Review Article **Asian J Agri Biol, 2016, 4(4): 134-139.**

REVIEW ON EFFECTS OF DIETARY POLY UNSATURATED FATTY ACIDS ON SEMEN QUALITY OF BIRDS AND MAMMALS

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ABSTRACT

The use of poly unsaturated fatty acids has pronounced significant effects on the efficiency of male reproductive system. Poly unsaturated fatty acids like docosahexaenoic acid, omega 3, Omega 6, oleic and linolinic acid are rich in diets like flaxseed oil, soybean oil, fish oil, sunflower oil. These diets have the capability to increase serum testosterone level, fertility rate, ejaculation period, sperm motility, semen volume, sperms concentration and sexual behavior. Similarly, these fatty acids reduce the oxidative stress and maintain membrane integrity. In this review, some of the basic information regarding the importance of poly unsaturated fatty acids on semen quality parameters of male is summarized.

Keywords: poly unsaturated fatty acids, Semen quality

INTRODUCTION

Fatty acids are playing the significant roles in the maintenance of motility of sperm, membrane integrity of membrane as well as protection of sperm against the cold shock (Robinson et al., 2006). Linseed oil has the quality of feeding oil and commonly used in the diet of human and animals. This oil is known as the full source of alpha linolinic acid as rather than the other polyunsaturated fatty acids (PUFA) (Vereshagin and Novitskaya, 1965). Diet supplementation with linseed oil has capability to make the suitable changes in the lipid contents of sperm as well as the improvement in live percentage of sperms (Steven et al., 2005; Pena et al., 2011). The omega -3 fatty acids are also present in the eyes and testes of animals (Salem et al., 2001). Turkey supplemented with omega-3 fatty acids has improved the viability of sperms (Zaniboni et al., 2006). Samadian et al. (2010) investigated the effect of omega-3 fatty acids from 3% fish oil in Zandi fat-tailed rams for 13 week. Mammalian spermatozoa are rich in large quantities of PUFA, which play an important role in the process of fertilization (Esmaeili et al., 2015). Keeping in view the rising demand of polyunsaturated fatty acids in semen, efforts were made to collect the all information of fatty acids in this review.

Mechanism of Polyunsaturated Fatty acids

Libido, volume, motility, morphology and membrane integrity are considered as the major attributes of male reproductive system in semen evaluation. The level of testosterone plays an important role in the control of sexual behavior in male. The improvement in libido may be due to higher production of testosterone. The precursor of testosterone is cholesterol and flax seed are the major source of cholesterol (Needleman et al., 1986). The volume of semen is the result of secretion of accessory sex glands and increase in volume of semen may be due to antioxidants properties of flax seed. The motile sperms have the abilities to reach at site of fertilization. The supplementation of flax seed increases the fatty acids composition of sperms which results in the increase in motility of sperms (Mourvaki et al., 2009). The functional integrity is considered as the prerequisite for the fertilization of sperms and increase in this property may be due to fats (Adeel et al., 2009). Gholami et al. (2010) reported that the feeding with higher amount of polyunsaturated fatty acids affect the quality of fresh and frozen semen. Progressive motility, average motility and membrane integrity was improved at 9th week of feeding in fresh and cryopreserved semen. However, volume of semen and concentration of sperm was not altered. Docosatetraenoic has a parallel effect on motility % of sperm and fertility characteristics in chicken and the supplementation of linseed oil has positively increased the omega-3 fatty acids in sperm, thus increasing the quality of semen in term of volume of semen and concentration of sperms (Cerolinia et al., 2003). Study on the human

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showed that the supplementation of feed with docosahexaenoic acid (DHA) for three month in three different groups getting 0 mg/day, 400 mg per day and 800 mg showed an increase motility of sperm, increased level Docosahexaenoic acid omega -3 fatty acids in semen in both treated groups (Conquer et al., 2000). Use of omega-6 and omega-3 fatty acids revealed that higher amount of poly unsaturated fatty acids in the sperms are required for normal membrane functional integrity, progressive motility, reduction in ROS and promotion of fertility in male (Wathes et al., 2007).The effects of different PUFA on semen of various species are summarized in Table - I.

Table – I: The effects of different PUFA on semen of Birds and Mammals

Species	Dose	Findings	Reference
Sprague Dawley male rats	omega-3 and omega-6 fatty acids with 7% flaxseed and soybean oil	Omega-3 fatty acids showed a remarked increase in the levels of reproductive hormones (GnRH, FSH, LH and Testosterone). The volume of semen, motility and density of sperm were improved. Likewise, abnormalities in neck and head of sperm were significantly reduced.	Yan et al. (2013)
Cockerels	omega-3and omega-6	Increase in volume of semen and motility %	Zanini et al. (2003)
Japanese quail (*Coturnixcoturnix japonica)*	different dietary oils (sunflower oil, flax oil, corn oil, or fish oil)for 12 weeks	Best results in all aspects were present in the improvement of semen volume, count of sperm, viability and sperm morphology.	Al-Daraji et al. (2010)
Boars	15% dietary flaxseed with omega -3 fatty acids for 63 days	Reduction in motility and tail abnormalities while increased volume of ejaculate.	Mary et al. (2010)
Turkey male	fish oil with omega-3 PUAs	Enhanced the reproductive performance in term of increased hatchability rate, viability of embryo and fertility abilities.	Blesbois et al. (2004)
Boars	Polyunsaturated fatty acids n-3	Increase in morphology and osmotic resistance of sperm with no harmful effects on health of animals.	Yeste et al. (2011)
Equine	Docosahexaenoic acid (DHA) @ 250g/day	Mean count of sperm in semen of horses feeding of DHA was 1.8 times more. Similarly, semen preserved for one day showed an increased velocity, (P = 0.03), progressive motility and reduction of sperm abnormalities in fresh and cryopreserved semen.	(Steven et al., 2005)
Rams	Dietary oliec and linoleic acid showed	The sperm motility, live and acrosomal integrity after 6 weeks of experiment wasimproved.	Graaf et al. (2007)
Rams	Dietary omega-e using fish oil to rams for a period of 9 weeks.	There was significant rise in count of sperm with no sperm motility and volume of semen.	Fair et al. (2014)

Rams	Fatty acids omega-3 and omega-6 fatty acids with dose of 35 g per ram/day.	The results were in the form of increase in total sperm motility and progressive motility. Level of testosterone was also elevated.	Esmaeili et al. (2012)
Bulls	Flax oil with dose of450g with alpha linolinicacid per day.	Motility percentage and progressive motility increased in both supplemented groups however after thawing motility percentage was higher in flax oil supplemented group.	Moallem et al. (2015)
Boars	0.3kg daily diet having31% omega -3 fatty acidsfor 16 weeks	Sperm concentration and sexual behavior of treated boars was also improved. The volume of semen was also enhanced period of ejaculation was also increased in experimental group.	Estienne et al. (2008)
Rams	diet supplemented with 2.5% fish oil3	Rams supplemented with fish oil had higher functional integrity and sperm acrosomal integrity. Similarly, semen volume, sperm motility, and progressively motility were improved.	Jafaroghli et al. (2014)
Sprague-Dawley rats	10% flaxseed for whole life	Increased weight of reproductive organs and high blood testosterone level.	Janet et al. (2008)
Cockerels	Feed with diet containing 6% soya bean oil and 6% linseed oil	Increased in fertility rate	Kelso et al. (1997).
Boar	2.9% shark liver oil	Increased in semen quality parameters.	(Mitrea et al., 2004)

It is evident from Table 1 that dietary feeding of polyunsaturated in the forms of various feeds has beneficial effects on male reproductive system. The polyunsaturated increases the male reproductive hormone especially testosterone. The testosterone controls sexual desire as well the normal spermatogenesis in male. The alpha linolenic acid is converted into cholesterol which ultimately is converted testosterone as shown in figure 1.

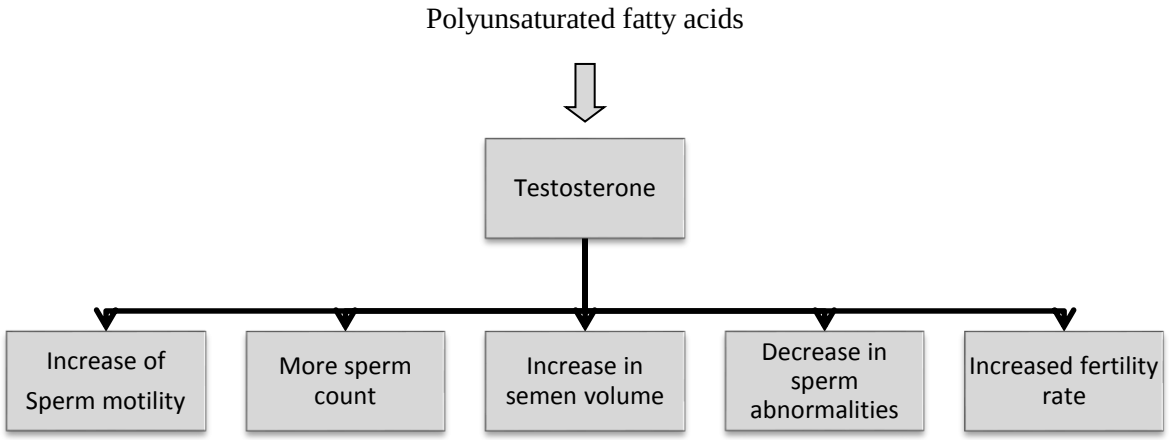

Fig – 1: Effects of Polyunsaturated Fatty Acids on Male Reproductive System

The use of fats in stress scavenges the harmful effects. Linseed oil played an important role in the improvement of reproductive performance of rams through the reduction of heat stress (Baiomy and Mottelib, 2009). The use of alfa linolenic acid present in the flaxseed oil increases the intake of omega-3 fatty acids which play an important role in the improvement of sperm motility (Comhaire and Mahmoud, 2003). Castellano et al. (2010) investigated that use of supplementation of omega-3 fatty acids (poly unsaturated) on cryopreservation of boar semen. Semen Quality parameters like sperm motility, viability, lipid peroxidation, sperm acrosomal integrity and DNA integrity were improved. Poly unsaturated fatty acids, mainly arachidonicacid increased motility percentage of boar sperm and acrosomal reaction (Hossain et al., 2007). Mourvaki et al. (2009) found that 5% flax seed supplementation to New Zealand White rabbits of 8 months age had positive effect on fatty acid profile of entire sperm in treated group (corn oil). Increased lipids concentration in the semen played a major role in motility of sperm, protection of sperm from cold shock and enhanced membrane functional integrity of sperm. Bongalhardo et al. (2009) compared effects of flaxseed diet with different oils (corn oil, fish oil) on the semen quality and membranes of semen using White Leghorn rooster. 26-30 weeks. A positive correlation was present between flaxseed feeding and other quality parameters of semen. Lausigk et al. (2014) conducted a study on Stallions to reduce the seasonal adverse effect on semen by the use of fatty acids. Animals were provided with 100 ml linseed oil and antioxidants. Semen was collected and processed for freezing. The control group showed a reduction in the motility percentage and membrane integrity in liquid semen during February as compared to November. Similar trend was seen in frozen semen of control group.

CONCLUSION

It is concluded from this review that the use of polyunsturtaed fatty acids have the beneficial effects on the semen quality and use of fats clears the oxidative stress conditions. It is recommended that fats should be used in the feed of dairy animals to improve their semen quality

CONFLICT OF INTEREST

Both authors have no conflict for the publication of this article**.**

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