

- Borowiec F., Migdał W., Furgał K., Koczanowski J., Tuz R., Micek P. (1998). Wpływ udziału surowych lub parowanych nasion rzepaku w mieszankach pełnodawkowych na umięśnienie i skład chemiczny mięsa tuczników. *Rośliny Oleiste*, 19, 1, 195-203.
- Busboom J.R., Rule D.C., Colin D., Heald T., Mazhar A. (1991). Growth, carcass characteristics, and lipid composition of adipose tissue and muscle of pigs fed zanola. *J. Anim. Sci.* 69, 1101-1108.
- Chichłowska J., Kliber A., Szkudelski T., Urbaniak M., Łyczyński A. (1995). Porównanie modyfikacji hormonalnych i ich skutków metabolicznych po zastosowaniu poekstrakcyjnej śruty z rzepaku podwójnie ulepszanego i nasion rzepaku Polo w tuczu świń. *Rośliny Oleiste* 16, 351-357.
- Janik A., Barowicz T., Rychlik T., Pacek K., Nogaj A. (1993). Wpływ rasy oraz genotypu lipoproteidów Lpb na poziom cholesterolu w surowicy krwi świń. *Rocz. Nauk. Zoot.* 20, 2, 87-95.
- Korzeniowski W., Ostoja H., Jarczyk A. (1992). Zawartość cholesterolu w tkance tłuszczowej i mięśniowej świń czystych ras i ich krzyżówek. *Medycyna Wet.*, 48, 10, 464-465.
- Kouba M., Mouro J. (1999). Effect of a high linoleic acid diet on lipogenic enzyme activities and on the composition of the lipid fraction of fat and lean tissues in the pig. *Meat Science* 52, 1, 39-45.
- Leszczynski D.E., Pikul J., Easter R.A., McKeith F.K., McLaren D.G., Novakofski J., Bechtel P.J., Jewell D.E. (1992). Characterization of lipid in loin and bacon from finishing pigs fed full-fat soybeans or tallow. *J. Anim. Sci.* 70, 2175-2181.
- Ostoja H., Lipiński K., Korzeniowski W., Tywończuk J. (1996). Wpływ zastosowania w mieszankach paszowych gniecionych nasion rzepaku na skład kwasów tłuszczowych i zawartość cholesterolu w tkankach tuczników. *Acta Acad. Agricult. Tech. Olst. Zootechnica*, 45, 151-161.
- Pietras M., Barowicz T., Brzóska F., Gąsior R. (1996). Wpływ dodatku tłuszczu porafinacyjnego do dawki na metabolizm i poziom hormonów u rosnących świń. *Rocz. Nauk Zoot.* 23, 2, 155-165.
- Rhee K.S., Dutson T.R., Smith G.C., Hostetter, Reiser R. (1982). Effects of changes in intermuscular and subcutaneous fat levels on cholesterol content of raw and cooked beef steaks. *J. Fd. Sci.* 47, 716-719.
- SAS/STAT. 1989. Guide for Personal Computers. Ver. 6, SAS Inst. Inc., Cary, NC.

SOME ASPECTS OF INVOLVEMENT AND APPLICATION OF HORMONES, GROWTH FACTORS AND RELATED SUBSTANCES IN ANIMAL PRODUCTION

A. V. SIROTKIN (1), A. V. MAKAREVICH (1), R. GROSSMANN (2), J. KOTWICA (3) P-G MARNET(4), H.B. KWON (5), H-J SCHAEFFER (6), MR CORKINS (7), P GRÁČIK (1), D. MERTIN (1), K. SÚVEGOVÁ (1), J. DUKESOVÁ (8), J. FRÁNEK (1), P. SANISLO (1), I.FLORKOVIČOVÁ (1), J. BUDÁČOVÁ (8), J PIVKO (1), J BULLA (1), A.KÚBEK (8), J. KOVÁČIK (8) L HETÉNYI (1)

(1) Research Institute of Animal Production, 949 92 Nitra, Slovakia (2) Institute for Animal Science and Animal Behaviour, 29223 Celle, Germany, (3) Institute of Animal Reproduction and Food Research, 10-718 Olsztyn-Kortowo, Poland, (4) INRA/ENSAR, 35042 Rennes, France, (5) Chonnam National University, Kwangju 500-757, Korea, (6) University of Koln, 50931 Koln, Germany, (7) Indiana University, Indianapolis IN 46202, USA, (8) Slovak University of Agriculture, 949 76 Nitra, Slovakia.

Summary

His report represents brief review of original data of authors concerning involvement and application of hormones, growth factors and intracellular messengers of their action in the regulation of reproduction, growth and performance in farm animals. It was shown, that these substances are involved in the control of bovine, porcine, rabbit, nutria and fowl's ovarian functions, as well as of porcine and nutria growth. Furthermore, it was shown, that these hormones can be used for the evaluation of biological activity of stimulators of bovine, porcine, rabbit, nutria, human and fowl's reproduction, for characterisation and prediction of state of porcine and nutria puberty and reproduction, growth, plain of nutrition and meat production, for improvement of biotechnological methods (bovine, porcine and rabbit cell transfection and embryo production), as well as for the direct control of reproduction and meat production rate in farm animals. Finally, our results suggest, that pharmacological regulators of intracellular mediators of hormones and growth factor action can be reliable, cheap and safe alternative to application of hormones in animal production and medicine.

Key words: hormones, growth factors, protein kinase, reproduction, puberty, growth, meat production

Introduction

Hormones, growth factors, growth factor binding proteins and intracellular messengers of their action play an important role in the control of various physiological processes and performance in farm animals. Nevertheless, their effects, mechanisms of action and areas of subsequent applications require further studies. This report represents brief review of original data of

authors concerning involvement and application of these substances in the regulation of reproduction, growth and performance in different farm animal species.

Material and methods

As model objects Slovakian white gilts, Holstein cattles, New Zealand rabbits, domestic nutria and white leghorn hens kept in standard conditions in experimental farms, and their ovaries obtained at local slaughterhouse. Human ovaries were obtained from womens, whose were operated in Nitra hospital. Isolated ovarian follicles, granulosa cells, oocytes and embryos were cultured during 1-12 days with and without different hormones, growth factors, cDNA constructs encoding IGFBP-3 and -4, stimulators and inhibitors of protein kinases listed below. Level of substances in plasma and ovarian cells conditioned medium was measured using RIA/IRMA and ligand blotting, cell proliferation, apoptosis, expression of hormones, growth factors, IGFBPs and intracellular messengers within the cells was evaluated using immunocytochemistry, TUNEL and Western blotting.

Results

Results of our in-vitro experiments demonstrated that production of hormones by ovarian cell cultures can be used for quick evaluation of biological activity of preparations of gonadotropins and other gonadotropic substances used for the induction of superovulation and embryo production in cows and rabbits in vivo and in vitro. This in-vitro approach demonstrated the usefulness of cells isolated from reproductive system for cheap, fast and sensitive evaluation of biological activity, mechanisms of action and safety of hormones, growth factors and drugs.

Results of our further in-vivo and in-vitro experiments suggest that measurement of production of hormones and related substances can be used for characterisation and prediction of physiological state, reproduction, growth and meat production of farm animals. It was observed, that plasma level of thyroid hormones, steroids, nonapeptide hormones, IGF-I, IGFBP-3, cAMP, cGMP, as well as cellular production of these substances and intracellular mediators of their action (protein kinase A, tyrosine kinase, MAP kinase, CDC2 kinase, transcription factor CREB) and indicators of proliferation (p34, PCNA) and apoptosis (TdT, BAX) and their responses to gonadotropic substances is associated with stage of puberty, ovarian folliculogenesis and reproduction rate in gilts and domestic hens. Furthermore, these indexes can be reliable indicators of plain of nutrition in pigs and domestic nutria. It was observed, that plasma IGF-I, IGFBP-3 and thyroid hormone level can be used for characterisation and prediction of growth and reproductive efficiency in pigs.

Other important aspect of application of hormones, growth factors, growth factor binding proteins and pharmacological regulators of intracellular messengers of their action can be use of these substances for regulation of ovarian secretory and generative functions in farm animals in vivo and in vitro. It was demonstrated, that GnRH, gonadotropins, GH, prolactin, serotonin, melatonin, oxytocin, arginine-vasopressin, arginine-vasotocin, IGF-I, IGF-II, TGF, thrombopoietin, analogues of cAMP and cGMP, activators and inhibitors of protein kinase A, tyrosine kinase, MAP kinase, CDC2 kinase can be potent regulators of proliferation, apoptosis, and production of steroid hormones, oxytocin, arginine-vasopressin, arginine-vasotocin, IGF-I, IGFBP-3, inhibin A and B, prostaglandins F and E and related protein kinases and transcription factor by cultured bovine, porcine, nutria, rabbit, human and fowl's ovarian cells. Addition of IGF-I, cAMP and cGMP analogues was able to prevent effect of reduced nutrition on nutria ovarian cells. Transfection of bovine and porcine ovarian cells with cDNA constructs, whose changed expression of IGFBP-3 and IGFBP-4, affected production of steroids, oxytocin and prostaglandins F and E by these cells. Furthermore, addition of IGF-I, IGF-II and EGF were able to stimulate maturation of porcine oocytes and development of rabbit embryos in vitro. Treatment of nutria with GH, IGF-I, forskolin and IBMX (stimulators of cAMP- and cGMP-dependent intracellular mechanisms) stimulated secretion of ovarian hormones and growth factors, enhanced number of ovulations and offsprings, and increased growth rate in females and their pups.

Conclusions

Results of our studies demonstrate, that hormones, growth factors, growth factor binding proteins and intracellular messengers of their action are involved in the control of reproduction, growth and performance in different farm animal species. Furthermore, it was shown, that these hormones can be used for the evaluation of biological activity of stimulators of reproduction, for characterisation and prediction of state of puberty and reproduction, growth, plain of nutrition and meat production, for improvement of biotechnological methods (cell transfection and embryo production), as well as for the direct control of reproduction and meat production rate in farm animals. Finally, our results suggest, that pharmacological regulators of intracellular mediators of hormones and growth factor action can be reliable, cheap and safe alternative to application of hormones in animal production and medicine.