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OPEN ACCESS | WORLD ZOONOSES DAY – 06 JULY | POPULAR ARTICLE

Immunization Against Reproductive Hormones

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Introduction:

Immuno-neutralization of hormones involves the use of antibodies to block or neutralize the biological effects of specific hormones in the body. It also refers to raising antibodies against hormones to manipulate the signaling and recognition systems of hormones.

Immunization against Reproductive Hormones:

The endocrine control of reproduction in mammals involves hormone signaling between the brain, pituitary gland and gonads. Luteinising hormone releasing hormone (LHRH) is released from the basal hypothalamus-median eminence and stimulates the anterior pituitary gland to secrete luteinising hormone (LH) and follicle stimulating hormone (FSH), which together orchestrate testicular and ovarian function. The gonads in turn secrete a range of protein and steroid hormones. Gonadal steroids serve diverse functions which include the regulation of LHRH, LH and FSH secretion through feedback mechanisms, stimulation of brain centres associated with sexual and aggressive behaviour, and maintenance of accessory sex tissues and secondary sex characteristics. Since hormones are transported in the general circulation, they are readily accessible to antibodies.

It has therefore been argued that antibodies specific for a particular hormone will bind that hormone in the circulation and consequently block its biological actions. This concept has been largely substantiated for reproductive hormones. It should be noted that gonadal steroids and LHRH are not immunogenic and therefore require conjugation to antigenic carrier proteins for Immunization. Gonadotrophic hormones are immunogenic when used inter specifically and do not necessarily require conjugation. However, there appear to be some improvements in antibody responses when gonadotrophic hormones are conjugated to carrier proteins.

Consequences have been enlisted following immunization against different hormones are given below.

Immunization against Testosterone:

It stimulates ovarian activity but it usually causes abnormal ovarian cycles. In rams and bulls appears not to influence sexual behaviour or testicular and accessory sex gland function (anti-testosterone antibodies would neutralise the actions of testosterone on sexual behaviour and somatic tissues).

Immunization against Estrogen:

Ewes immunized against oestradiol-17β become anovular and anoestrus but it precipitates abnormal ovarian activity including cystic follicles.

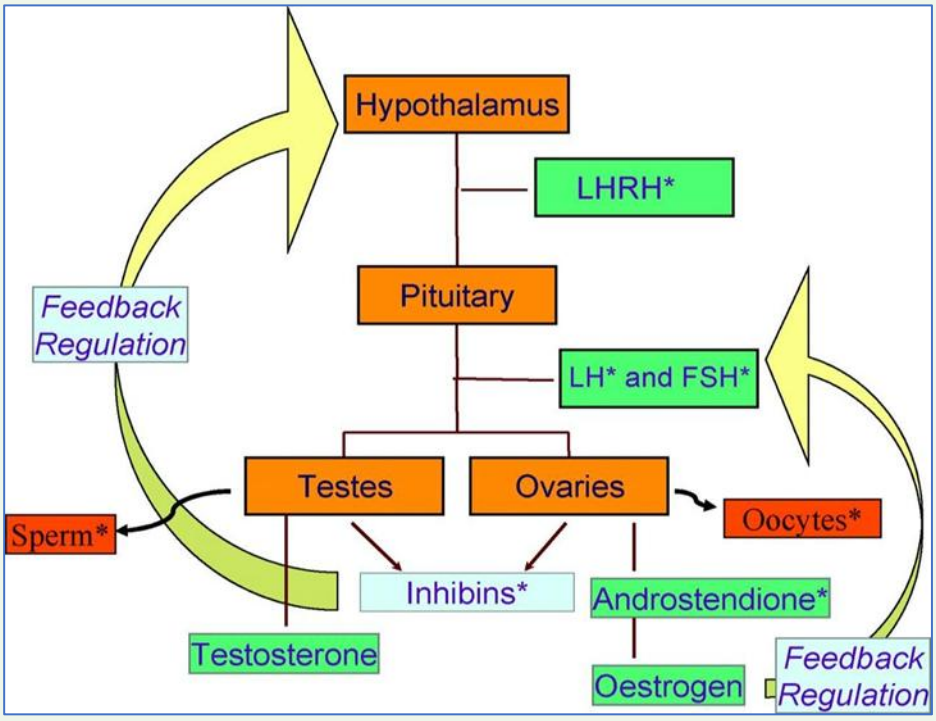
Immunization against PGF2α:

Extended oestrous cycle lengths continued secretion of progesterone may provide an endogenous anabolic effect in meat producing heifers.

Immunization against Oxytocin:

In ewes and goats extended the oestrous cycle.

Immuno-neutralization of Androstenedione and Inhibin:



- ***Immunization against androstenedione:***

  Increases ovulation rate and fecundity and can be used as 'fecundity vaccine'. Androvax and Ovastim, are commercial vaccine for use in sheep. It is available in various developed countries.

- ***Immunization against inhibin:***

  Passive immunisation by using ovine follicular fluid as immunogen resulted in increase in ovulation rate in cattle. Active immunisation against inhibin á-subunit conjugated to suitable carrier protein has

resulted in 2-4 fold increase in ovulation rate.

Immuno-neutralization of Hormones to Control Fertility: 2 types of antifertility vaccines which include-

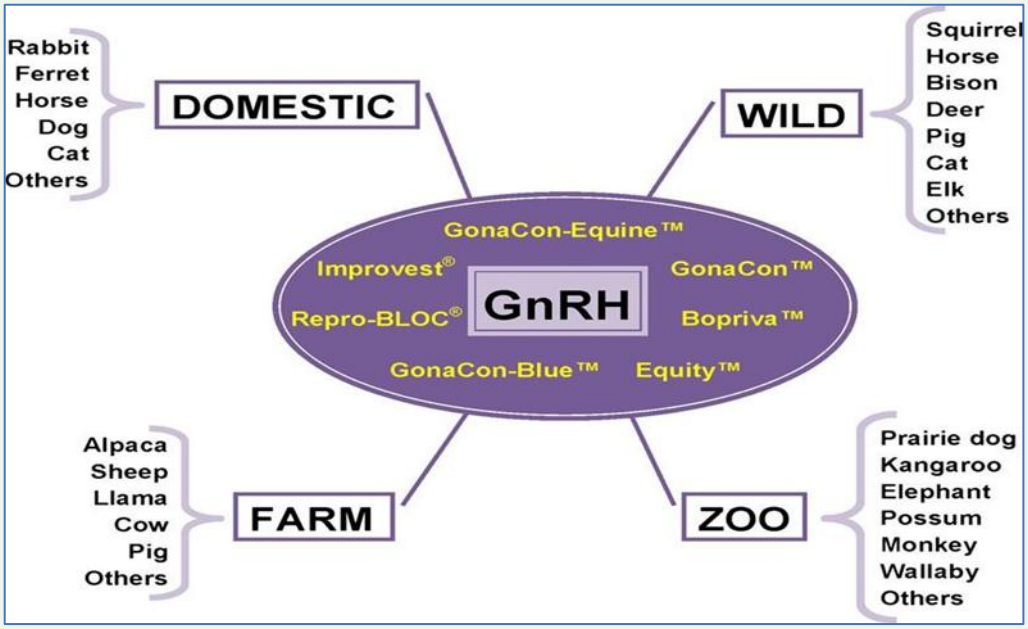
- ***Immuno-contraceptive vaccines:***

  They aim to prevent either fertilization of the oocyte by sperm or implantation of the fertilized egg yet retain sexual behaviour patterns and competition in mating.

- ***Immuno-neutering vaccines:***

  They aim to prevent all sexual behaviours in both male and female animals as well as controlling fertility.

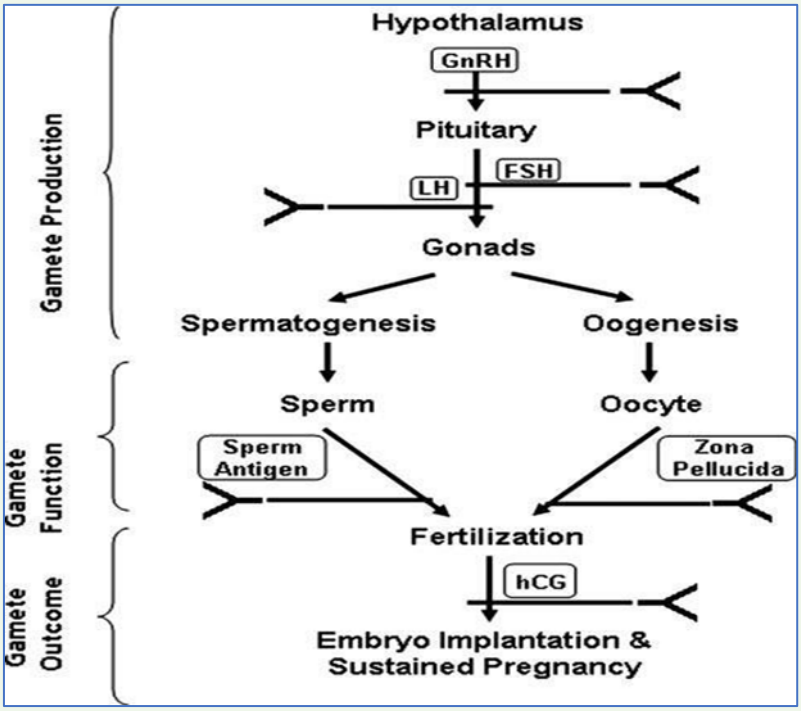
Immunological neutralization of GnRH:



➢ **Points:**

- Blocks pituitary secretion of gonadotropins resulting in gonadal quiescence.
- It prevents reproductive function, provides contraception, controls estrus behaviour in females and sexual and aggressive behaviour in males.
- GnRH is non immunogenic, therefore require conjugation to antigenic carrier proteins for immunization.
- ***Vaxstrate***- first commercial vaccine developed against GnRH.
- ***Improvac***- for male pigs to control boar taint due to steroid androsterone and skatole.
- ***Equity***- for female horses to control estrus.
- ***GonaCon***- for wild animals to control estrus.

➢ Schematic presentation of the probable sites for immuno-contraception. Antibodies against the respective targets may result in interference in their functions, leading to blocking of fertility-



Immunisation against Gonadotrophic Hormones:

- The gonadotrophins LH & FSH share a common α subunit but differ in the β subunit.
- Specific responses are obtained after using only β subunit for immunization.
- Gonadotrophic hormones are immunogenic and do not necessarily require conjugation.

Immunization against FSH:

- In males, results in maintenance of sexual function but only inhibiting spermatogenesis.
- While in females no sexual characters are seen due to less estrogen.

Immunization against LH:

- Following immunization against a bovine LH-ovalbumin conjugate suppression of ovarian activity can be seen.
- Young bulls immunised against LH showed reduced testis growth and had serum testosterone concentrations similar to surgical castrates.

Vaccine against Sperm Antigen:

- Different sperm antigen like PH-20, SP-10, lactate dehydrogenase-C4 are immunized.
- But, no one sperm antigen gives an exceptional contraceptive effect.
- Both male and female can be vaccinated.
- But side effects like autoimmune mediated orchitis are seen in males.

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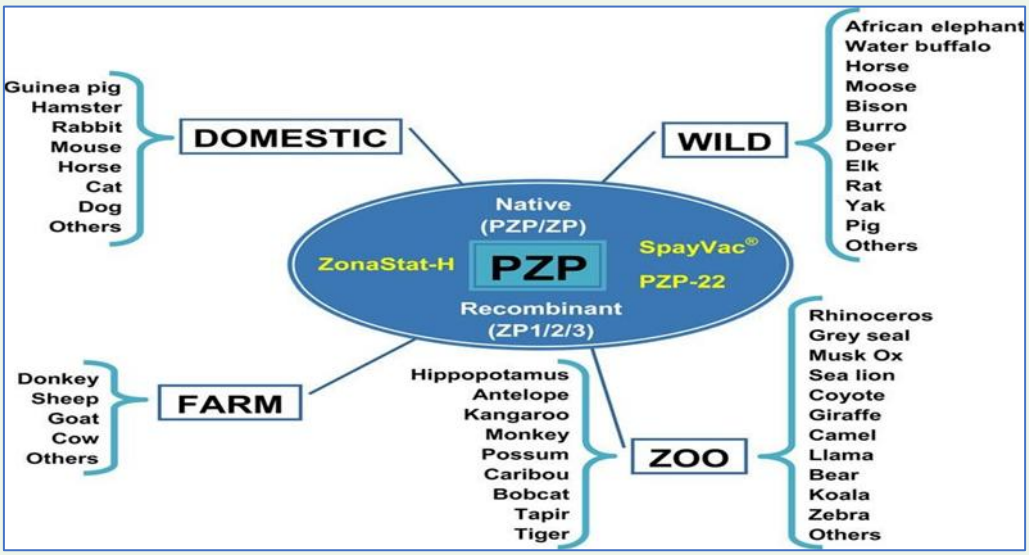
Vaccine against Zona Pellucida Antigen:



- The zona pellucida (ZP) forms a coating around mammalian eggs and is comprised of ZP glycoproteins and are involved in sperm binding during penetration of the zona.
- Immunisation of females against ZP antigens has shown to reduce fertility in a number of species.
- ***SpayVac***- Commercially available vaccine based on crude porcine ZP antigen preparation has been shown to have efficacy in a number of species.
- ***ZonaCon***- for deer and feral horse.
- But use of these vaccines is associated with abnormal ovarian function and altered reproductive hormone profiles.

Conclusion:

Immunological methods of contraception or sterilization show promise for effective and efficient fertility control of individual domestic and wild animals. However, many factors must be considered before implementing this type of control on wild and domestic animal populations.

Knowledge of immune function may aid in an effective choice of antigen and delivery method. Such knowledge should be combined with an understanding of the normal behavior and the reproductive biology of an animal Immuno- neutralization of hormones represents a powerful tool in both research and potentially in clinical practice for manipulating hormonal signaling pathways. By selectively blocking hormone activity, researchers and clinicians can gain insights into hormone function and potentially develop new therapeutic interventions for hormone-related disorders.

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