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WŁADYSŁAW WAWRON, MAREK SZCZUBIAŁ

*Behaviour of some non-specific immunity indices  
in various periods of oestrus cycle in sows*

Zachowanie się niektórych wskaźników odporności nieswoistej  
w różnych okresach cyklu rujowego u świń

**Key words:** non-specific immunity, oestrus cycle, sows.

**Słowa kluczowe:** odporność nieswoista, cykl rujowy, świnię.

INTRODUCTION

Organism defense against the penetration of pathogenic microbes into its tissues and their elimination are predominantly conditioned by non-specific immunity mechanisms. The non-specific mechanisms are not too precise, yet they quickly respond to a penetrating pathogen making the first defense line against infection. The non-specific immunity mechanisms include, among others phagocytes (granulocytes and macrophages), complement system, lysozymes, interferons and the cells capable of spontaneous cytotoxicity.

There are numerous data confirming the effect of the reproductive system on the immune one. It is known that the immune system cells have receptors for sex hormones and therefore they can affect their functions (23). It was found that ovarian hormones affect: the proliferative response of lymphocytes to mitogens (4, 13, 20), the suppressor activity of T cells (4), the antibody response to antigens (4), the cytotoxic activity of lymphocytes (19) and the number of circulating immunocompetent cells (15, 21). To elucidate the effects of sex hormones on the immune system *in vivo*, the studies involving injection of oestrogens in castrated animals have been undertaken in the rat (5), cow (21), horse (24) and pig (14). It was established that administration of oestradiol enhances the phagocytic function of the reticulo-endothelial system in the mouse (17), increases the total number of neutrophils in the cow (6, 21) and promotes the phagocytic capacity by neutrophils in the cow (6, 9), mare (24) and the sow (14). It was proved that ovaries activity influences the defensive mechanisms



of the uterus with a vital function of phagocytosis with neutrophilic granulocytes (8, 16, 26). In the luteal phase of the oestrus cycle the uterus is far more susceptible to infections than in the oestrus phase which can be explained, among others, with a decrease of phagocytal abilities of neutrophils caused by progesterone (1, 2, 7, 9, 10, 25).

The objective of the work was to determine the behaviour of some non-specific immunity indices in various periods of oestrus cycle in sows.

## MATERIAL AND METHODS

The examinations covered 7 virgin gilts aged 6-8 months and 110-130 kg weight. The animals were healthy clinically and showed a regular oestrus cycle. The oestrus was recognized on the basis of changes in the visible parts of the reproductive tracts and gilts behaviour (tolerance reflex). The first day of the oestrus symptoms occurrence was considered the 1<sup>st</sup> day of the oestrus cycle. Blood was sampled from the jugular external vein (*carotica externa*) of all the animals examined. The blood collected on the first day of oestrus symptoms appearance and then on 5<sup>th</sup>, 10<sup>th</sup>, 15<sup>th</sup> (luteal phase), 18<sup>th</sup> (follicular phase) and 22<sup>nd</sup> (spontaneous oestrus) day of the cycle. In the full blood or serum there were determined: the total count of leucocytes, quantitative nitroblue tetrazolium test (NBT) by cytochemical method (18), phagocytic index by cytochemical method with standard strain *Staphylococcus aureus* 209P (3), total protein level and immunoglobulin complex by the Lowry's method (12) and lysozyme activity with the turbidimetric method (22).

## RESULTS

The results of the determination of the total count of leucocytes, neutrophils abilities to reduce NBT and their phagocytal activity are presented in Table 1. It manifests that an oestrus cycle phase influenced the total number of leucocytes and neutrophilic granulocytes abilities for phagocytosis. The leucocyte count was the highest during the oestrus, whereas it clearly decreased on the tenth cycle day (luteal phase). Throughout the oestrus the phagocytic activity of neutrophils and phagocyte index reached the highest value. However, there were no distinct differences in

Table. 1 Development of some indices of non-specific cellular immunity in the oestrus cycle in sows (n = 7)

Examination time	Total leucocyt. count $\times 10^9/l$	NBT %	Phagocytic activity %	Phagocytic index
1 <sup>st</sup> day spontaneous oestrus	17.4	29.8	50.2	10.8
5 <sup>th</sup> day luteal phase	11.2	26.5	38.4	7.9
10 <sup>th</sup> day luteal phase	10.8	24.3	35.1	8.2
15 <sup>th</sup> day luteal phase	12.4	23.1	39.7	6.8
18 <sup>th</sup> day follicular phase	12.9	25.7	42.5	9.2
22 <sup>nd</sup> day spontaneous oestrus	16.8	23.2	45.3	10.6



Table. 2. Development of some indices of non-specific humoral immunity in the oestrus cycle in sows (n = 7)

Examination time	Total protein g/l	Immunoglobulin complex g/l	Lysozyme activity g/l
1 <sup>st</sup> day spontaneous oestrus	70.2	30.4	10.1
5 <sup>th</sup> day luteal phase	68.9	28.2	8.2
10 <sup>th</sup> day luteal phase	70.1	27.4	7.8
15 <sup>th</sup> day luteal phase	69.8	26.9	7.9
18 <sup>th</sup> day follicular phase	70.5	29.8	9.4
22 <sup>nd</sup> day spontaneous oestrus	71.2	31.4	12.1

neutrophils abilities to NBT reduction between the particular periods of the oestrus cycle. Table 2 presents the data showing a total protein level, immunoglobulin complex and lysozyme activity over the oestrus cycle course in the sows examined. The results obtained demonstrate that both total protein level and immunoglobulin one in sows' blood serum do not change significantly in the oestrus cycle (immunoglobulin complex level was slightly higher during the oestrus). However, lysozyme activity growth was recorded over the oestrus.

#### DISCUSSION

The examinations made indicate that an oestrus cycle phase and regular sex hormones level connected with it do affect the mechanisms of cellular and humoral non-specific immunity. The results obtained are confirmed in the observations of other authors. A clear increase of the total count of leucocytes in blood and phagocytal activity of neutrophils in cows' blood during the oestrus and after oestradiol administration was shown by Hussain and Daniel (9) and Saad and Astrom (21). Other authors found the stimulant effect of oestrogens on the phagocytic activity of neutrophils in the the sow (14) and mare (24). Magnusson and Fossu (15) reported an increase in the total blood leukocyte count under the influence of high concentration of oestrogens during parturition in the sow (14). The increase in phagocytic capacity of neutrophils in the oestrus phase is also confirmed by the findings of other authors who stated that uterus sensitivity to infections decreases clearly over the oestrus (1, 2, 7, 9, 10, 25). The lack of significant differences in phagocytal activity of neutrophils over the oestrus and post-oestrus cycle was proved by Roth et al. (20) and Guidry et al. (6). No effect of the oestrus cycle on neutrophils ability to NBT reduction in cows was observed by Krakowski et al. (11). Roth et al. (20) reported decrease in NBT reduction under the influence of high concentration of progesterone (luteal



phase of the cycle). The increase in lysozyme activity in the oestrus phase recorded by the authors of the present paper during their own examinations was confirmed by Krakowski et al. (11). Alike, the results concerning total protein and immunoglobulin complex correspond to the findings presented by the authors of this paper.

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## STRESZCZENIE

Przedmiotem podjętych badań było określenie zachowania się niektórych wskaźników odporności nieswoistej w różnych okresach cyklu rujowego u świń.

Badania przeprowadzono na 7 dziewiczych loszkach w wieku 6-8 miesięcy i wadze 110-130 kg. Do badania pobierano od wszystkich zwierząt krew z żyły szyjnej zewnętrznej. Krew była pobierana pierwszego dnia występowania objawów rujowych (pierwszy dzień cyklu), 5, 10, 15 (faza lutealna) oraz 18 (faza pęcherzykowa) i 22 (ruja spontaniczna) dnia cyklu.

W pełnej krwi lub surowicy określano: całkowitą liczbę leukocytów, test redukcji NBT, indeks fagocyтары, poziom białka całkowitego, kompleks immunoglobulin oraz aktywność lizozymu.

Otrzymane wyniki wskazują na wzrost całkowitej liczby leukocytów, aktywności fagocyтарыnej neutrofili i aktywności lizozymu podczas rui u świń.