Հայաստանի Գիտությունների Ազգային Ակադեմիա
Национальная Академия Наук Армении
National Academy of Sciences of Armenia

Հայաստանի Կենսաբանական Հանդես
Биологический Журнал Армении
Biological Journal of Armenia

• Փորձարարական և տեսական հոդվածներ • Экспериментальные и теоретические статьи •
• Experimental and theoretical articles •

Biolog. Journal of Armenia, 4 (63), 2011

EFFECTS OF TESTOSTERONE AND GROWTH HORMONE INJECTION ON OVIDUCT MORPHOLOGY OF LAYING HENS

H.GH. MOHAMMADI, R.S. MKHITARYAN, M.M. BOUYEH, S.G. YEGHOYAN, G.R. HAMBARDZUMYAN, O.V. SHCHERBAKOV

Armenian State Agrarian University (ASAU)
mohammadyhm@yahoo.com

The ovarian functions are an intricate complex of several processes including folliculogenesis, proliferation and differentiation of follicular cells, oocyte maturation and ovulation, steroidogenesis, regression of tissues (atresia). If these events occur in an accurate manner, the development and subsequent maintenance of ovarian function will be guarantied. Different hormonal constituents (comprising gonadotropins, ovarian steroids and various growth factors) affect ovarian morphology and subsequently promote reproduction. The results of this study showed that testosterone and growth hormone injection at special doses may affect ovarian morphology positively.

Testosterone – growth hormone – ovarian morphology – laying hens

Ընտանի թռչունների վերարտադրողական համակարգում տեղի ունեցող ֆիզիոլոգիական և ձևաբանական փոփոխությունները մի շարք գործընթացների՝ ֆոլիկուլների գոյացման և տարբերակման (դիֆերեցման), պրոլիֆերատիվ գործընթացների գերակշռման, օվոցիտների հասունացման, ֆոլիկուլների օվուլյացիայի, ստերոիդների գոյացման և ֆոլիկուլների ատրեզիայի բարդ համակարգ է: Թռչնի վերարտադրողական համակարգում նշված գործընթացները հաջորդաբար տեղի ունենալով ապահովում են ձվարանի նորմալ զարգացումը և դրա հետագա գործառույթային գործունեությունը: Հորմոնները (գոնադոտրոպ, ստերոիդ և աճի տարբեր գործոնները), նույնպես ազդելով հավերի վերարտադրողական համակարգի ձևաբանության վրա, նպաստում են նրանց ձվարանի նորմալ գործունեությանը և սեռական համակարգի լավ զարգացմանը, այսինքն ապահովում են դրանց վերարտադրությունը: Հետազոտության արդյունքները ցույց են տալիս, որ տեստոստերոնի և աճի հորմոնի որոշակի չափաքանակի ներարկումը դրական ազդեցություն է գործում ձվարանի և ձվափողի ձևաբանության վրա:

Տեստոստերոն - աճի հորմոն - ձվարանի ձևաբանություն - ածան հավեր

Физиологические и морфологические изменения в половом аппарате кур представляют собой сложный комплекс нескольких процессов – образование и дифференцировку фолликулов, преобладание пролиферативных процессов, созревание ооцитов, овуляции фолликулов, образование стероидов и атрезии фолликулов. Эти изменения, происходящие последовательно в половом аппарате кур, обеспечивают нормальное развитие яичника и его дальнейшую функциональную деятельность. Гормоны (гонадотропные, стероиды и различные факторы роста), воздействуя также на морфологию полового аппарата кур, способствуют нормальному функционированию яичника и правильному развитию половой системы, т.е. обеспечивают их воспроизводство. Результаты наших исследований показали, что инъекция определенных доз тестостерона и гормона роста оказывают положительное воздействие на морфологию яичников и яйцевода.

Тестостерон - гормон роста - морфология полового аппарата - куры-несушки

There are few articles related to growth hormone and/or testosterone influence on insulin-like growth factors and insulin-like growth receptors in layer. The effect of growth hormone on gene expression of insulin-like growth factors has been studied for several times [1]. For the first time, usage of testosterone to stimulate ovulation was reported in 1955 and 1961 [3]. In an active ovary of domestic fowl which contains a complete follicle hierarchy, the increase of progesterone (secreted mainly from the F1 follicle causes evaluated gonadotrophins-releasing hormone (GnRH) and finally LH surge [4]. The increase of progesterone and LH plasma concentration which have been observed between 4-7 hours before ovulation in laying chicken is as a result of increased concentration of testosterone and estradiol [6].

Injection of testosterone to laying hens which have an active ovary may stimulate ovulation, so it has been thought that testosterone surge prior to ovulation causes LH surge, suggesting its important role in ovulation process. Further more, active or passive immunization of testosterone effects lead to ovulation cease [6].

It has been reported that injection of progesterone and testosterone to laying hens, stimulate ovulation in 8 and > 9 h respectively, suggesting that probably testosterone should be converted to active form to exert its biological action [3]. None physiologic doses of testosterone stimulate the ovulation. Preovulatory increase of testosterone causes LH surge before ovulation by influencing hypothalamic-pituitary– ovarian axis [6].

Altogether the opinions above can be briefly summarized as follows:

1. Only activated testosterone exerts the biological effects [1]; and
2. Testosterone stimulates the hypothalamic-pituitary– ovarian axis and causes LH prior to ovulation [1].

With consideration to the currently available evidences the first theory is not expected and testosterone doesn't influence the LH surge, and Progesterone isn't a metabolite of testosterone but the second theory is probable [5].

It is reported that administration of oestrogen and progesterone in ovaryectomized layers triggers the response of the hypothalamic-pituitary axis (LH secretion) to stimulant effect of progesterone, suggesting testosterone may simulate the effect of oestrogen [3] probably preovulatory testosterone surge causes LH surge. The main concentration of preovulatory ovarian-derived progesterone is secreted by granulosa cells of the mature hierarchical follicles and partly by granulosa cells of preovulatory follicles [6].

Gonadotrophins and other steroid and none steroid hormones could play a key role during follicular growth and development period. The ovary through endo/ paracrine activity manages the follicular development. The biological interactions of the hormones which influence reproductive events are well known and it is a confirmed fact that progesterone, androgen and oestrogen are the most indisputable hormones. Steroid hormones affecting the hypophysis, regulate the general (generic) ovary events, however, steroid hormones especially androgens may also exert direct effects on ovary. Yolk proteins formation is directly depends on oestrogen effects. Ovulation is regulated by progesterone and probably also by oestrogen. Oestrogen effects clear aspects of calcium metabolism so may affect the egg shell formation [4].

In brooding hens, plasma concentration of testosterone is higher during broodiness [3, 5]. In birds, testosterone may affect plasma concentration of T3 and T4, which play critical roles in proper function of various organs including reproduction and gonadal development, as also shown in other species [5, 4]. Testosterone increases the deiodination of thyroid hormones (thyroxin or T4 and triiodothyronine or T3) in peripheral tissues [3, 5].

Growth Hormone: Somatotropin, also is called growth hormone, is a protein hormone with an isoelectric point of 7.5, a molecular weight of approximately 22 kilo Dalton and 191 amino acids. GH was isolated from avian pituitary tissue recombinant

chicken. GH has been produced with the same biological activity of wild-type pituitary-derived avian GH [5].

There is evidence for different structural variants of avian GH [6]. Unlike human, GH variants in birds are not due to multiple genes and different splicing patterns of mRNA, whereas, they are as a result of post translation modification, which produce glycosylated GH, phosphorylated GH [5, 6], dimeric, and other oligomeric forms in the chicken pituitary gland [5]. Although, most Chicken pituitary-derived GH is monomeric, dimeric, and other oligomeric forms are detected via polyachrilamidgel [4]. GH may be found in other tissues like nervous system, reproductive system and immune system. Specific form of GH gene expression in these different tissue will results in different biological action [2].

GH has a structural similarity between different species. GH, prolactin and placental-derived lactogen have also structural similarity. The gene for GH is located on chromosome No 1 and 17 of birds and human, respectively.

In human's hypophysis, hGHN gene encodes GH. hGHN is expressed in the form of 2 types of mRNA which are translated to 2 different proteins (20, 22 kilo Dalton protein) the 22 kilo Dalton protein is the dominant form of GH which form 90% of total blood concentration of GH (4).The half life of GH in chicken is around 20 min [3]. Several physiologic events like growth, egg production, body composition, appetite regulating, aging and reproduction are influenced by GH [6].

There are high-affinity GH-binding sites, which are regulated in a tissue-specific manner, in both granulosa and theca layers of hen preovulatory follicles, which modulate reproductive roles of GH [4].

Materials and methods. The experiment was carried out to evaluate single injection of old laying hens with human testosterone (hT) and growth hormone (hGH), in post peak production period (when ovulation rates are decreased) on ovarian morphology of layer hens.

73 week aged white Leghorn hens were weighed individually and (live weights used as covariate in the analysis of ovarian characteristics) were located in individual cages with free access to food and water. The hens were randomly allocated into one of four experimental groups. Each treatment consisted of 4 replicates with 10 chicks per each.

Injection manner: The birds were injected subcutaneously with hT and hGH at live weight-dependent dosages as follows:

injection of 100 pl distilled water (control group)

injection of 500 pg hT/kg BW + 50 pg hGH/kg BW

injection of 500 pg hT/kg BW + 100 pg hGH/kg BW

injection of 500 pg hT/kg BW + 150 pg hGH/kg BW

Growth hormone was prepared for injection according to manufacturer's recommendations and neutral oil was used as vehicle for testosterone injection.

Results and Discussion. The results were analyzed by SAS software [7]. However ovarian anatomical characteristics were affected by hormone injection, but some of them was significant and the others were insignificant (Data are presented in Table 1 below).

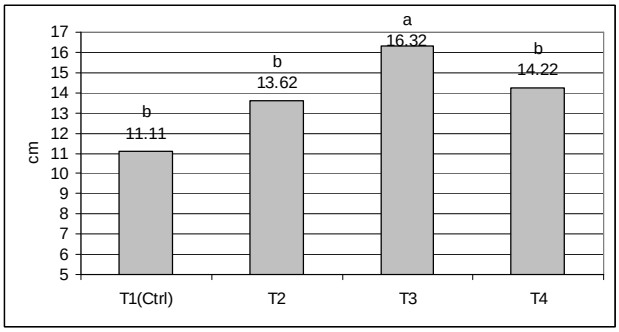
Table 1. Effect of GH and testosterone injection on oviduct morphology

	Treatments				
	T1(Ctrl)	T2	T3	T4	SEM*
Infundibulum length(cm)	5.95b	6.84b	8.95a	6.95b	0.021
Ampulla length(cm)	37.32	39.23	38.09	38.61	0.028
Isthmus length(cm)	13.95	17.01	15.60	14.02	0.055
Uterus length(cm)	11.11b	13.62b	16.32a	14.22b	0.039
Vagina length(cm)	12.065	11.97	11.75	9.975	0.049

.055Uterus length(cm)11.

11b13.62b16.32a14.22b0.039Vagina length(cm)12.06511.9711.759.9750.049 *Stand

ent letters between columns indicate a significant difference. (P < 0.05)H.G. MOHAMMADI et alInfundibulum (or funnel) length: In
fundibulum length was significantly increased by hormone injection in treatment 3. (P < 0.05)Ampulla or magnum length: Ampulla l
ength was increased by hormone injection in treatment 2 but it wasn't significant. (P > 0.05)Isth
mus length: treatment 2 increased Isthmus length numerously but not significantly. (P > 0.05)Uterus leng



th: Uterus length was significantly increased by hormone injection

in treatment 3. (P < 0.05)Diagram.1. Effect of GH and testosterone injection on uterus lengthVagina lengt
h: Vagina length was insignificantly reduced by treatment 4 compared with control. (P > 0.05)According to the above-mentioned results, the hormone injection can affect ovarian morphology. It demonstrated the definite roles of hormonal system in reproductive system. Making decision to inject or not to inject hormones should be discussed, because it depends on different situations and the final goal. These kinds of researches have been initiated the new way in birds' reproduction physiology. In next research the effects of hormone injection on other characteristics of layers' reproduction system will be focused.

*REFER*ENCES

1. Ansari Pirsaraei, Z., Zare Shahneh, A., Zaghari, M., Zamiri, M.J. and Rahimi Mianji, G. Effect of Testosterone and Growth Hormone Injection on Expression of IGF-I, Type-I IGFR and Type-II IGFBP Genes of the Mazandaran Native Breeder Hens. Ph.D thesis, Department of An*imal Science, Faculty of Agri*culture and Natural Resources, University of Tehran, Iran, 2009.Dawson, A., and
2. *P.J. Sharp. F*unctional Avian Endocrinology. Narosa Publishing House. New Delhi. India, 2005.Johnson, A.L. Reproduction in the female. In: Sturkie's Avian
3. *Physiology. G.C. Whittow* (ed.). Academic Press, San Diego, London, Boston. Pp 569-596, 2000.Liu, H.K. and Bacon, W.L. Changes in Egg Production Rate
4. *Induced by Pr*ogesterone Injection in Broiler Breeder Hens. Poultry Science 84, 321–327, 2005.McNabb, F.N. The hypothalamic-pituitary-thyroid (*HP*T) axis in birds
5. *and its role in bird development and reproduction. Crit. R*ev. in Toxicol. 37, 163–193, 2007.Pehlivan, T. Mansour, A. Spaczynski, R.Z. and Duleba, A.J. Effects of transforming growth factors α and *β* on proliferation and apoptosis of rat theca-interstitial cells. Journal of Endocri*nology, 170, 639–64*
6. SAS User's Guide: Statistics. SAS Inst. Inc., Cary, NC, USA, 2001.

Received 07.09.2011