

Effect of Dietary Selenium Supplementation on Morphology and Antioxidant Status in Testes of Goat

Iqra Bano^{1,*}, M. Malhi², S.A. Soomro², Safia Kandhro³, Muhammad Awais², Seema Baloch², Saba Perveen² and Hira Sajjad⁴

¹Department Veterinary Physiology and Biochemistry Shaheed Benazir Bhutto University of Veterinary & Animal Sciences Sakrand, Pakistan

²Department Veterinary Physiology and Biochemistry Sindh Agriculture University Tandojam, Pakistan

³Department of Veterinary Pharmacology Baqai College of veterinary medicine Karachi, Pakistan

⁴Key Laboratory of Agricultural Animal Genetics, Breeding, and Reproduction, Education Ministry of China, Huazhong Agricultural University, Wuhan, Hubei 430070, People's Republic of China

Abstract: The fitness of animal has an enormous influence on its reproductive capability, nowadays feeding of microelements is practiced in many feed formulations because micro-nutrient possesses strong influence on animal's reproductive ability. The male generative zone produces spermatozoa which needs a little number of free radicals for the maturation as well as for smooth fertilization. Whereas the raised level of these free radicals disturbs the entire process of sperm formation and also lead to infertility. The Selenium is a micro nutrient which naturally possess some enzymes and selenoproteins which diminish manufacture of unnecessary free radicals by acting as an antioxidant. Subsequently, it protects male gamete from destruction triggered by oxidative stress. Selenium also assistance in maintenance of semen quality by declining construction of atypical spermatozoa. Additionally, some studies have revealed that it possesses striking influence on both gross and histological characteristics of male reproductive organ, feeding this mineral improved circumference, size, the mass of the testis and speed up sperm construction by means of having a solid effect on seminiferous tubules histology. Hence, selenium shortage can cause infertility and further reproductive syndromes.

Keywords: Male reproduction, selenium, Oxidative stress, Antioxidant.

INTRODUCTION

The livestock nowadays frequently suffers from the nutritional deficiencies due to a deficient feeding of minerals and getting the high yield of products from them including meat, milk and other by-products. Generally, the minerals can be divided into macro and micro minerals due to their various properties. The micro minerals are essential components of the livestock's ration. They are required in very little amount and their extra feeding leads to toxicity. The important micro minerals include Se, cobalt, copper, iodine, manganese and zinc generally. According to previous studies the lack of minerals especially, micro minerals results in poor reproductive performance [1]. The trace minerals are also involved in various other biological systems, for instance, some of them act as enzyme cofactors and metallic enzymes. Generally, they act as activators of those enzymes, which take part in the detoxification of intracellular free radicals. Some of these minerals are also chief components of some hormones and therefore are directly regulating

the endocrine system and metabolism. Due to this reason, any alteration in their level may modify the creation of conceptual and other different hormones involved in the maintenance of animal reproduction. In male animals, it might change spermatogenesis and decrease sexual desire. Moreover, majority of the non-conventional diet are insufficient in smaller scale minerals and are probably going to highlight conceptive issues [2]. The Se is the 34th element in the periodic table and a common trace mineral found on earth crust. Its properties resemble with sulfur and tellurium element. Originally it was discovered by Martin Heinrich Klaproth, a German scientist, but was mistakenly identified as tellurium. Since 1818 Jon Jacob, a Swedish chemist discovered it and named it "selenium" for word Selene the Greek goddess of the moon [3]. The Se plays a fundamental task for maintenance of many functions of the body. It has been recommended by some researchers that this element plays an important role in the persistence of fertility in males. The Se also applies various activities upon the cancer prevention agents named as antioxidants [4], key factor of immune system [5-6], acts as regenerative agent, have implications of endocrine system of animal body [2].

*Address correspondence to this author at the Department Veterinary Physiology and Biochemistry Shaheed Benazir Bhutto University of Veterinary & Animal Sciences Sakrand, Pakistan;
E-mail: iqrashafi05@yahoo.com

SELENIUM ABSORPTION, DISTRIBUTION, AND METABOLIC FATE

In nature, Se is present in both organic and inorganic forms the main organic formulae are selenomethionine (Semet) and selenocysteine (Secys). The inorganic forms include selenite, selenite, selenide and the Se element. The fundamental Se supplement that has been utilized as a part of the animal's ration is inorganic form. Though the absorption of inorganic form is lesser as compared to the organic form in ruminant animals [7]. An outline of the metabolism of Se is described in Figure 1. The absorption of Se arises in the small intestine, where both organic as well as inorganic forms of this mineral are absorbed. The selenite is inertly absorbed via the gut barrier, whereas selenate seems to be transported through the sodium-facilitated transporter mechanism merged with sulfur [8]. The organic forms of Se are vigorously distributed. Generally, the Se is spread all over the body by the liver in the direction of the brain, kidneys, pancreas and testes. The upper most Se amounts are found in the kidneys and liver mostly, although the highest total concentration arises in muscle for the reason of their increased proportion present within the body of an animal [9]. The Se is transported within blood by means of selenoprotein (SePs), which are SePP1 in addition to the extracellular glutathione peroxidase [10]. The SePP1 comprises approximately 50% of Se circulating within the blood. Additionally, it has been discovered, that diet supplemented with Se-yeast augmented the Semet concentration within the blood in a dosage dependent method although the Secys

amount persisted constant [11]. These variations in circulating selenised amino acids can imitate capacity of the selenoenzyme besides a transformation from the combination of Se into purposeful SePs to the nonspecific combination of Semet into hepatic tissue protein. Ensuing protein turnover, the free Se can be recycled via the enterohepatic passage or else can be expelled from the body by means of urine and feces [12]. Generally, the metabolism and absorption of inorganic Se are similar to that of other micro minerals, whereas metabolism of organic Se is similar to amino acid metabolism. Moreover, the absorption of inorganic Se is faster than organic form [13].

THE SELENOPROTEIN

The selenoproteins (SePs) are the proteins which are comprising of the 21 amino acids in their structures (Stillwell *et al.*, 2005). They were discovered in 1973 at the University of Wisconsin, by a researcher named Hoekstra along with his colleagues. They recognized the existence of Se inside GPx as the first animal SePs [14]. Generally, the proteins which are inherently planned and accomplish crucial biological jobs are regarded as SePs [15]. Some of them are enzymes, for example, the thioredoxin reductases, deiodinases and antioxidant GPx are elaborate for thyroid secretion by means of catalyzing the initiation besides deactivation of the thyroid hormones [16]. The Secys is obtained via the animal tissues generally and Semet is obtained by plants, algae, bacteria and yeast. They both are sources of Se and are appropriate for the creation of SePs [17]. Furthermore, the Secys is combined with

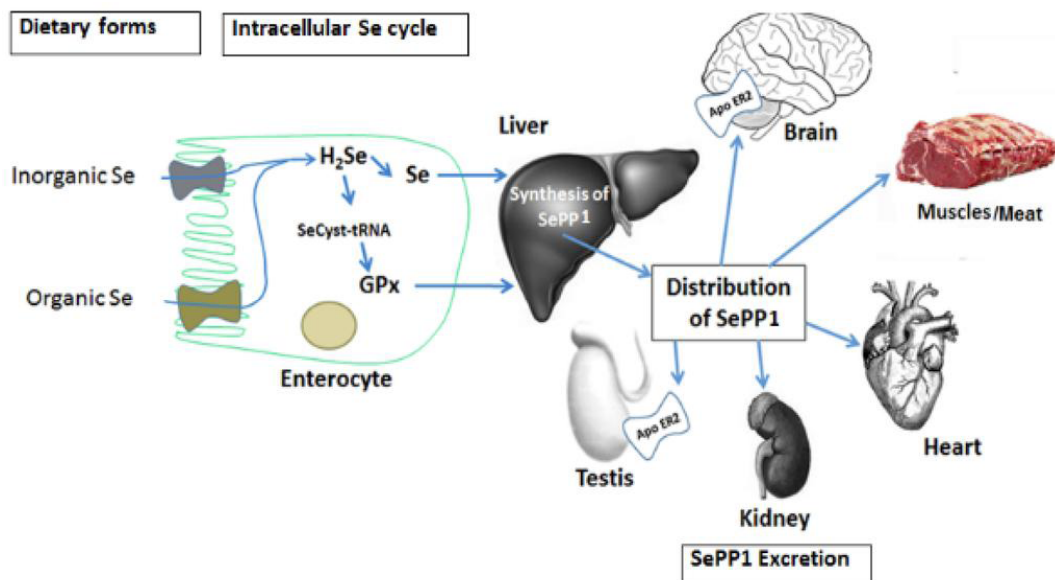


Figure 1: The General pathways of Se absorption, hepatic synthesis of SePP1 and distribution to various organs [40].

selenium-comprising proteins, ensuing the command of certain codon intended for Secys residue. The guideline of SeP synthesis is crucial to considerate Se equilibrium and disorders resulting in the letdown of the homeostasis [18]. The SePP1P is a plentiful glycoprotein which resides extracellularly and is rich in Secys. It is regarded as a leading SePs in the blood plasma quantitatively, and has both cell reinforcement and transportation functions [10]. It also takes part in the transportation of Se between the liver and other organs. Generally, the SePs can influence at best three wide ranges of cell biochemistry, precisely melanoma inhibition, thyroid hormone regulation and maintenance of redox status of organelles. The Se-containing amino acids methionine are known as Semet, just like methionine the Semet is also not created in the animal body, therefore it is obtained from plant sources while the Secys is synthesized inside the animal body. Since in Semet the Se is covalently bound to two carbon atoms, therefore, it is noticeably less reactive than Secys [18]. Some SePs and their functions are defined in Table 1.

THE REPRODUCTIVE SYSTEM OF BUCK

The reproductive system of buck is comprising of a network of outlying and inner organs that function to create, nourish and transport the worthwhile sperm needed for the continuation of reproduction. Initially, the male sex organs are designed beneath the encouragement of hormone known as testosterone released from the testes of the fetus. On reaching puberty, the secondary sexual characteristics develop and the sexual organs become mature and fully functional. The male gamete is known as sperm, which is created within the testes and is transported by means of ducts known as the epididymis, ductus deferens, and the ejaculatory duct, besides urethra. Concomitantly the prostate gland, bulbourethral gland, and seminal vesicles create the seminal fluid that

nourishes the spermatozoa when it is discharged by the penis throughout ejaculation and during the fertilization procedure [19].

ANATOMY OF TESTES OF BUCK

The testes of buck can be divided into nearly 400 sections named lobules each of which is filled by SFT, which are incharge for manufacturing spermatozoa. The testicles of buck are nearly 10 cm long in diameter having about 250 g to 300 g weight when fully matured [20]. Structurally the testicles of buck are encircled by three protective sheaths the outermost casing is known as the tunica vaginalis, which is being extended from the peritoneum. The middle portion is occupied by a thin white covering named as tunica albuginea, which is composed of flexible connective tissue and is somewhat thicker in nature than tunica vaginalis. The deepest layer is termed as tunica vasculosa which is comprising of huge amount of blood vessels. The capsule of testis has been originated to react, by retrenchment, to numerous electrical and biochemical responses. The bulk of capsule is comprising of tunica albuginea, and is consisting of collagen fibers, elastic fibers in addition to abundant fibroblasts are also present [21].

SPERMATOGENESIS AND ITS VARIOUS STAGES

The entire practice of sperm creation is usually regulated through a complex web of the signals including paracrine, endocrine and the autocrine signals. Under the influence of the hypothalamic gonadotropin liberating hormone, the hypophyseal gland also known as pituitary gland releases some hormones including the LH besides FSH which are tangled in the maintenance of sperm formation. The LH regulates the testosterone release from somatic leydig cells positioned within SFT. While the FSH acts on sertoli cells, which are regarded as somatic cells inside the SFT, via gene expression, exciting signaling,

Table 1: The Selenoproteins, their Location, and Impact on Male Reproduction [40]

Name	Location	Function
Cytosolic GPx4	Testis; epididymal epithelium	Antioxidant
Secreted enzyme (GPx)	Epididymal lumen	H ₂ O ₂ scavenger
nucleus GPx4	Sperm nucleus	Compression of chromatin throughout sperm formation
Mitochondrial GPx4	Mitochondrial capsule at midpiece	Antioxidative, mechanical constituent of established spermatozoa
Plasma Selenoprotein P	Blood	Transportation of Se in the direction of testis.

besides the emission of some proteins and additional signaling particles. The process of spermatogenesis is a quite ordered method through which standard diploid cells are converted into sperm inside the SFT. It can be divided into three discrete stages which comprise the propagation of diploid cells known as spermatogonia, the meiotic division of spermatocytes into haploid celled structures known as spermatids, in addition to the differentiation of spermatids all through spermiogenesis. The spherical spermatids are segregated into extended spermatozoa having a midpiece and a tail at the concluding stage of the spermiogenesis.

As a consequence of widespread chromatin renovation throughout spermiogenesis, the spermatozoa having an extremely reduced nucleus are designed [22]. Moreover, the Spermatozoa are unconfined within the SFT, the under developing spermatogonia and juvenile spermatocytes unite by the side of the basal sector of the seminiferous epithelium. Hence the SFT is regarded as the main site of the testes where sperm cell construction and ripening occurs. Additionally, when both mitosis and meiosis are completed the spermatids pass in spermiogenesis, which is a process in which sperm cell becomes mature and physically grown via acquiring some structures including tail, head and midpiece region. This physical growth generally occurs inside SFT while further maturation and storage take place within the epididymis region. Furthermore, the epididymis correspondingly creates the blood-epididymal barrier, in order to regulate and modify the luminal liquefied fillings. Diverse fluid contents within the caput epididymis, corpus epididymis besides the cauda epididymis modify the superficial layer of the sperm plasma casing into a completely ripened state and offers spermatozoa through motility as well as strength intended for fertilization as the immotile undeveloped spermatozoa transfers from the epididymis. Thus, it is recommended that the internal environment of the epididymis is vital for fruitful sperm development. Lastly, subsequently sequences of morphology fluctuations, developed spermatozoa are deposited in a dormant state. The seminal plasma is correspondingly very significant in sperm nourishment and function, counting initiation, the fortification of bacteria in addition to the grounding of spermatozoa designed for fertilization. Hence, the internal status of SFT, as well as epididymis, is predominantly significant in supporting spermatids to experience ripening effectively [23].

THE ROS AND OXIDATIVE STRESS

The ROS are extremely active oxidizing factors consisting of single or multiple unpaired types of an electron in their structure belonging to the set of free radicals. The ROS molecules have the capability for succession reactions, with the aim of "radical begets radical". As they are created as a consequence of cellular metabolism, therefore they are highly oxidizing agents in nature. Generally, the ROS represent a variety of radicals including nitric oxide (NO), hydroxyl ion (OH⁻), peroxy (RO₂), superoxide ion (O₂⁻) and the lipid peroxy (LOO), along with some non-radical molecules including, singlet oxygen (¹O₂), hypochloric acid (HOCL), lipid peroxide (LOOH), ozone (O₃) and hydrogen peroxide (H₂O₂) respectively [30]. The inner as well as external foundations of ROS are shown in Table 2. The superoxide (O₂⁻) is the one of the chief free radical created within living organizations throughout the usual respiration inside the mitochondria. It can deactivate various enzymes as a result of the establishment of uneven complexes with conversion prosthetic of some metallo enzymes tracked by oxidative autolysis of their active sites. The O₂⁻ can act as both oxidizing as well as reducing agent depending on conditions of cell. It is essential to remark that this free radical, by itself is not very hazardous and does not speedily cross fatty casing boundaries. Though, the O₂⁻ is a pioneer of some other, additional influential ROS. For instance, it responds with the nitric oxide and forms peroxynitrite (NO₃⁻), which is regarded as a potent oxidant compound. Because it causes construction of reactive by products due to unprompted disintegration. It is usually believed that the electron transport chain (ETC) inside the mitochondria is responsible for the creation of O₂⁻ in the body. The mitochondrial ETC mechanism utilised approximately 85% of all oxygen consumed by the cell, as the efficacy of ETC is not up to 100%, near 1-3% of electrons outflow from the ETC, this reduction of molecular oxygen leads in the construction of O₂⁻ particles [24].

The oxidative stress (OS) is a stage which shows an unevenness among the general existence of the ROS and imbalance in the natural mechanism of detoxification of oxidative compounds to repair consequential distortions. The OS leads to develop a range of pathologies which afflict the reproductive physiology. When oxidants like free radicals or non-radical groups attack on lipid possessing carbon-carbon double bond(s), particularly PUFAs that engage removal of hydrogen from a carbon, with oxygen addition leading the formation of lipid peroxy radicals

and hydroperoxides the entire procedure is named as lipid peroxidation reaction. The chemicals which induce oxidative stress are known as pro-oxidants. They generate this condition either by promoting the construction of free radicals or by prohibiting antioxidant system. The greatest significant impacts of ROS up on the cellular metabolic activity is because of their contribution in lipid peroxidation feedbacks (LPO). The initial phase of this reaction is known as the initiation stage, in which a fatty acid radical is formed. The greatest prominent initiators within living organisms are hydroxyl radical (OH) and hydroperoxyl radical (HO₂) which combine with the hydrogen particle to synthesize a fatty acid radical and water. The next step is named as propagation phase of LPO. The newly formed fatty acid radical is not an extremely steady particle, therefore it responds willingly by existing molecular oxygen, by this means producing a peroxy-fatty acid particle. It is also an unstable particle that act upon alternative free fatty acid, manufacturing a diverse fatty acid radical besides a molecule of lipid peroxide. Consequently, the sequence continues, as the innovative fatty acid radical responds in the similar manner. The final step of chain reaction is termination stage. These radical responses stop as soon as two radicals react result in production of a non-radical particle. This occurs only when a number of radical species is quite plentiful to designate a high likelihood of collision between two radicals. The Living creatures have dissimilar particles that boost termination process by offsetting the free radicals consequently, shielding the cell sheath acting as an antioxidant. Thus, the lipid peroxidation is a chain reaction so its huge quantity of cycles could lead considerable destruction to cells [25].

Table 2: Internal and External Foundations of ROS [7]

Internal sources	External sources
Phagocytes	Radiation
Mitochondria (ETC)	UV light
Peroxisomes	Chemical reagents
Inflammation	Pollution

THE ANTIOXIDANTS

The antioxidants are the compounds which stopover the synthesis of ROS molecules or resist their activities. The antioxidants can be classified into two classes which are the enzymatic and non-enzymatic antioxidants. These both types of antioxidants are present in the male reproductive organ. The Enzymatic

antioxidant comprises the glutathione peroxidase (GSH-Px), catalase, superoxide dismutase (SOD), and peroxidase that eliminate ROS from biological structures catalytically. The seminal antioxidant movement is correspondingly accompanied via some non-enzymatic antioxidants within semen. They are generally existing by means of beta-carotenes, vitamin E, vitamin C, carotenoids besides some proteins like the myoglobin, albumin, and ferritin. In a healthy body, the concentration of pro-oxidants compounds and antioxidants compounds remains in equilibrium. The sperm cells are outfitted by the antioxidant protection mechanisms and are prone to reduce ROS, in this manner shielding gonadal cells and protect spermatozoa from oxidative damage. Conversely, under pathological states the abandoned creation of ROS exceeds the antioxidant potential of the semen resulting to the oxidative stress [26].

ANTIOXIDANTS OF MALE REPRODUCTIVE TRACT

The GSH-Px besides Glutathione reductase (GR) are the chief reducing mediators in the living cells and is regarded as hunting antioxidants in male reproductive tract especially at the region of epididymis and testicles. Their alteration of the spermatozoa sheath consults fortification on the lipid ingredients, consequently protecting the motility and viability of sperms [27]. The earlier studies performed *in vitro* have revealed that Gpx conserves the tail-beat consistency, decreases LPO, and progresses the sperm casing characteristics. Typically, reduced GSH concentrations within cells are connected with amplified LPO. Additionally, in pathological situations, this enzyme prevents the shortage of vitamin E and proteins and acts a significant part of cell signaling modulator. The animals and human are able to synthesize GPx. The GPx is the regarded as most plentiful non-protein thiol in mammalian cells playing a crucial role in numerous biological procedures including cell growth and proliferation, xenobiotic metabolism, immune regulation, and the transport of amino acids. Another important antioxidant is SOD which strolls both extracellular as well as intracellular superoxide anion and prohibits LPO of the plasma casing [26]. The SOD enzyme was discovered by a scientist named McCord and Fridovich in 1969. Right now, three different isoforms of SOD have been recognized in animals, and their genomic assembly besides proteins have been defined. The first SOD enzyme to be discovered was SOD1 also known as Cu-SOD, which is comprising of copper (Cu) and zinc (Zn) homodimer that is originated nearly entirely in intracellular spaces of cytoplasm.

Another enzyme of SOD class is SOD2 which possess the manganese (Mn) by means of cofactor and thus called Mn-SOD. It is inducible in nature and its actions are induced via cytokines in addition to OS [27]. The third member of SOD enzyme is known as extracellular superoxide dismutase (EC-SOD), as it is entirely present outside of cell. The EC-SOD is a glycoprotein molecule possessing high affinity for heparin. It comprises one Cu and one Zn atom for each subunit, which are compulsory for the activity of this enzyme. As the O_2^- is the key free radical created during biological circumstances inside the living structures action of the SOD is regarded to be the chief component of the primary state of antioxidant protection within the cell. It dismutates the existing superoxide radical within cell by performing its actions. In sequence to proceed in opposition to H_2O_2 , it has got to be conjugated with catalase or GPx [28].

THE SOURCES OF ROS IN MALE REPRODUCTIVE TRACT

The white blood cells, mainly neutrophils, and macrophages, have been related to extreme free radical construction, and they eventually cause sperm abnormalities. An additional significant cause of free radical is immature and morphologically dysfunctional spermatozoa. The creation of free radicals in sperm cell can take place by two methods (i) They are generally produced during nicotinamide adenine dinucleotide phosphate oxidase method which occurs within outer plasma covering of sperm. (ii) They are produced during nicotinamide adenine dinucleotide-dependent oxido reductase reaction which occurs at the mitochondrial level. The second method appears to be the major source of ROS production. As the sperms require a continuous availability of energy for motility so they are rich in the mitochondria. For that reason, the existence of abnormal spermatozoa in the seminal fluid can considerably promote the creation of free radical, which in order affects the function of mitochondria along with sperm motility [27].

THE SE AS SPERM ANTIOXIDANT AGENT

The selenium as a sperm antioxidant protects its motility and fertility. As it contains GPx1 which was first identified SePs. The other selenoenzyme with sturdy antioxidative actions are GPx, GPx1 GPx3, GPx4, GPx5, and GPx6. These all enzymes of Gpx family take part in protecting cells against oxidative demolition from ROS as well as from reactive nitrogen species. which are comprised of O_2^- , H_2O_2 , OH^- , NO and per-

oxy-nitrite. The machinery via which Se employs its valuable properties upon health are due to presence of SePs in their structure. As the Secys are used for the creation of various selenoenzyme such as the iodothyronine deiodinases, which generally regulates the thyroid hormone action besides thioredoxin reductases which has impacts on regenerating the antioxidant schemes [29]. Among these, all SePs, the most studied SePs family is GPx and is concerned in the maintenance of oxidative activities and cell casing safety. Additionally, it was suggested that the Gpx and GPx1 prevent apoptosis induced by OS. Correspondingly, the Se substitutes sulphur in methionine to synthesise the Semet, which can combine non-specifically with proteins. Moreover, both antioxidant and antitumor activities have been stated for Se comprising compounds [4] Thus, minute or optimal grades of Se consumption were related with an extensive variety diseases like numerous forms of cancer and heart diseases [29]. Furthermore, the Se as Gpx is existing in spermatids and creates the organizational fragment in the mid piece of developed spermatozoa. For that reason, deficiency of Se can show the way to the variety of physiological disorders in animals [3].

THE SE AND SPERMATOGENESIS

The presence of enough Se, within the male reproductive region is necessary for the usual sperm cell formation as well as Se has a vital position in the maturation of mammalian spermatozoa. Decreased or higher range of Se is directly related to the growth of sperm. While semen value and fertility depend on the maturation of spermatozoa, any disruption during this method possibly will direct to decreased quality of semen as well as infertility in males. The task of Se in sperm creation by means of X-ray fluorescence microscopy (XFM) technique was observed. It was reported that selenoprotein P within the blood plasma is responsible in favor of carrying the Se from the blood stream in the direction of the testis [30]. The Se conveyed toward testis is used for making of SePs within both tests as well as inside epididymis. An enzyme called GPx5 is present within the epididymal lumen. While some studies showed that within the lumen of epididymis duct, GPx5 and GPx3 moves beside spermatozoa throughout the epididymis, as protector from ROS all through the growth progression. Therefore, the Se as an element of SePs besides selenoenzyme is concerned in the sperm synthesis via defending spermatozoa from free radical damage. In order to evaluate the impact of Se on semen in 2009 a

research was conducted which revealed that the organic Se improved semen quality in rams via rising semen amount for every ejaculate, spermatozoa motility skills and its concentration in addition to reducing the percentage of dead spermatozoa, along with acrosome injury [31].

EFFECTS OF SE ON GROSS MORPHOLOGY OF TESTIS

The Se is acknowledged to manipulate both gross as well as the histomorphology of the testis. The development and maturity of the testicular organs in various species of farm animals has been well recognized. Furthermore, the morphometric investigation of the testis of several breeds is essential to assess and estimate the qualitative variations in testicular machinery and spermatogenic functions. The utilization of male with superior testicular development and consequently with high fecundation capability is significant to ensure the good reproductive competence of the flock. Moreover, the increase in the size of the testes may result in better fertility [32]. The size of testes has significantly interrelated with some hormones, including the FSH, LH, and the testosterone concentrations in the body. Though the testicular size may show variations with time, age and breed. There is a positive correlation between testicular weight, diameter, length and epididymis and length. The parental age, size, and body weight always affect the growth of testis. The measurements of right and left testes showed no significant difference. The testicular volume is connected to a variety of reproductive endocrine factors [33]. Additionally, it was observed that the heavier testis creates more sperm cells as compared to smaller testes acknowledged that the testes which possess a larger quantity of sustentocytes were heavy weighted and created extra spermatozoa when compared to testes with fewer sustentocytes [32].

The sodium selenate at 0.1 ppm of dry matter in the diet of rams has been reported to raise scrotal length and circumference. Furthermore, it was observed that the male progeny of mice consuming little grades of dietary Se (2–7g/kg in feed) revealed late testicular enlargement and maturation [34]. Conversely, this outcome was minute in contrast with that in the second and third progeny in which Se shortage affected the morphology of testes to a greater degree. While in the fourth generation, testis size being a minor quantity than partially of offspring of those mice consuming adequate Se (250–300 g / kg sodium selenite), and testis were observed to be bilaterally shrunken lacking

mitotic action in spermatogonia [35]. Moreover, the actual concentration of Se in the tissue of male reproductive organ is yet unknown stated, but it is recommended that testis contains the highest concentration of Se. Yet it has been suggested that various supplementation of dietary Se either in organic or inorganic form result in an extensive intensification in tissue concentration. Selenoproteins transport Se to various parts, particularly to testis and brain, The Se centralization in testis is among highest in tissues of the adult rat when related to the dry mass of organ. In addition, the Se shortage was connected with a major decrease in testicular weight in rats, impairing reproductive performance [36].

SELENIUM AND HISTOMORPHOLOGY OF MALE GONADS

The elemental nano-Se has been reported to have an influence on the structural architecture of the testes within male goats. The spermatozoa of boars utilized Se deficient diet showed abnormalities in their midpiece, plasma membrane, tail and in mitochondrial gaps [37]. Conversely, Se deficiency has been revealed to result in bilateral atrophy of the testes of rats. A study in broiler rooster breeder showed Se at 0.2 mg/kg in the feed as sodium selenite or Sel-Plex (Alltech Inc., USA) to be a chief aspect in male sexual maturation. The roosters fed Se produced semen at the 19th week of consumption, whereas those fed a non-supplemented diet produced semen at the 26th week of the experiment. The roosters fed organic Se (Sel-Plex) has showed a definite hierarchy of spermatogenic cells exhibiting the spermatogonia, spermatocytes, spermatids, and spermatozoa. Additionally, some studies revealed that due to Se deficiency the diameter of the SFT was condensed, sheathed by sertoli cells or a small number of amount of stem cells, in the company of osseous metaplasia, and partial or compact spermatogenic action was experiential [38]. According to a research, it was concluded that introduction of 0.2 mg/kg Se enhanced sperm parameters within mice as compared to the control group consequently, it gave the impression that Se element can undoubtedly progress testicular job besides sperm value. A study was conducted in 2011 on effects of high-fat diet and organic Se supplementation on histological appearance and hormonal levels of the murine testis. The result showed that high-fat diet decreased serum testosterone levels and cause damage to SFT along with atrophy of muscles. While the Se-enriched diet improved the adverse impacts of hyperlipidemia via

decreasing testicular muscle damage, improving levels of serum testosterone, besides improving sperm indexes [39].

CONCLUSIONS

The mammalian reproductive organs need a continuous conveyance of certain minerals and Selenium is one of them. The Selenium has a solid effect on male generative system via fighting against the creation of extreme ROS. In addition, the morphology of male gonads strongly rest on on the satisfactory dietary stock of Se in both inorganic or organic forms in ration of livestock. The rations or feed stuffs excessive or undersupplied in Se disturb the gross along with the histological morphology of the gonads. The selenoproteins inside testis take part in spermatogenesis and lack or additional dietary Se result in poor semen characteristics ultimately causing infertility.

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