg live weight). The animals were fed on a balanced diet, according to the feed requirements for the corresponding category. Blood samples were taken immediately before the onset of the treatment period, at the end of the starter period (20 kg/live weight) and at the end of the grower period/50 kg live weight).

Serum lysozyme concentration was determined by the methods of Kostov and Bonovska (1983). Plasma urea was assayed as described by Rerat et al. (1979). Plasma cholesterol and indol were determined by the methods of Watson (1960) and Balahovskii (Chilov, 1959), respectively. Phagocytic index and phagocytic number were assayed as described by Plyastenko and Sidorov (1979). The results were statistically analyzed by Student, t-test.

![Figure 1. Serum lysozyme concentration in Sangrovit and Flavomicin treated pigs](image)

Results and discussion

Serum lysozyme concentrations before the treatment period showed no significant differences between the 3 groups despite the higher lysozyme values in I st and III rd group of pigs, due to sizeable individual differences (Fig. 1). Lysozyme concentrations increased both at the end of starter periods (P>0.05) and grower period (P<0.05). Lysozyme is capable of hydrolyzing the cell wall of certain
bacteria. However, most organisms are resistant to the direct action of lysozyme and may become sensitive to its action after exposure to antibody and complement. Bacterial death appears to precede the action of lysozyme and thus its action may be mostly digestive (Athens, 1993). The higher lysozyme concentration in Sangrovit treated pigs could have a beneficial effect especially during the starter period when the floral colonization of the gastrointestinal tract is not completed yet and intestinal flora is readily a subject for disturbances and imbalances (Pluske et al., 1997).

![Phagocytic index in Sangrovit and Flavomicin treated pigs](image1)

**Figure 2. Phagocytic index in Sangrovit and Flavomicin treated pigs**

![Phagocytic number in Sangrovit and Flavomicin treated pigs](image2)

**Figure 3. Phagocytic number in Sangrovit and Flavomicin treated pigs**

Phagocytic index during the starter period tended to be higher in both experimental groups (Fig. 2). Control value of the phagocytic index during starter period was significantly lower (P<0.05) compared to the corresponding value before the treatment. The phagocytic index shows the average number of microbes phagocytosed by one active leukocyte. The higher phagocytic index in Sangrovit treated pigs is not in agreement with the results presented by Agarwal et al. (1997),
who found decreased neutrophilic chemotaxis and rate of degranulation following sanguinarine. This discrepancy could be due to their “in vitro” experimental design. The lower phagocytic index in the control group during Starter period was not unexpected, since the colostral immunity duration in pigs is around 5-6 weeks (Playastenko and Sidorov, 1979), and the acquired component of immunity are not completely developed yet. The immediate protection during this period is conferred by activation of the innate immune cells macrophages, dendritic cells, polymorphonuclear cells and epithelial cells) via different toll-like receptors that recognize critical molecules on the bacterial surface (Boulioux et al., 2003). The major function of neutrophilic granulocytes, that contain lysozyme in both the primary and secondary granules, is to prevent intrusion of infectious agents and other foreign materials into the host environment (Ahens, 1993). This is completed by phagocytosis and digestion. Our data indicate that during the critical period, when the animal relies mostly on the innate immunity, Sangrovit stimulates phagocytic activity and thus promotes host protective responses. There were no significant differences in the phagocytic number values between the groups during the starter and grower periods (Fig. 3). However phagocytic number values tended to be lower in I and II group and were significantly lower (P<0.05) in III group when compared with the pretreatment period. The phagocytic number reflects the ratio between the phagocytosed bacteria and the total number of leukocytes (both active and inactive). Therefore it shows leukocytes aggressiveness and activity. The very fact, that the phagocytic number values declined during the starter period, suggests that pigs are more vulnerable to detrimental exogenous factors.

![Figure 4. Plasma indol levels in Sangrovit and Flavomicin treated pigs](image)

Taken together these results come to show that the higher phagocytic index in II and III group during the starter period (Fig.2) was due to enhancement of active leukocytes potency rather than to an increase of their number. Plasma indol levels
in all groups tended to be higher during the starter period and declined sharply (P<0.001) during the grower period (Fig.4).

Claus and Raab (1999) have hypothesized that tryptophan, which is indol predecessor is derived from mucosa cell debris. Given the fact that intestines are more vulnerable to disturbances during the starter period one could speculate that the higher indol level in all groups during the starter period is related with an increased level of gut cells debris.

On the other hand, the company producing Sangrovit presents data for Sangrovit – induced protection of tryptophan from enzymatic breakdown into biogenic amines. Given the protective effect of Sangrovit against the breakdown of tryptophan it could be assumed that Sangrovit treated group may have higher level of intact tryptophan, despite the increased indol level during the starter period. This interpretation is consistent with the growth indicators of the starter pigs presented in our previous paper (in press) showing higher daily weight gain in Sangrovit treated pigs, during the starter period. Tryptophan is known to promote serotonine synthesis and the latter takes part in central regulation of feed consumption.

Figure 5. Plasma urea levels in Sangrovit and Flavomicin treated pigs
Plasma urea levels increased in all groups (P<0.05) during the starter period, compared to the pretreatment period (Fig.5). There were no significant differences between the groups. Urea levels declined abruptly during the grower period. The increase of urea level during the starter period suggests less efficient utilization of protein, because high plasma, urea level reflects losses of nitrogen (Roseler et al., 1993). The lack of difference between the groups both during the starter and grower periods, is not in agreement with the higher daily gain and forage utilization in III group of pigs during the starter and grower periods as compared to the other 2 groups (in press). Blood urea nitrogen has been proposed as an useful tool for prediction of nitrogen excretion, and the efficiency of utilization of dietary protein in pigs (Kohn et al., 2005). It is difficult to explain the higher feed utilization in III group of pigs, since blood urea level is linearly related to urinary nitrogen excretion rate in pigs.

Plasma cholesterol level in Sangrovit treated pigs was significantly lower compared to control (P<0.001) and Flavomicin treated pigs (P<0.01) during the starter period (Fig.6). There were no significant differences between the groups during the pretreatment and grower periods. The observed lower cholesterol level in Sangrovit treated pigs during the starter period could be related with the post weaning anorexia caused by the modified diet (Manzanilla et al., 2004) that compromises gastrointestinal function and causes changes in the composition of the intestinal flora (Berghouse et al., 1984). The increased phagocytic index during this period (Fig. 2), induced by Sangrovit, could alleviate disturbances and imbalances of the intestinal flora and restore the equilibrium of the normal flora.

It has been found that lactobacillus acidofillus reduces total serum cholesterol in pigs (De Rodas et al., 1996). The authors have hypothesized that the increased deconjugation of bile acids, caused by some species of Lactobacili, results in greater excretion of bile acids from the intestinal tract, because free bile acids are less likely to be reabsorbed in the intestine. The increased excretion of bile acids stimulates
the synthesis of replacement bile acids from cholesterol, thus reducing plasma cholesterol level. This hypothesis is consistent with our result, concerning the lower cholesterol level in Sangrovit treated pigs during the starter period, since plasma cholesterol level is coupled with lower serum bile acids (De Rodas et al., 1996), and according to the data presented by the company producing Sangrovit-phytobiotics (2000), the latter stimulates the formation of bile.

Conclusions

In conclusion we have provided evidence that, Sangrovit stimulates phagocytic index in pigs during the starter period. Furthermore it stimulated lysozyme activity both during the starter and grower periods. Sangrovit decreased plasma cholesterol level during the starter period but had no affect on the level of cholesterol, urea, indol and phagocytic activity during the grower period.

References


