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The Effects of Selenium Nanoparticles Enriched food on Sperm Quality and Fertilization of Rainbow Trout (*Oncorhynchus mykiss*) Male Breeders

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Abstract

In this study, the effects of selenium nanoparticles on the reproductive performance of rainbow trout breeders (Oncorhynchus mykiss) were investigated. A total of 84 male reproductive strains were selected from among the breeders of the Genetic and Genetic Research Center of Shahid Motahari Yasouj. After adaptation, the fish were divided into 4 experimental groups with 3 replications. Male broilers fed with commercial foods (without selenium nanoparticles) (control group) and male brooders fed diets containing 0.5, 1 and 2 milligrams of selenium nanoparticles per kilogram of diet. After evaluating the quantity and quality of sperm, replication and fertilization were performed for different groups using female oocytes. The results showed that the highest volume of sperm and the highest sperm density were observed in rainbow trout fed with 2 mg selenium nanoparticles per kilogram of diet. The lowest sperm volume was observed in the control and 0.5 mg selenium nanoparticles and the lowest sperm density was observed in the control group. The duration of sperm motility in fish fed diets containing selenium nanoparticles (0.5, 1 and 2 mg) was significantly higher than that of the control group fed with selenium nanoparticle diet. No significant difference was found between the percentage of sperm motility and spermatocrit between experimental groups. The highest percentage of fertilization, laceration and hatching of eggs were from rainbow trout breeders fed with 2 mg nano-selenium per kilogram of diet. In this study, the supplementation of the male breeder diet with selenium nanoparticles did not have a significant effect on progeny survival at the onset of active feeding. Selenium nanoparticles seem to have a positive effect on hatching eggs ob n embryos and larvae, but in the onset of active nutrition, there is no significant effect on the survival of larvae. selenium nanoparticles of diet improve the reproductive performance in male rainbow trout.

Key words: Selenium nanoparticles, Sperm quality, Fertilization, Reproduction, Rainbow trout

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Refrences

Aas, G. H., Refstie, T. and Gjerde, B. (1991). Evaluation of milt quality of Atlantic salmon. *Aquaculture 95*: 125-132.

Agarwal, A., Nallella, K. P., Allamaneni, S. S. and Said, T. M. (2004). Role of antioxidants in treatment of male infertility: an overview of the literature. *Reproductive Biomedicine online 8*: 616-627.

Ahsan, U., Kamran, Z., Raza, I., Ahmad, S., Babar, W., Riaz, M. H. and Iqbal, Z. (2014). Role of selenium in male reproduction—A review. *Animal Reproduction Science 146*: 55-62.

Beckett, K. and Bruce, H. (2005). Challenging Medicine: Law, Resistance, and the Cultural Politics of Childbirth. *Law and Society Review 39*(5): 125-169.

Behne, D., Hofer, T., von Berswordt-Wallrabe, R. and Elger, W. (1982). Selenium in the testis of the rat: studies on its regulation and its importance for the organism. *Nutrition 112*(9): 1682–1687

Billard, R. and Gillet, C. (1981). Ageing of eggs and temperature potentialization of micropolluant effects of the Aquaculturetic medium on trout gametes. *Cahier du Laboratoire de Montereau 12*: 35-42.

Brown, D. G and Burk, R. F. 1973. Selenium Retention in Tissues and Sperm of Rats Fed α Torula Yeast Diet. *Nutrition 103*(1): 102–108.

Cheraghi, A., Bahrani, N. and Malekfar, R. 2004. Investigating the Impact of Nanotechnology on Medical and Environmental Sciences from the Perspective of Nanometric Instruments. *Life Quarterly 22*: 85-94. (In Persion)

Dreanno, C., Suquet, M., Desbruyeres, E., Cosson, J., Delliou, H. and Billard, R. (1998). Effect of urine on semen quality in turbot (*Psetta maxima*). *Aquaculture 169*: 247 – 262.

Geffen, A. J. and Evans, J. P. (2000). Sperm traits and fertilisation success of male and sex-reversed female rainbow trout (*Oncorhynchus mykiss*). *Aquaculture 182*: 61 – 72.

Hedaoo, M., Khllare, K., Meshram, M., Sahatpure, S. and Patil, M. (2008). Study of some serum trace minerals in cyclic and non-cyclic surti buffaloes. *Veterinary World 1*(3): 71-72.

Hilton, J., Hodson, P. and Slinger, S. (1980). The requirement and toxicity of selenium in rainbow trout (*Salmo gairdneri*). *Nutrition 110*: 2527-2535.

Horky, P. (2012). The effect of various forms (organic, inorganic) and levels of selenium on the laboratory values of the ejaculate of breeding boars in summer season. *Research in Pig Breeding 6*: 24–32.

Jaramillo Jr, F., Peng, L. I. and Gatlin Iii, D. M. (2009). Selenium nutrition of hybrid striped bass (*Morone chrysops* × *M. saxatilis*) bioavailability, toxicity and interaction with vitamin E. *Aquaculture Nutrition 15*: 160-165.

Johari, S. (2014). Toxicity effect of colloidal silver nanoparticles on fertilization capacity and reproduction success of rainbow trout (*Oncorhynchus mykiss*). *Nanomedicine Research 1*: 00001.

Kim, H. J., Sakakura, Y., Maruyama, I., Nakamura, T., Takiyama, K., Fujiki, H. et al. 2014. Feeding effect of selenium enriched rotifers on larval growth and development in red sea bream Pagrus major. *Aquaculture 432*: 273-277.

Lin, Y. H. and Shiau, S. Y. (2005). Dietary selenium requirements of juvenile grouper, Epinephelus malabaricus. *Aquaculture 250*: 356-363.

Lovercamp, K. W., Stewart, K. R., Lin, X. and Flowers, W. L. (2013). Effect of dietary selenium on boar sperm quality. *Animal Reproduction Science 138*: 268-275.

Naderi, M., Keyvanshokooh, S., Salati, A. P. and Ghaedi, A. (2017). Combined or individual effects of dietary vitamin E and selenium nanoparticles on humoral immune status and serum parameters of rainbow trout (*Oncorhynchus mykiss*) under high stocking density. *Aquaculture 474*: 40-47.

Nagler, J. J., Parsons, J. E. and Cloud, J. (2000). Single pair mating indicates maternal effects on embryo survival in rainbow trout, *Oncorhynchus mykiss*. *Aquaculture 184*: 177-183.

Olson, G. E., Winfrey, V. P., Hill, K. E. and Burk, R. F. (2004). Sequential development of flagellar defects in spermatids and epididymal spermatozoa of selenium-deficient rats. *Reproduction 127*: 335-342.

Pappas, A., Zoidis, E., Surai, P. and Zervas, G. (2008). Selenoproteins and maternal nutrition. Comparative Biochemistry and Physiology Part B: *Biochemistry and Molecular Biology 151*: 361-372.

Penglase, S., Hamre, K., Rasinger, J. D. and Ellingsen, S. (2014). Selenium status affects selenoprotein expression, reproduction, and F 1 generation locomotor activity in zebrafish (*Danio rerio*). *British Journal of Nutrition 111*: 1918-1931.

Rezvanfar, M. A., Rezvanfar, M. A., Shahverdi, A. R., Ahmadi, A., Baeeri, M., Mohammadirad, A. and Abdollahi, M. (2013). Protection of cisplatin-induced spermatotoxicity, DNA damage and chromatin abnormality by selenium nano-particles. *Toxicology and Applied Pharmacology 266*(3): 356-365.

Rotruck, J. T., Pope, A. L., Ganther, H. E., Swanson, A. B., Hafeman, D. G. and Hoekstra, W. G. (1973). Selenium: Biochemical Role as a Component of Glutathione Peroxidase. *Science. 179*(4073): 588-590.

Sánchez-Gutiérrez, M., García-Montalvo, E., Izquierdo-Vega, J. and Del Razo, L. (2008). Effect of dietary selenium deficiency on the in vitro fertilizing ability of mice spermatozoa. *Cell Biology and Toxicology 24*: 321-329.

Scott, R., MacPherson, A., Yates, R., Hussain, B. and Dixon, J. (1998). The eVect of oral selenium supplementation on human sperm motility. *British Journal of Urology 82*: 76-80.

Seyyedi, J and Kalbasi, M. 2017. The effect of different levels of dietary nano-selenium on growth indices, gonad quality and antioxidant activity of male Golden Caras (Carassius auratus gibelio) seminal plasma. *Aquatic Physiology and Biotechnology 5*(2): 67-70. (In Persion)

Shi, L. G., Yang, R. J., Yue, W. B., Xun, W. J., Zhang, C. X., Ren, Y. S. et al. (2010). Effect of elemental nano-selenium on semen quality, glutathione peroxidase activity, and testis ultrastructure in male Boer goats. Animal *Reproduction Science 118*: 248-254.

Surai, P. F., Fisinin, V. I. and Karadas, F. (2016). Antioxidant systems in chick embryo development. Part 1. Vitamin E, carotenoids and selenium. *Animal Nutrition 2*: 1-11.

Ursini, F., Heim, S., Keiss, M., Maiorino, M., Roveri, A., Wissing, J. et al. (1999). Dual function of the selenoprotein PHGPx during sperm maturation. *Science 285*: 1393–1396.