Int J Pharm Bio Sci 2013 Oct; 4(4): (B) 1 - 15

Review Article **Bio sciences**

International Journal of Pharma and Bio Sciences **ISSN 0975-6299**

A SYSTEMATIC REVIEW OF SELENIUM AND ITS ROLE IN HUMAN REPRODUCTIVE SYSTEM

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ABSTRACT

Selenium (Se) is considered to be one of the most controversial trace elements. Se deficiency is a global health problem related to an increased susceptibility to various diseases of animals and humans particularly male infertility. This review covers particularly the current knowledge of selenium in the reproductive system. Nowadays, infertility is one of the most stressful conditions amongst married couples. Male factor infertility is implicated in almost half of these cases. Recent advances in the field of reproductive medicine have focused the role of selenium concentration in relation with male fertility. The main aim of the present review was to provide further data on the distribution of this metal throughout the human male reproductive tract.

KEYWORDS: **Antioxidant, Reproductive system, Selenium, Toxicity**

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INTRODUCTION

HISTORICAL BACKROUND

In 1818 the Swedish chemist Jons Jacob Berzelius discovered selenium when investigating the chemicals responsible for outbreaks of ill health among workers in a Swedish sulphuric acid plant (1). He named it Selene after the Greek goddess of the moon. One hundred and forty years later, Schwarz and Foltz identified selenium as essential to animal health when they discovered that trace amounts protected against liver necrosis in vitamin E deficient rats (2). Interest in the role of selenium in human health gathered momentum in the late 1960's, and investigations looked for human diseases similar to those of Se-responsive animal disorders (3).Although selenium was identified as essential to human nutrition 42 years ago, a universal marker of daily requirement remains elusive. In 1957, Klaus Schwarz with Foltz (4) proved that selenium is an essential nutrient necessary for both normal growth and reproduction in animals. Using biochemical procedures, the first selenium-containing enzyme, glutathione peroxidase-1 (GPX1), was discovered in 1973 (5). Dietary importance of selenium dates back in history when it was first reported to cause the toxic symptoms in the members of the caravan of the great adventurer, Marco Polo. Livestock disorder, commonly referred as alkali disease or blind stagger, was found endemic in areas with selenium rich soils. Similarly, symptoms of chronic selenium intoxication, depression and fatigue, and loss of hair and nails, were noticed in human beings living geographic in regions with high soil selenium before it was known to be the causative agent. That is why early scientists showed interest in selenium because of its toxic effects. However, the approach towards selenium research in life sciences began to change as early as 1916 when selenium was detected in normal human tissue samples. It was suggested “it may have a position in the organism which will without doubt be of the utmost significance in the study of life processes” (6)

WHAT IS SELENIUM

Selenium is a trace mineral with important structural and enzymatic roles, found in minute quantities within the body. In the last century, interest in selenium and health was focused primarily on the potentially toxic effects of high intakes in humans, stimulated by reports of alkali disease in livestock raised in seleniferous areas (7). Selenium is a group VI element and has both metallic and non metallic properties. It has an atomic weight of 78.96. It can exist in four oxidation states (-2, 1, +2, +6) and forms chemical compounds analogous to those of sulphur. The salts of selenous acid (H_2SeO_3) and selenic acid (H_2SeO_4) are selenites (Se^{4+}) and selenates (Se^{6+}) respectively. The essentiality of selenium was demonstrated in the mid-1950s (8), when rats fed a highly purified casein diet developed a fatal liver disease, which was prevented by certain foods, including brewer’s yeast; selenium was identified as the active ingredient (9). In recent years, there has been growing interest in selenium in relation to Keshan disease (an endemic cardiomyopathy), infertility, and also possible protective effects against cancer and other chronic diseases. There is a relatively narrow margin between selenium intakes that result in deficiency or toxicity, with health effects being related to level of exposure and selenium status.

ROLE OF SELENIUM

Selenium is an essential component of selenoproteins playing an important role in many biological functions, such as antioxidant defense, formation of thyroid hormones, DNA synthesis, fertility and reproduction. Selenium can be converted into various metabolites in the organism. Some, like methylselenol, play a role in cancer prevention. Selenium has also a role, besides vitamin E, in muscle function by improving endurance and recovery and slowing the ageing process [10, 11].For human body selenium is essential element playing important role in body antioxidant system; it is considered individual antioxidant that can cooperate with

other antioxidants, such as C and E vitamins and in processes protecting the cells from free radicals. In such manner selenium protects the body from development of cancer, cardiovascular diseases and masculine sterility [12]. Selenium participates in thyroid hormone metabolism, immune system, inhibits virulence, and slows down the development of AIDS through reducing the speed of HIV development. Furthermore, it can reduce the risk of spontaneous abortions as well [13]. Balanced content of selenium in human food helps in the case of complications connected with diabetes and affects also the prevention of asthma. Through free radicals inhibition, selenium moderates harmful effects of radiation [14]. Selenium is important for proper function of cerebral neurotransmitters and reduces epileptic waves in children. Selenium deficiency is connected with acceleration of senility and development of Alzheimer´s disease. Selenium affects human mind and mental wellness in a positive manner [15].It works as a good antioxidant, especially when combined with vitamin E. Antioxidants like selenium help fight damaging particles in the body known as free radicals. Free radicals can damage cell membranes and DNA, and may contribute to aging and a number of conditions, including heart disease and cancer. Antioxidants can neutralize free radicals and may reduce or even help prevent some of the damage they cause. Selenium has been found to be important in male fertility; increasing selenium levels leads to improved sperm motility. Many of the benefits of selenium are related to its role in the production of glutathione peroxidase (GP), an antioxidant enzyme that helps for the detoxification of the body.

SOURCES OF SELENIUM

Selenium is abundant in the earth's crust at concentrations of 50 to 90 µg/kg, often in association with sulphur containing compounds. High concentrations may be found in volcanic, sedimentary and some carbonate rocks. The concentration of selenium in soil varies from 5 to 1,200,000 µg/kg. Several species of grasses and herbaceous plants are known to accumulate selenium (16). Primary accumulators are Astragalus, Oonopsis, Stanelya, Xylorhiza and Machaeranthera containing 100-100,000 mg Se/kg plant tissue. Secondary accumulators are Astor, Gatierreaia, Atriplex, Grindelia, Castillaja and Comandra containing 25-100 mg Se/Kg plant tissue. Non-accumulators contain less than 25 mg Se/kg plant tissue. Plant foods are the major dietary sources of selenium in most countries (17,18).Wheat is the most efficient selenium accumulator of the common cereals and is one of the most important selenium sources for man (19,20).The content in food depends on the selenium content of the soil in which plants are grown or animal are raised. Dietary selenium intake in most parts of Europeis considerably lower than in the United States, mainly because of the European soils providing a poorer source of selenium (21,22).The selenium in soil varies with soil type and texture, organic matter content and with rainfall. Its assimilation by the plant is influenced by the physicochemical factors of the soil, such as redox status, pH and microbiological activity. The average concentration of selenium in soil varies from 0.1 to 0.7 mg·kg−1. For clay soils, it is 0.8 to 2 mg·kg−1, while in tropical soils, it is 2 to 4.5 mg·kg−1 [23].Volcanic soils and granite are poor in selenium. These soils are found in the mountainous countries of Northern Europe, such as Finland, Sweden and Scotland. Shale soils are rich in selenium. Generally, selenium tends to be concentrated in soils of the driest regions in the world. The toxic effects of selenium on animals occur on these soils [24, 25]. Soil acidity determines the rate of selenium in plants and crops. Alkaline soils release more selenium than acid ones. In alkaline soils, selenite oxidizes and becomes soluble selenate, which is easily assimilated by the plant. By contrast, in acid soils, selenite is often linked to iron hydroxides, which makes it highly fixed by the soil [26].According to Minson [27], grasses contain typically higher concentrations of selenium than leguminous plants. This difference decreases in soils with

low levels of selenium. Cereal plants can also store selenium in the seeds, mainly in the form of selenomethionine. Burning coal and oil are the primary sources of emissions of selenium compounds in the air. The selenium content in ambient air is generally low. It varies from 1 to 10 ng·m−3 [28, 29]. The selenium content in foods depends on the concentration of selenium in the soil where the crops were grown.

The following foods are generally considered good sources of selenium

1. Brazil Nuts
2. Sunflower Seeds
3. Fish (tuna, halibut, sardines, flounder, salmon)
4. Shellfish (oysters, mussels, shrimp, clams, scallops)
5. Meat (Beef, liver, lamb, pork)
6. Poultry (chicken, turkey)
7. Eggs
8. Mushrooms (button, crimini, shiitake)
9. Grains (wheat germ, barley, brown rice, oats)
10. Onions, turnips, peas, beans, carrots, tomatoes, beets, potatoes

Fruits generally contain only low amounts of selenium, rarely exceeding 10 µg·kg−1.The levels of selenium in groundwater and surface water range from 0.06 µg/l to about 400 µg/l (30, 31, 32). In some areas, selenium levels in groundwater may approach 6000 µg/l (33).Concentrations increase at high and low pH as a result of conversion into compounds of greater solubility in water. Levels of selenium in tap water samples from public water supplies around the world are usually much less than 10 µg/l but may exceed 50µg/l (34, 35, 36). Drinking water from a high soil selenium area in China was reported to contain 50–160 µg/l (37).Most people obtain virtually all of their selenium from the foods they eat. In plant and animal tissues, selenium is found mostly bound to proteins. Therefore, the most important food sources of selenium are meats and seafood (0.3–0.5 mg/kg), because of their high protein contents, and cereals (0.1–10 mg/kg), because they tend to be consumed in large amounts. In contrast, foods with relatively low protein levels, such as vegetables and fruits, tend to have relatively low selenium contents (<0.01 mg/kg).Most drinking-water contains concentrations of selenium that are much lower than 10 µg/l, except in certain seleniferous areas. Therefore, it would be unusual for drinking-water to make a significant contribution to total selenium intake. Even in high-selenium areas, the relative contribution of selenium from drinking water is likely to be small in comparison with that from locally produced food.

RECOMMENDED DAILY ALLOWANCE (RDA)

- Children (under 3): 20 mcg
- Children (4-8): 30 mcg
- Children (9-13): 40 mcg
- Adolescents (14-18): 55 mcg
- Adults 19 and older: 55 mcg
- Pregnant women: 60 mcg
- Lactating women: 70 mcg

In many countries of Europe, Asia and part of Africa the intake of selenium from food doesn´t reach recommended daily intake [38]. In India the average intake of selenium per day is 27 - 48µg. [39]

FACTORS AFFECTING SELENIUM REQUIREMENT

Most dietary selenium is highly bioavailable, varying between 50% and 80%. Selenomethionine, which is estimated to account for at least half of the dietary selenium is absorbed by the same mechanism as methionine, and its selenium is made available for selenoprotein synthesis when it is catabolized via the transsulfuration pathway. The bioavailability of selenium in the form of selenomethionine is greater than 90 %. The selenium in selenocysteine, another significant dietary form, is also highly bioavailable. There was also a report from China, during the outbreak of the Keshan Disease that women of childbearing age were more susceptible to developing the disease. There were however no additional reports on this gender effect. Adequacy of vitamin E has been said to be

able to compensate for lack of selenium, as vitamin E can perform the functions of an antioxidant, just as selenium. On the other hand, free radicals produced by polluted environment tend to increase the need for selenium as an antioxidant to protect against cell damage. Similarly, smokers have a higher requirement for selenium. Studies have shown that low dietary selenium intake is a risk factor for lung cancer

ANALYSIS OF SELENIUM

Four methods are commonly used for selenium analysis. Fluorometric determination of selenium requires exacting chemical separations (40), whereas neutron activation analysis is limited to collaboration with scientists at research reactors (41).Atomic absorption spectroscopy using either hydride generation (42) or graphite furnace (43) is now the most common method for routine analysis. Improved instrumentation and availability suggests that inductively coupled plasma-mass spectroscopy (44) will increasingly provide reliable analysis of selenium in combination with analysis of other elements

ABSORPTION OF DIETARY SELENIUM

Selenium homeostasis is clearly not regulated by absorption. The pre intestinal absorption of selenium is negligible. So, the absorption operates mainly in the duodenum and caecum. Absorption occurs primarily by active transport through a sodium pump. Animals and humans readily digest proteins containing selenomethionine, and absorb the selenomethionine intact. Selenite, selenate, and selenomethionine are highly available, and selenium from selenocysteine-containing selenoproteins is also highly available. Numerous studies demonstrate absorption rates well above 50%;in one recent series of studies with large doses (45), selenite and selenomethionine absorption from 200g selenium doses was 84%and 98%, respectively, illustrating that these high rates are real. A recent study reported that selenomethionine was twice as avaiable as selenite when given as daily single tablet supplements to treat extremely selenium deficient Chinese subjects(46).The enzymes/transporters responsible for absorption or movement of selenium across membranes are unknown. Selenomethionine is actively transported by the same systems that transport methionine.

METABOLISM OF SELENIUM

The intracellular metabolism of selenium is unique relative to other mineral nutrients because these trace “metal” bonds covalently to carbon. In addition, novel metabolic pathways are necessary to convert simple dietary forms of selenium into the selenocysteine moiety found in selenoproteins. Foods contain various amounts and chemical forms of Se (selenium), most of which is covalently bound to carbon in organic molecules including as selenomethionine (SeMet), selenocysteine (SeCys) and Se-methylselenocysteine (SeMSC) [47,48]. These forms can each be metabolized to selenide (H_2Se), which serves as the obligate intermediate in selenoprotein synthesis [49–53]. SeMet, unlike other forms of Se, can substitute for methionine (Met) in protein synthesis for which reason it is incorporated non-specifically into proteins [54, 55]. Selenide can also be metabolized by methylation and sugar-derivation to produce a variety of excreted products [52]. These include selenosugars, which are the major urinary metabolites in humans, and methylselenol (CH_3SeH), which is regarded as the major anticarcinogenic Se metabolite [56]

TOXICITY

Selenium was first known as a toxic element, due to high soil levels resulting in the accumulation of selenium in plants, which then caused chronic and acute toxicity in livestock (57). Selenium can be toxic for all animals, such as invertebrates (58), fishes (59), amphibians and reptiles (60), birds (61), mammals (62, 63, 64) and humans (65, 66, 64) depending on the dose and duration of intake, and also on its chemical form. Tolerance for selenium toxicity depends on, among other

factors, the rate of excretion, and selenium excretion depends on the rate of decreases the methylation of selenium as was found in fishes (67). Selenium is especially toxic to waterfowl. The Kesterson Reservoir, located in the San Joaquin Valley, gained considerable notoriety in the 1980s for environmental selenium toxicity. A high incidence of dead and deformed new born and adult waterfowl was observed at the reservoir, and selenium was identified as the probable cause. The origin of the selenium was the high-selenium soils that led to an average concentration of 350gSe/L in the runoff, and further concentrated in the reservoir (68). This toxicity is specific in birds, apparently because embryos in the egg have limited ability to excrete the selenium. Exceeding 400 mcg per day can lead to selenium toxicity. Toxic symptoms that manifest in selenosis include a garlicky odour of the breath, hair loss, nausea, diarrhoea, fatigue and changes in fingernails and toenails. Rashes and cirrhosis of the liver may also develop.

DETOXIFICATION OF SELENIUM

Methylation of selenium by both plants (69) and animals (70) serves to detoxify selenium by generating methylselenides, however excess amount of selenium in the form of selenocysteine decreases the methylation of selenium (71). Alternatively, full reduction of Se to elemental selenium (Se^0) as done by some bacteria and the formation of heavy metal selenides such as Ag_2Se or Hg_2Se, results in a non-catalytic non toxic form of selenium. This catalytic prooxidant attribute of some selenium compounds appears to account for its toxicity when such activity exceeds plant and animal methylation reactions and antioxidant defenses. The excess selenium alternatively can be catabolized into hydrogen selenide and secreted in breath or into trimethyl-selenonium ion and secreted through urine (72).

FERTILITY

Many studies have highlighted the involvement of selenium in human and animal reproduction. Selenium plays an important role in fertility, embryonic implantation, and placenta retention, synthesis of testosterone and sperm, and sperm mobility. Selenium deficiency affects reproductive parameters and animal performance. The use of selenium supplements for fertility problems in some domestic animal species prompted an investigation into the relationship between selenium and impaired fertility in both men and women, and reproductive outcomes. Much of the current evidence has been focused on the role of selenium in male spermatogenesis and semen quality (e.g., sperm count, semen volume, motility, and morphology), but links have also been made to female reproductive issues such as pre-eclampsia and miscarriage (73). The evidence supporting a role for selenium in female fertility is limited, although are data to suggest that women with unexplained infertility may have lower selenium levels in the follicular fluid than those with explained infertility (74). A study in which couples were assessed over a period of five years found that the pregnancy rate was greatest in the mid-range of selenium status (75); however, status was only measured in the semen of the men, and therefore these findings require cautious interpretation as the exposure of both partners would not necessarily be similar. There are several studies supporting a potential role for selenium, and antioxidants in general, in postconception physiology and complicated pregnancies. Infants born to mothers with the lowest selenium status in the early stages of pregnancy have significantly lower birth weights than those born to mothers with higher selenium status (76).Cross-sectional analysis suggests that women with pre-eclampsia have both a significantly lower selenium status in the latter stages of pregnancy and lower levels of placental GPx at delivery than healthy pregnant women (77).Miscarriage has also been linked with selenium status; Barrington et al.(78) found that women recently suffering a miscarriage in the first trimester of pregnancy had significantly lower selenium status than pregnant women at the same gestational age.

The relationship between selenium and male fertility has been widely studied using animal models and cross-sectional analysis of semen samples. However, the effect of dietary supplementation on fertility measures has not been widely studied through human interventions, and has thus far given inconsistent results. Behne et al.(79) showed that the test is are a primary target for selenium within the body, and during times of deficiency the supply of the micronutrient to the male gonads appears to be prioritized. The selenium content of the testis is high, and increases during puberty. SePP is required to transport selenium, particularly to the testis, where apoER2 is known to act as a receptor (80). In Sepp1knock-out mice the semen quality is severely compromised, and wild type mice fed low selenium diets show almost identical problems, but these are reversed upon feeding a high-selenium diet (81, 82).The majority of selenium found within the testis is incorporated into the selenoprotein GPx4, which is expressed in particularly large amounts and is now thought to have multiple roles within spermatogenesis. The selenium-containing GPx enzymes are considered to have key antioxidant activities, scavenging and protecting cells from reactive oxygen species. GPx4 fulfils this role within the testis, and is highly expressed and active during the process of sperm maturation. GPx4 also has a structural role within the mature spermatozoa, most of the selenium content of mature spermatozoa is still present as GPx4; however, the activity of the enzyme is negligible (83). During the final phases of sperm maturation, GPx4 forms interlinking structures and comprises>50% of the mitochondrial containing capsule of mature spermatozoa, a unique example of a GPx enzyme forming a keratin like structure and subsequently losing its activity (83). The position of the capsule, in the mid-piece of the spermatozoa, is likely to explain the structural defects commonly seen in selenium-deficient animals, particularly the brittle and weak connection between the head and tail regions (84). Two recent animal studies that used spermatocyte specific GPx4knockouts or mice lacking expression of mitochondrial GPx4both found that these mice were infertile, characterized by a reduced number of spermatozoa plus increased abnormalities (85, 86). Other selenoproteins present in the testis include selenoproteins V, W, K, 15ka, and S, but the specific function of these within the testis remains unknown (87). Three different measures of selenium content in semen can be made: the selenium concentration in the semen as a whole, the concentration in the seminal plasma, and the concentration in the sperm. The choice of compartment is critical in assessment of selenium concentration. Sperm selenium content is well regulated and does not appear to be heavily influenced by dietary intake. Seminal plasma, however, is largely composed of secretions from other glands (notably the prostate) and therefore may not accurately reflect the selenium present within the testis. Semen selenium takes both measures into account, but it is, to a certain extent, dependent upon sperm density (88).Semen selenium values are typically about a third of the value of blood plasma selenium (89) and extremes of semen concentration have been associated with reduced semen quality, particularly motility (75). Many cross-sectional analyses have been conducted to attempt to establish a relationship between infertility and selenium content of semen. Takasakiet al. (90) found no significant difference between the selenium concentration in whole semen or seminal plasma of fertile and infertile men, although the sperm selenium content was significantly higher in the infertile group. The exact proportion of semen selenium that is contributed by sperm appears to vary, and not only according to the sperm count. Behneet al. (88) found a correlation between the sperm count of men seeking treatment for infertility and the contribution of sperm selenium to whole semen concentrations, but the proportion ranged from 0% to 41% and was not in agreement with previous studies that suggested a value of around 15% regardless of sperm count (75). Since the discovery of the importance of the GPxs to male fertility,

particularly GPx4, a number of cross-sectional analyses of their relevance to measures of male fertility have been conducted. Alkanet al. (91) reported that levels of GPx in the seminal plasma of infertile men were lower than those of fertile men, which in turn led to higher levels of reactive oxygen species. GPx4 expression is significantly lower in the spermatozoa of some men with reduced fertility, but this only appears to account for about a quarter of infertile men (92). A comparison of the rescued GPx4 activity of specimens from fertile and infertile men found the range of activity to be significantly lower in the latter (93).

Selenium is essential for testosterone biosynthesis and the formation and normal development of spermatozoa. [94,95] Testicular tissue contains high concentrations of selenium, predominantly as GPx4, and this provides the link between selenium, sperm quality, and male fertility because GPx4 is a fundamental determinant of the architecture of the spermatozoan midpiece [96,97] and is considered to shield developing sperm cells from oxidative DNA damage [98,99]. ROS have been implicated in male infertility because, through attack of the spermatozoa membrane, sperm viability is decreased. Some evidence suggests that increasing selenium dietary intake increases antioxidant GPx activity, thereby increasing male fertility [100]. The deficiency of selenium likely to affect male fertility, particularly in the synthesis of testosterone and sperm [101]. According to Maiorino [102], selenium deficiency is most often characterized by fragility of the intermediate piece with as result reduced sperm motility. In 64 men, Mistry [103] reported improvement in semen quality and fertility after selenium supplementation. Selenium plays a specific role during implantation. Selenium deficiencies have been involved in retained placenta and metritis. Spears [104], reported that selenium supplementation of dairy cows decreased the incidence of retained placenta. Cases of uterine prolapse were attributed to a deficiency of selenium [105]. Moreover, low concentrations of selenium in red blood cells and hairs are recorded in women with recurrent spontaneous abortions [103].

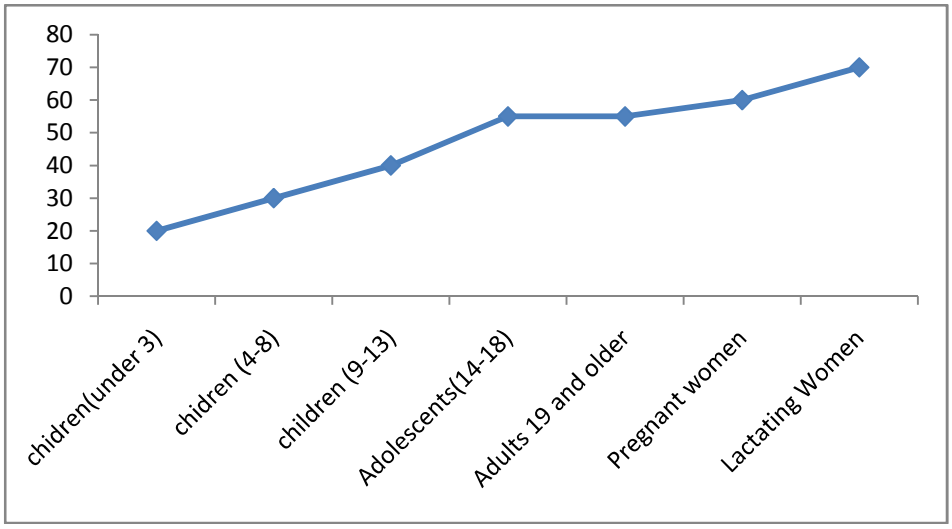
ANTIOXIDANTS AND FERTILITY

Since ROS (reactive oxygen species) has both physiological and pathological roles, an array of antioxidants maintains a steady state of ROS in the seminal plasma. Antioxidants act as free radical scavengers to protect spermatozoa against ROS. These antioxidants are superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPX). In addition, semen contains a variety of non-enzymatic antioxidant molecules such as vitamin C, vitamin E, pyruvate, glutathione, and carnitine (106). These antioxidants compensate for the loss of sperm cytoplasmic enzymes as the cytoplasm is extruded during spermiogenesis, which in turn, diminishes endogenous repair mechanisms and enzymatic defenses (107).Vitamin E and selenium supplementation lead to a significant decrease in MDA (malondialdehyde) concentrations and improved sperm motility (108).Selenium by itself could potentially protect against oxidative DNA damage in human sperm cells.

Table 1
Shows the concentration of selenium in some plants and animals foods

Selenium content of various food items	
Food	µg
Brazil nuts, dried 1 oz	840
Bun, tuna 1 piece (68g)	81.6
Wheat flour, whole meal 1 cup	53
Tuna canned in oil, drained, 3 ½ oz	48
Roti prata with egg, 1 piece	38.3
Noodles, enriched, boiled,1 cup	35
Guava, green skinned, raw, flesh only 12 g	34
Macaroni and cheese (box mix), 1 cup	32
Bread, fiber increased, white, toasted 2 slices	32
Thosai, masala, 1 piece	31.7
Macaroni, elbow, enriched, boiled, 1 cup	30
Spaghetti w/meat sauce, 1 cup	25
Chicken, meat only, 1/2 breast	24
Bread, enriched, whole wheat, 2 slices	20
Roti prata, 1 piece	17.5
Oatmeal, 1 cup cooked	16
Egg, raw, whole, 1 large	15
Bread, enriched, white, 2 slices	14
Rice, enriched, cooked, 1 cup	14
Cottage cheese, low fat 2%, ½ cup	11
Walnut, black, dried, 1 oz	5
Cheddar, black, dried, 1 oz	4

Figure 1
RDA in line chart



CONCLUSION

Selenium is an essential nutrient that appears to play a role in reproductive system. Inadequate selenium intake can result in increased levels of ROS/oxidative stress, which results in reproductive failure and degenerative organ changes. Reproductive organs are highly

susceptible to free radicals or oxidative damage from environmental toxins like pesticides, insecticides and heavy metals. Free radical or oxidative damage to sperm is thought to be responsible for many cases of idiopathic oligospermia. This is causally related to the ability of male germ cells to generate reactive oxygen metabolites. When produced in low levels such metabolites are thought to enhance sperm function by DNA compaction and promoting the induction of sperm capacitation. Selenium is a component of glutathione peroxidase, which possesses antioxidant activity, and demonstrates antioxidant properties in humans. Many of the benefits of selenium are related to its role in the production of glutathione peroxidase (GP).It must be remembered that selenium is a toxic mineral with a fairly small therapeutic window so the intake of selenium is depends on individuals body requirement. Inadequate selenium intake in diet of pregnant women may result in early pregnancy loss, A balanced nutritional diet and nutritional supplements with antioxidants and selenium content can help reverse some of the oxidative damage from environmental toxins and can improve the function of reproductive system.

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