9.2. Summary

Increasing industrialization influences the environment, contributing to the exposure of living organisms to potentially harmful factors – including extremely low-frequency electromagnetic field (EMF) emitted by household devices. In living organisms, EMF can influence the course of many physiological processes, but the consequences of the exposure of the female reproductive system to EMF are not well understood. Taking into account the importance of the endometrial tissue during embryo implantation examined the influence of the EMF on the synthesis of and secretion of androgens and estrogens in the endometrium of pigs (*Sus scrofa domestica* L.) during the peri-implantation period and the transcriptomic profile of the tissue.

It was found that, depending on the EMF frequency (50 and 120 Hz), treatment duration (2 h and 4 h), and the presence or absence of progesterone (P_4), EMF changes the mRNA transcript abundance, *i.e. CYP17A1, HSD3B1, CYP19A3,* and *HSD17B4,* and the concentration of encoded proteins and the secretion of androstenedione (A_4), testosterone (T), (estrone) E_1, and (estradiol-17β) E_2. It has also been documented that EMF (50 Hz, 2 h) changes the transcriptomic profile of the endometrium.

Decreased A_4 secretion and increased E_1 secretion were observed after a short treatment duration (2 h) of the endometrium with EMF at 120 Hz compared to the control (no EMF). The above changes were not observed after incubation in the presence of P_4. Thus, P_4 had a protective effect against the adverse effects of EMF. However,

it was also observed, that in the presence of P_4, T secretion (50 and 120 Hz, 2 and 4 h) and E_2 (50 Hz, 2 h) were decreased after exposure to EMF (vs. control – no EMF) but these changes were not observed in the absence of P_4 in the incubation medium. Therefore, it can be assumed that P_4 may also sensitize the tissue to the EMF treatment. It has been shown that in the peri-implantation period P_4 can not only protect the endometrium against the adverse/hazardous effects of EMF but also sensitize the tissue to EMF.

The next-generation sequencing (NGS) used in the present work allowed to determine changes in the transcriptomic profile of the endometrium as a consequence of exposure to EMF. The changes in the expression of 461 genes, including: *IFNGR1, MRAP2, NOS3, SERPINE1, VDR* (increased expression) and *EGR2, HSD17B2, ID2, IL1RAP, PTGER4* (decreased expression). It cannot be excluded that the EMF-related differences in *VDR* and *HSD17B2* expression may interfere with the synthesis and secretion of estrogens in the endometrium, contributing to the potential hyper-concentration of E_2 in the intrauterine environment, which may have a toxic effect on the embryos during the peri-implantation period. It was determined, that genes with altered expression under the influence of EMF are involved in many important biological processes, such as regulation of energy homeostasis, proliferation, uterine blood flow, modulation of cell migration, and metabolism.

The observed changes in the process of steroidogenesis and transcriptomic profile of the endometrium may not only lead to disrupt the activity of the tissue but also may cause changes in the concentration of steroid hormones in the intrauterine environment, which may affect the success of implantation.

Due to the daily activities that require the use of electronic devices, we are not able to completely eliminate EMF from the surrounding environment. Knowledge and awareness of the potential risks of EMF exposure can help in developing strategies to reduce potentially harmful exposure to this factor in order to maintain the proper functioning of the female reproductive system and to protect it.

Keywords: domestic pig (*Sus scrofa domestica* L.); electromagnetic field; endometrium; peri-implantation period; steroidogenesis; transcriptomic profile