Journal of Livestock Science and Technologies, **2018, 6 (2): 67-72** ***http://lst.uk.ac.ir***

DOI: 10.22103/jlst.2018.11741.1228

Short communication

Effect of long-term oral administration of extra thyroxine on oviductal expression of carbonic anhydrase and avidin-related protein-2 genes in broiler breeder hens

M. Hatami[1], Z. Ansari Pirsaraei [1*], A. Akhlaghi[2] and H. Deldar[1]

[1]Department of Animal Science, Faculty of Animal Science and Fishery, Sari Agricultural Sciences and Natural Resources University, Sari, Iran.

[2]Department of Animal Science, Faculty of Agriculture, Shiraz University, Shiraz, Iran.

*Corresponding author, E-mail address: zarbakht_ansari@yahoo.com

Abstract Avian sperm are stored in the sperm storage tubules (SSTs) of the hen oviduct for a prolonged period. The impact of avidin-related protein-2 ($AVRP_2$) and carbonic anhydrase II (CA II) in sperm viability in the SSTs has been suggested. The aim of the present study was to investigate the effect of oral administration of a high dose of thyroxine on the oviductal expression of $AVRP_2$ and CA II genes in broiler breeder hens. The birds (n=70), housed in separate cages, were randomly allotted to two treatment groups to either zero (CON) or 0.30 mg thyroxine per day (T_4 group) for 12 weeks. Feed and water were supplied according to the Cobb 500 standards (metabolizable energy: 2700 kcal/kg and crude protein: 14%). Blood samples were prepared seven times for determination of plasma triiodothyronine (T_3) and T_4 concentration. At the end of the treatment period, 20 hens were randomly selected and killed to determine the expression of $AVRP_2$ and CA II in the SSTs using the real-time PCR procedures. Expressions of $AVRP_2$ and CA II genes were influenced by T_4 treatment where an increased expression of CA II was recorded for T4-exposed hens ($P<0.05$). However, expression of $AVRP_2$ was not significantly different between the treatment groups ($P>0.05$).

Keywords: avidin-related protein-2, breeder hen, carbonic anhydrase, oviduct, thyroxine

Received: 23 Feb. 2018, *accepted:* 04 Jun. 2018, *published online:* 08 Dec. 2018

Introduction

The avian oviduct consists of 5 sections: the infundibulum, magnum, isthmus, uterus, and vagina. Among these sections, the utero-vaginal junction (UVJ) is an important area, because of having more than 3000 sperm storage tubules (SST; Bakst et al., 2010). The period of sperm storage among various birds is different [e.g. 6 d in pigeons, over 2 months in some seabirds (Hemmings et al., 2015) or about 3 months in the domestic turkey (Christensen and Bagley, 1989)]. On the other hand, there is a positive correlation between the duration of fertility and the number of the SSTs (Pierson et al., 1988).

Therefore, modification of the SST microenvironment may be instrumental in prolonged storage of sperm within the sperm SST. In birds, in addition to a complex systemic effect associated with the maintenance of an adequate basal metabolic rate (Sechman, 2013) and their impact on the processes of growth and development (McNabb, 2007), thyroid hormones are necessary for the normal functioning of the reproductive system (Sechman et al., 2000). Thyroid inhibition in adult hens has led to a decline or even a cessation of egg production in laying hens (Akhlaghi et al., 2012).

Avidin is a member of a gene family that encoding 7 avidin-related proteins ($AVRP_1$ to $AVRP_7$) with a 91 to 96% structural similarity (Daryabari et al., 2015). Avidin-related proteins bind to biotin with high affinity (Laitinen et al., 2002). Avidin is a four-component protein with 128 amino acids in each section that forms strong non-covalent bond with a biotin molecule (Kuramitz et al., 2003). In the oviduct of laying hens, the synthesis of avidin is influenced by the progesterone (P_4) and protects the growing embryo against microbial infections (Tuohimaa et al., 2003).

Carbonic anhydrase (CA) catalyzes the reaction $CO_2 + H_2O \leftrightarrow H^+ + HCO^{-3}$, consists of seven isozymes (CA I – CA VII), and carbonic anhydrase may be soluble (CA I, II, III and V), membrane bound (CA IV) or secr-

eted (CA VI), while many cells may contain more than one isoenzyme (Dobyan and Bulger, 1982). Kuryl (1981) suggested the presence of CA activity infundibular mucosa of birds, and Holm et al. (1996) localized CA histochemically in the infundibulum and the UVJ and provided the first evidence for the role of CA in rapid pH changes in these regions.

The objective of the present study was to determine the effects of oral administration of a high dose of T_4 on the oviductal expression of $AVRP_2$ and CA II genes in broiler breeder hens.

Materials and methods

Birds and experimental treatments

Cobb 500 broiler breeder hens (n=70) were randomly selected at 47 wk of age and assigned to two treatment groups of either zero (CON) or 0.30 mg T_4 per day (T_4 group) for 12 consecutive weeks in a completely randomized design. Each treatment consisted of 5 replicates of 7 birds that were kept in separate cages. A total of 20 Cobb 500 broiler breeder roosters was also used for artificial insemination. The roosters were habituated to abdominal massage for semen collection for 10 days. Semen samples were prepared, pooled, and diluted in homogenized-pasteurized low-fat milk (Akhlaghi et al., 2013). Each hen was inseminated with 200×10^6 sperm to eliminate the effect of sperm number on gene expression (Foye-Jackson et al., 2011). The hens were inseminated on two successive days for three separate phases. The birds were fed on a corn-soybean meal-based diet (Table 1), and a 16L:8D artificial lighting schedule was provided throughout the trial.

Table 1. Ingredients and chemical composition of the experimental diets

Ingredient (DM basis) %	
Corn grain	0.366
Wheat grain	25
Barley grain	0.134
Soybean meal (44%)	0.1576
Oyster shell	0.0706
Vitamin premix[1]	0.001
Mineral premix[2]	0.001
Sodium chloride	0.0018
Sodium bicarbonate	0.0016
DL-methionine	0.00095
Dicalcium phosphate	0.0148
L-threonine	0.00025
L-Lysine	0.0004
Dietary composition	
Metabolizable energy (kcal/kg)	2700
Crude protein (%)	14.00
Ca (%)	2.99
P (%)	0.36

[1]Supplied per kg diet: vitamin A, 14,000 IU; vitamin D_3, 3000 IU; niacin, 50 mg; vitamin E, 35 mg; calcium pantothenate, 20 mg; vitamin K_3, 4 mg; riboflavin, 7.0 mg; pyridoxine, 5.7 mg; vitamin B_{12}, 25 µg, and biotin, 50 µg.
[2]Supplied per kg diet: Fe ($FeSO_4 \cdot H_2O$), 85 mg; Mn ($MnSO_4 \cdot H_2O$), 90 mg; Zn (ZnO), 67.3 mg; Cu ($CuSO_4 \cdot 5H_2O$), 11.1 mg, and Se (Na_2SeO_3), 0.19 mg.

Blood samples

During the treatment period, blood samples were prepared from all hens once every two weeks (7 times in total), centrifuged at 1800 × g for 15 min, and plasma was separated for determination of T_3 and T_4 using commercially available ELISA kits (Pars Azmoon Co., Tehran, Iran).

Oviductal gene expression

Tissue sampling: At the end of the treatment period, SST tissue specimens were prepared according to the procedure described by Foye-Jackson et al. (2011). Twenty hens in each group, 2 hens/replicate (10 hens/treatment) were randomly selected and killed by cervical dislocation. The UVJ was dissected and rinsed with phosphate buffered solution (0.15 *M* at pH 7.4). The UVJ mucosa containing the SSTs was removed, immediately transferred into liquid nitrogen and subsequently stored at -80°C for RNA isolation.

Total RNA extraction and cDNA synthesis: Total RNA isolation from the SST tissue samples was performed by using RNX-Plus (CinnaGen) and the real-time PCR reactions were carried out by Master SYBR Green I Mix kits according to the manufacturer's instructions. DNase was used for removing genomic DNA contamination.

Real-Time PCR analysis: *The r*eal-time PCR analysis was used to compare the expression of $AVRP_2$ and CA II in the oviductal SST tissues. Table 2 shows the gene-specific primers used in the present study. The reference gene, β-actin (Li et al., 2010), was used as endogenous control to normalize the expression of $AVRP_2$ and CA II genes.

One µ*M* cDNA template was used in a 15 µL RT-PCR reaction mixture containing 1 µ*M* gene specific primers, 7.50 µL QuantiFast SYBR Green Master Mix, and 4.50 µL RNase-free water, under the following conditions: initial denaturation 95°C for 300 s, 50 cycles each of denaturation (95°C, 10 s) as well as annealing and extension (60°C, 30 s). To prepare the standard curve for each gene, pooled cDNA was serially diluted in distilled H_2O and amplified by the gene-specific primer pairs. The relative expression of the desired genes

Table 2. Primer sequences for the real-time PCR amplifications of oviductal target genes

Gene[1]	Primer sequence (5′-3′)	Base pair	Reference
$AVRP_2$	Forward: ATCATGACCATCGGAGCTGT	155	Foye-Jackson *et al*., 2011
	Reverse: CAATGGACAGTGAAGCCAAA		
CA II	Forward: TGACCCTACTGGACTGCTGC	199	Holm and Ridderstrale, 1998
	Reverse: TGACAGTGATGGGCTCCTTC		
β- actin	Forward: TGCGTGACATCAAGGAGAAG	300	Li *et al*., 2010
	Reverse: TGCCAGGGTACATTGGTGGTA		

[1]$AVRP_2$: Avidin-related protein-2, CA II: Carbonic anhydrase II, β-actin: Beta actin.

was measured for each sample by using the $2^{(-\Delta\Delta Ct)}$ method (Livak and Schmittgen, 2001), where the average ΔCt values of the control treatment.

Statistical analysis

The expression levels of $AVRP_2$ and CA II mRNA measured by RT-PCR were analyzed, using the GLM procedure (SAS, 2003). Differences between means were determined by the least squares means contrasts.

Results and discussion

Plasma T_4 level, but not T_3 concentration, was higher in T_4-treated hens (Table 3), which may be the consequence of quick and almost complete conversion of T_4 to the metabolically inactive reverse-T_3 (Akhlaghi et al., 2012).

Because thyroid disorders often lead to abnormalities in the reproductive system, thyroid hormones have long been implicated to have a role in the avian reproduction (Sechman, 2013). Administration of exogenous T_4 in drinking water for 4 weeks decreased the incidence of ascites in the cold-exposed broilers (Akhlaghi et al., 2012)**.** The UVJ, containing the SST, is an important region affecting the fertility in birds (Bakst et al., 2010). It is sensitive to a changing hormonal environment that provides the oviduct for development of the ovulated egg and promotes the most efficient use of sperm to fertilize as many eggs as possible (Foye-Jackson et al., 2011). Other studies have shown the presence of several UVJ genes that would be needed to optimize the fertilization being affected by E_2 (Das et al., 2006a) and P_4 (Yoshimura et al., 2000) signals to control tissue development and maturation, avidin expression, and response to transforming growth factor β isoforms (Das et al., 2006b). Since avidin and possibly avidin analogs (Foye-Jackson et al., 2011) and carbonic anhydrases (Holm and Ridderstraale, 1998) are involved in maintaining spermatozoa in the SSTs, and because of the well-established role of thyroid hormones in the normal functioning of the reproductive system (Sechman et al., 2000; Sechman, 2013), we hypothesized that expressions of $AVRP_2$ and CA II genes might be affected by THs.

In previous studies, the expression of avidin was P_4-dependent or independent, according to the region from which the tissues were obtained (Elo, 1980). The expression of avidin in the oviduct was dependent on P_4 (Gope et al., 1987; Kunnas et al., 1992) but not in other tissues (Board and Fuller, 1974; Kunnas et al., 1993). In the chick oviduct, injections of E_2 and P_4 led to the production of ovalbumin and avidin, respectively (Chan et al., 1973). Estradiol stimulates ovalbumin gene activity in the oviduct, which parallels the *in vivo* ovalbumin accumulation (Comstock et al., 1972), but the absence of E_2 results in the disappearance of ovalbumin gene activity (Means et al., 1972). Carbonic anhydrase II level is also influenced by the steroid hormones (especially P_4 and E_2). Carbonic anhydrase is an important index for study of hormone actions on the reproductive system (Miyake and Pincus, 1959). Miyake and Pincus (1959) showed that injection of of E_2 to ovariectomized mature rats led to a reduction in uterine CA activity. On the other hand, Bialy and Pincus (1962) reported that uterine CA level in sexually immature rats is almost comparable to that of mature rats. In rabbits, CA activity was increased by P_4 but decreased by E_2 (Hodgen and Falk, 1971); however, E_2 and P_4 showed opposite effects in the mice (Maren, 1967). Carbonic anhydrase activity

Table 3. Effect of long-term oral administration of a high dose of thyroxine on thyroid hormone concentration in broiler breeder hens (LS means ± SE)[1]

Treatment	Control (no thyroxine)	Thyroxine
Triiodothyronine (T_3)	1.59±0.26	1.64±0.24
Thyroxine (T_4)	10.24±0.93	27.08±0.89*
T_3:T_4 ratio	0.152±0.007	0.059±0.007*

[1]Thyroxine was orally administered at 0.30 mg/bird/day for 100 days and the control group received drinking water (n=35 hens/group),
*Significantly different from control ($P \leq 0.05$)

Table 4. Oviductal expression of $AVRP_2$ and CA II in broiler breeder hens orally administered with thyroxine[1]

Gene	Control (no thyroxine)	Thyroxine	*P*-value
Avidin-related protein-2 ($AVRP_2$)	1.01±0.08	1.54±0.42	NS
Carbonic anhydrase II (CA II)	1.14±0.25	4.50±1.23*	0.0287

[1]Thyroxine was orally administered at 0.3 mg/bird/day for 100 days and the control group received drinking water (n=35 hens/group). *Significantly different from control. NS: Non-significant.

was shown in the uterus of estrogen-treated immature pullets; however, CA activity was not as high as in mature birds (Nys et al., 1986). Estradiol seems to be involved in the regulation of the avian oviductal CA (Holm et al., 2000). Sechman et al. (2009) reported that E_2 secretion was decreased by T_3 in all of ovarian follicles in a dose-dependent manner, whereas P_4 secretion was increased by T_3 in the granulosa layer of the preovulatory F_1 and F_2 follicles. In the present work, expression of CA II, but not CA II, was increased in T_4-supplemented hens (Table 4). Based on the published data on the effect of steroids on the expression of $AVRP_2$ and CA II in the oviduct (Kunnas et al., 1992; Miyake and Pincus, 1959), it may be concluded that long-term administration of thyroid hormones on the expression of these gene in the present study could have been affected through changes in the secretion of ovarian steroids, although blood levels of steroid hormones were not measured in this study.

Acknowledgements

The authors wish to appreciate Sari Agricultural Sciences and Natural Resources University Research Council and the academic members of the Animal Science Department.

References

Akhlaghi, A., Zamiri, M.J., Ahangari, Y.J., Atashi, H., Pirsaraei, Z.A., Deldar, H., Hashemi, S.R. 2013. Oral exposure of broiler breeder hens to extra thyroxine modulates early adaptive immune responses in progeny chicks. *Poultry Science* 92, 1040-1049.

Akhlaghi, A., Zamiri, M.J., Shahneh, A.Z., Ahangari, Y.J., Javaremi, A.N., Mianji, G.R., Atashi, H. 2012. Maternal hyperthyroidism is associated with a decreased incidence of cold-induced ascites in broiler chickens. *Poultry Science* 91, 1165-1172.

Bakst, M.R., Donoghue, A.M., Yoho, D.E., Moyle, J.R., Whipple, S.M., Camp, M.J., Bramwell, R.K. 2010. Comparisons of sperm storage tubule distribution and number in 4 strains of mature broiler breeders and in turkey hens before and after the onset of photostimulation. *Poultry Science* 89, 986-992.

Bialy, G., Pincus, G. 1962. Effects of estrogen and progestin on the uterine carbonic anhydrase of immature rats. *Endocrinology* 70, 781-785.

Board, R.G., Fuller, R. 1974. Non-specific antimicrobial defences of the avian egg embryo and neonate. *Biological Reviews* 49, 15-49.

Chan, L., Means, A.R., O'Malley, B.W. 1973. Rates of induction of specific translatable messenger RNAs for ovalbumin and avidin by steroid hormones. *Proceedings of the National Academy of Sciences* 70, 1870-1874.

Christensen, V.L., Bagley, L.G. 1989. Efficacy of fertilization in artificially-inseminated turkey hens. *Poultry Science* 68, 724-729.

Comstock, J.P., Rosenfeld, G.C., O'Malley, B.W., Means, A.R. 1972. Estrogen-induced changes in translation, and specific messenger RNA levels during oviduct differentiation. *Proceedings of the National Academy of Sciences* 69, 2377-2380.

Daryabari, H., Akhlaghi, A., Zamiri, M.J., Pirsaraei, Z.A., Mianji, G.R., Deldar, H., Eghbalian, A.N. 2015. Oral administration of supplementary biotin differentially influences the fertility rate and oviductal expression of avidin and avidin-related protein-2 in low-and high-fertility broiler line hens. *Poultry science* 94, 289-295.

Das, S.C., Isobe, N., Nishibori, M., Yoshimura, Y. 2006a. Expression of transforming growth factor-β isoforms and their receptors in utero-vaginal junction of hen oviduct in presence or absence of resident sperm with reference to sperm storage. *Reproduction* 132, 781-790.

Das, S.C., Nagasaka, N., Yoshimura, Y. 2006b. Changes in the expression of estrogen receptor mRNA in the utero-vaginal junction containing sperm storage tubules in laying hens after repeated artificial insemination. *Theriogenology* 65, 893-900.

Dobyan, D.C., Bulger, R.E. 1982. Renal carbonic anhydrase. *American Journal of Physiology-Renal Physiology* 243, 311-324.

Elo, H.A. 1980. Occurrence of avidin-like biotin-binding capacity in various vertebrate tissues and its induction by tissue injury. *Comparative Biochemistry and Physiology Part B: Comparative Biochemistry* 67, 221-224.

Foye-Jackson, O.T., Long, J.A., Bakst, M.R., Blomberg, L.A., Akuffo, V.G., Silva, M.V.B., McMurtry, J.P. 2011. Oviductal expression of avidin, avidin-related protein-2, and progesterone receptor in turkey hens in relation to sperm storage: Effects of oviduct tissue type, sperm presence, and turkey line. *Poultry Science* 90, 1539-1547.

Gope, M.L., Keinānen, R.A., Kristn, P.A., Conneely, O.M., Beattie, W.G., Zarucki-Schulz, T., Kulomaa, M.S. 1987. Molecular cloning of the chicken avidin cDNA. *Nucleic Acids Research* 15, 3595-3606.

Hemmings, N., Birkhead, T.R., Brillard, J.P., Froment, P., Brière, S. 2015. Timing associated with oviductal sperm storage and release after artificial insemination in domestic hens. *Theriogenology* 83, 1174-1178.

Hodgen, G.D., Falk, R.J. 1971. Estrogen and progesterone regulation of carbonic anhydrase isoenzymes in guinea pig and rabbit uterus. *Endocrinology* 89, 859-864.

Holm, L., Ridderstraale, Y. 1998. Localization of carbonic anhydrase in the sperm-storing regions of the turkey and quail oviduct. *The Histochemical Journal* 30, 481-488.

Holm, L., Ridderstraale, Y., Knutsson, P.G. 1996. Localisation of carbonic anhydrase in the sperm storing regions of the domestic hen oviduct. *Cells Tissues Organs* 156, 253-260.

Holm, L., Ruziwa, S.D., Dantzer, V., Ridderstraale, Y. 2000. Carbonic anhydrase in the utero-vaginal junction of immature and mature ostriches. *British Poultry Science* 41, 244-249.

Kunnas, T.A., Joensuu, T.K., Viitala, K.K., Sopanen, P., Tuohimaa, P., Kulomaa, M.S. 1992. Induction of avidin messenger ribonucleic acid in the chick oviduct by progesterone and other steroids. *Endocrinology* 130, 3421-3426.

Kunnas, T.A., Wallén, M.J., Kulomaa, M.S. 1993. Induction of chicken avidin and related mRNAs after bacterial infection. *Biochimica et Biophysica Acta (BBA)-Gene Structure and Expression* 1216, 441-445.

Kuramitz, H., Matsuda, M., Sugawara, K., Tanaka, S. 2003. Electrochemical evaluation of the interaction between avidin and biotin at biotinylated polypyrrole electrode using a redox marker. *Electroanalysis* 15, 225-229.

Kurył, J. 1981. Carbonic anhydrase activity in the membrane and contents of the ovarian follicles and oviduct mucosa of hens. *Acta Physiologica Polonica* 33, 279-285.

Laitinen, O.H., Hytönen, V.P., Ahlroth, M.K., Pentikäinen, O.T., Gallagher, C., Nordlund, H.R., Johnson, M.S. 2002. Chicken avidin-related proteins show altered biotin-binding and physico-chemical properties as compared with avidin. *Biochemical Journal* 363, 609-617.

Li, Z., Yang, L., Wang, J., Shi, W., Pawar, R.A., Liu, Y., Xia, F. 2010. β-actin is a useful internal control for tissue-specific gene expression studies using quantitative real-time PCR in the half-smooth tongue sole cynoglossus semilaevis challenged with LPS or *Vibrio anguillarum*. *Fish & Shellfish Immunology* 29, 89-93.

Livak, K.J., Schmittgen, T.D. 2001. Analysis of relative gene expression data using real-time quantitative PCR and the $2^{-\Delta\Delta CT}$ method. *Methods* 25, 402-408.

Maren, T.H. 1967. Carbonic anhydrase: chemistry, physiology, and inhibition. *Physiological Reviews* 47, 595-781.

Means, A. R., Comstock, J. P., Rosenfeld, G. C., O'Malley, B. W. 1972. Ovalbumin messenger RNA of chick oviduct: partial characterization, estrogen dependence, and translation in vitro. *Proceedings of the National Academy of Sciences* 69, 1146-1150.

McNabb, F.A. 2007. The hypothalamic-pituitary-thyroid (HPT) axis in birds and its role in bird development and reproduction. *Critical Reviews in Toxicology* 37, 163-193.

Miyake, T., Pincus, G. 1959. Hormonal influences on the carbonic anhydrase concentration in the accessory reproductive tracts of the rat. *Endocrinology 65*, 64-72.

Nys, Y., Parkes, C.O., Thomasset, M. 1986. Effects of suppression and resumption of shell formation and parathyroid hormone on uterine calcium-binding protein, carbonic anhydrase activity, and intestinal calcium absorption in hens. *General and Comparative Endocrinology* 64, 293-299.

Pierson, E.E.M., McDaniel, G.R., Krista, L.M. 1988. Relationship between fertility duration and in vivo sperm storage in broiler breeder hens. *British Poultry Science* 29, 199-203.

SAS. 2003. User's Guide: Statistics, Version 9.1 Edition. Inst., Inc., Cary, NC.

Sechman, A. 2013. The role of thyroid hormones in regulation of chicken ovarian steroidogenesis. *General and Comparative Endocrinology* 190, 68-75.

Sechman, A., Pawlowska, K., Rzasa, J. 2009. Influence of triiodothyronine (T3) on secretion of steroids and thyroid hormone receptor expression in chicken ovarian follicles. *Domestic Animal Endocrinology* 37, 61-73.

Sechman, A., Paczoska-Eliasiewicz, H., Rzasa, J., Hrabia, A. 2000. Simultaneous determination of plasma ovarian and thyroid hormones during sexual maturation of the hen (*Gallus domesticus*). *Folia-Biologica-Krakow* 48, 7-12.

Tuohimaa, P., Joensuu, T., Isola, J., Keinanen, R., Kunnas, T., Niemela, A., Kulomaa, M. 2003. Development of progestin-specific response in the chicken oviduct. *International Journal of Developmental Biology* 33, 125-134.

Yoshimura, Y., Koike, K., Okamoto, T. 2000. Immunolocalization of progesterone and estrogen receptors in the sperm storage tubules of laying and diethylstilbestrol-injected immature hens. *Poultry Science* 79, 94-98.

Communicating editor: *Mohammad Javad Zamiri*

تاثیر دراز مدت تجویز خوراکی تیروکسین اضافی بر بیان ژن‌های کربنیک آنهیدراز و پروتین وابسته به آویدین-۲ در اویداکت مرغ‌های مادر گوشتی

م. حاتمی[۱]، ز. انصاری پیرسرائی[۱*]، ا. اخلاقی[۲] و ح. دلدار[۱]

[۱]گروه علوم دامی، دانشکده علوم دامی و شیلات، دانشگاه کشاورزی و منابع طبیعی ساری، مازندران، ایران.

[۲]بخش علوم دامی، دانشکده کشاورزی، دانشگاه شیراز، فارس، ایران.

[*]نویسنده مسئول، پست الکترونیک: zarbakht_ansari@yahoo.com

چکیده اسپرم پرندگان در لوله‌های انباشت اسپرم (SSTs) اویداکت پرنده، برای مدت طولانی ذخیره می شود. تاثیر پروتین وابسته به آویدین-۲ ($AVRP_2$) و کربنیک‌آنهیدراز II (CA II) بر زنده‌مانی اسپرم در SST مرغ‌ها پیشنهاد شده بود. مطالعه حاضر با هدف تعیین تاثیر تجویز خوراکی یک دوز بالای تیروکسین بر بیان اویداکتی ژن‌های $AVRP_2$ و CA II در مرغ‌های مادر گوشتی انجام شد. پرنده‌ها (n=70) در قفس‌های جداگانه نگهداری شدند. تیمارها به طور تصادفی تیروکسین به مقدار صفر (CON) و ۰/۳۰ (T_4 group) میلی‌گرم به شیوه دهانی هر روز به مدت ۱۲ هفته دریافت کردند. نمونه‌های خون برای هفت بار برای سنجش غلظت‌های T_3 و T_4 پلاسما تهیه شدند. در پایان، شمار ۲۰ مرغ به طور تصادفی انتخاب و برای اندازه‌گیری بیان نسبی ژن‌های $AVRP_2$ و CA II در SST کشته شدند. داده‌های Real-time PCR نشان دادند که بیان نسبی ژن‌های $AVRP_2$ و CA II در پرنده هایی که ۰/۳۰ میلی‌گرم تیروکسین دریافت کرده بودند، افزایش یافتند؛ همچنین بیان نسبی ژن CA II اختلاف معنی داری را نشان داد ($P < 0.05$).