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Toxicity of selenium nanoparticles on the development of rat neonates

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ABSTRACT

The present study aims to investigate the impact of selenium on the morphological, biochemical and ultrastructural changes in the testes, ovaries and livers of mothers rats and their 14 days old age neonates by transmission electron microscopy. Female rats were dosed orally with distal water and 0.5, 1.7, and 6.0 mg Se/kg bw/day as (10 - 45) nm SeNPs, for 14 days old age neonates. At doses of 1.7 and 6.0 mg Se/kg bw/day, a lowering in body weight gain was recorded as compared with the control group. Decrease in Glutathione peroxidase (GPX) of moderate dose (MD) and high dose (HD) groups was explained as due to increase reactive oxygen species in body tissues. There was increase in oxidative status (GPX) of Low Dose (LD) comparing to control group. There were no histological changes in the liver, ovary and testes of the investigated neonates at LD , MD and HD groups.

The toxicity of Se NPs on oxidation status and ultrastructure of ovaries and testes did not occur at low levels 0.5 mg Se/kg but appear with degrees of changes at high level Se NPs(1.7 – 6.0 mg Se/kg). The present results indicated that Se NPs were not toxic at supra-nutritional levels and can induce a positive effect on both neonate rats health at a dose of 0.5 µg Se/kg-bw and in mother rats growth, whereas the chronic toxicity will be induced by more than 1.7 µg Se/kg-bw.

Key words: Selenium nanoparticles, ultrastructure, ovary, liver, neonates, rats.

INTRODUCTION

Selenium is commonly known as an antioxidant due to its presence as selenocysteine in selenoprotein that can catalyze reduction of disulfide bonds in proteins and peptides. One class of its compound is a main suppressor of cell growth with definite tumor specificity (Misra *et al.*, 2015).Selenium nanoparticles SeNPs form is considered as medical factor due to its low therapeutic effect, bioavailability and less toxicity characters. Chemical synthesizing of selenium nanoparticle has been reported as a drug carrier and tumor therapeutic element (Vekariya *et al.*, 2012).

Selenium has important effect on the reduction of oxidative stress reducing the risk of cell toxicity. it has anti-microbial role, anti-fungal activity, it possesses potential as a cancer chemo preventive agent and its immune stimulatory effect was confirmed (Hosnedlova *et al.*, 2018).The amount of selenium absorbed by human body can be evaluated by its level in serum, urine, hair or nails and its contents measured in serum with normal range between 75 and 140 µg/L (Morris *et al.*, 2013).

Effects of selenium are dose dependent were its high and low doses linked with pathological aspects. Selenium high dose are stimulate the toxicity in both humans and animals. In rats, the low dose of selenium protects them against other selenium compounds lethal effect (Ostadalova, 2012).

It is necessary to take care of Se toxicity because of its daily intake from food and water. It can be cumulative in the food chain, pollution by selenium mostly in the aqueous environment; can cause selenium poisoning (Wang *et al.*, 2017). High blood concentration of Se can cause selenosis disorder, a syndrome characterized by gastrointestinal symptoms, white blotchy nails, hair loss, garlic breath odor (due to methylated Se), irritability, fatigue, and peripheral neuropathy (Koller *et al.*, 1986). Nogueira *et al.* (2011) reported that farming animals poisoning (selenosis) caused by the ingestion of the Se element coming from its accumulating plants in reach Se soils.

Reproductive toxicity displayed as the toxic of a substance on the reproductive status of an organism, development of its neonates, and it is adverse effects on fertility and sexual function of adult females and males. As well as developmental toxicity in the offspring means adverse effects induced during pregnancy, or as a result of parental exposure, manifested at any point in the life span of the organism. However, in most of these reports the effect of selenium on the structure of internal organs of both mothers rats and its neonates recived a little attension particulary with respect to histological and ultrastructural changes. Therfore, the aim of the present work was designed to evaluate the morphological, biochemical and ultrastructural changes in the testes, ovaries and livers of mothers rats and their 14 days old age neonates by transmission electron microscopy.

MATERIALS AND METHODS

1. Experimental animals:

The present experimental study was carried out on 40 white albino rats (32 female and 8 males) (Sprague Dawley) weighted 150-200 g obtained from Medical Experimental Research Center MERC (Mansoura University, Faculty of Medicine).

For breeding:

Females caged together with male of proven fertility with (4:1 ratio) overnight under controlled environmental conditions of temperature, humidity and light. Pregnancy was determined next morning by the presence of spermatozoa in the vaginal smears and was considered as day zero of gestation.

1.1. Experimental design:

The Route of administration to females only was orally via gastric tube (Gavage), and the time of Nano selenium administration was scheduled from zero day of gestation, daily until day 13th of lactation for the adult pregnant females. Water and food were supplied ad libitum during all the experiment:

1.2. Experimental groups:

Pregnant rats (n =32) were randomly divided into equal four groups (8 pregnant female rats in each group). The experimental groups were as follows:

- **Control Group (NG):** received distilled water only.
- **Low Dose Group (LD):** treated daily with 0.5 mg/kg.bw of Se NPs.
- **Moderate Dose Group (MD)**: treated daily with 1.7 mg/kg.bw of Se NPs**.**
- **High Dose Group (HD):** treated daily with 6.0 mg/kg.bw of Se NPs.

Doses were selected according to He *et al.* (2014). All mother rats and their 14 days old age neonates were sacrificed at 14th of lactation.

a. Morphological Study:

A daily weight of the pregnant females was record throughout the whole gestation period. The daily weighted of neonates, fetal mortality rates still birth and living fetuses were recorded. Malformations were also recorded.

b. Biochemical Analysis:

Alanine transaminase (ALT) and Aspartate aminotransferase (AST) were determined using Spectrum Diagnostics kits (30 Obour City - Cairo, Egypt). Where ALT kit use End point method at wave length 530-550 nm (ECCLS ., 1989), but AST use Kinetic method at wave length 334 - 365 nm (Young , 1990).

Glutathione Peroxidase (GPX) was determined using diagnostic kit from Bio diagnostic company (29 El-Tahrer St. - Dokki- Giza – Egypt). Its principle is that GPX catalyzing the reduction of H2O2 to water and organic peroxides,the measurement at absorbance of wave length 340 nm (Paglia *et al*., 1967).

c. Histopathological examination:

1. Light Microscope examination

Immediately after scarifying neonates of the four groups by decapitation, Liver, ovaries and testes of neonates of each group were fixed in 10% formal saline for at least 24 hours and dehydration in ascending grades of ethyl alcohol. Specimens were cleared in xylene, and then embedded in paraffin at 56 degree in hot air oven for twenty four hours. Paraffin wax tissue were prepared for sectioning at 4 microns thickness with microtome, and then stained by hematoxylin and eosin (Banchroft *et al.*, 1996).

2. Transmission Electron microscope examination

Ovary, testes samples of neonates were fixed in 4% formaldehyde and 1% glutaraldehyde fixation, dehydrated in ascending ethyl alcohol, and then embedded in araldite resin. Sectioning to thickness of 0.5-1.0 um and then stained with toluidine blue stain for 2-5 min. Then sections observed under microscope for precise location to cut for ultrathin sections at 60-90 nm and collect sections onto grids(Cheville *et al.*, 2014).

RESULTS AND DISCUSSION

1. Morphological Changes

1.1 Effect of Selenium Nanoparticles (Se NPs) on body weight

The weight gain of LD pregnant rats was slightly increased, while in MD group, the weight of mothers was decreased comparing to the control group. In HD group, mother's weight was significantly decreased comparing to the control group (Table 1 and Fig. 1).

Table 1: Changes in weight gain of pregnant rats during gestation period from the 5th and the 20th day of gestation.

Group	Average increase in weight (g) between 5th and 20th day of gestation
NG	53.10±3.73
LD	56.20±2.77
MD	48.30±2.91
HD	39.07± 1.74**a,b,c

Each value represented the Mean ± SD. Significant at P<0.05

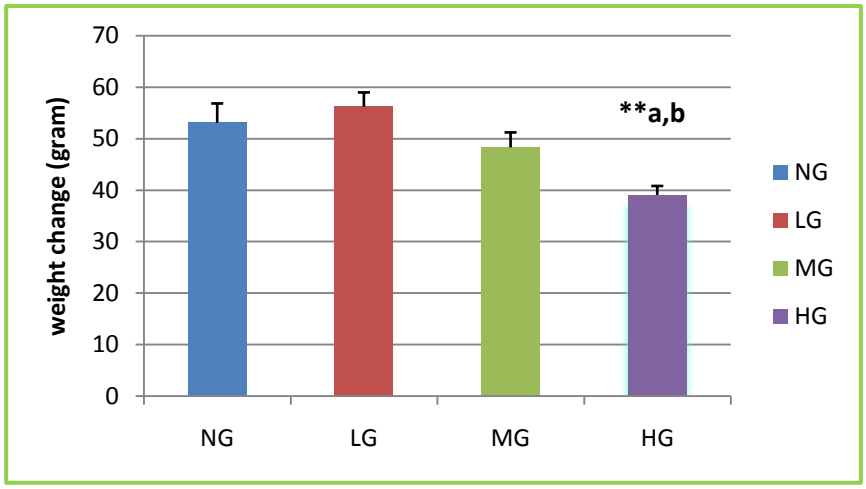

Fig. 1: Changes in weight gain of pregnant rats from the 5th to the 20th day of gestation.

In the current study, the obtained results of the body weight were in accordance with Flaws *et al.*, (2016), who reported that there was no effect of Se status on growth of mice or rats fed 0 to 0.2 µg Se/g diet, however, rats fed 5 µg Se/g diet showed a 23% decrease in growth indicating Se toxicity.

1.2 Effect of Se NPs on Fetal Mortality

As seen in Table (2), no fetal mortality was found in control group (0 %), while there was 6 dead neonates (5.6%) in the LD group, 13 (16.25) in MD group and 16 (28.6%) in HD group, whereas, there was a significant reduced in survivability of neonates comparing to control (Fig. 2).

Table 2: Effect of Selenium Nanoparticles (%) on Fetal Mortality from Zero day of Gestation to 14 the day of Lactation

Group	No. of rats give birth	Total no. of neonates	No. of dead neonates	Percentage of live neonates	T. Mortality rates %
NG	9	72	0	100 %	0%
LD	11	88	5	93.9 %	5.6 %
MD	10	80	13	83.75 %	16.25%
HD	7	56	16	71.4 %	28.6 %

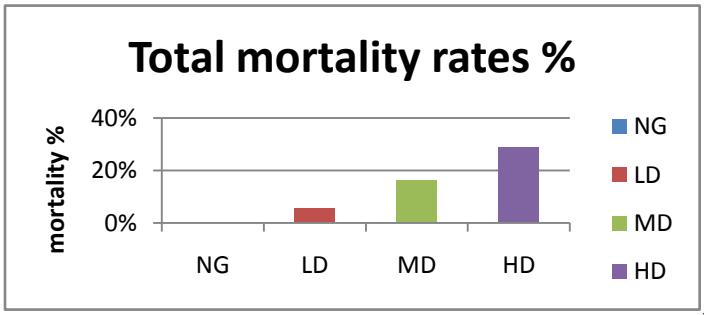

Fig.2: Fetal Mortality (%), from Zero Day of gestation to 14 the day of Lactation

The result of the fetal mortality of neonates was similar to that of Hosnedlova *et al.* (2018) who displayed that concentrations of 8.0 mg Se/kg caused an increase in mortality of rates in comparable to controls, while 4 mg Se/kg impaired growth and reduced survivability, and the weight gain was equivalent for treated and non-treated controls. However, a lower dose of 1.2 mg Se/kg body weight produced 100% mortality in five days. These results may be due to varies in the doses of selenium.

1.3 Effect of Se NPs on body weight of neonates growth

There was no significant change in the body weight of Neonates at 1st day of treated groups comparing with control group, however, the body weight of neonates at the 7th and 14th day, in LD neonates hadn't any change comparing with control group, while the body weight in MD and HD neonates had a significant decrease as compared with control group (Table 3 & Fig. 3).

Table 3: Effect of Se NPs on body weight of neonate at the 1st, 7th and 14th of lactation

Group	Average body wt. of neonates (g) 1st day of lactation	Average body wt. of neonates (g) 7th day of lactation	Average body wt. of neonates (g) 14th day of lactation.
NG	5.78± 0.10	9.48± 0.13	15.83±0.28
LD	5.90±0.04	9.80±0.06	15.98±0.12
MD	5.55±0.11	8.40±0.15**a,b	14.54±0.05**a,b
HD	5.41±0.07	7.91±0.03**a,b,c	13.12±0.07**a,b,c

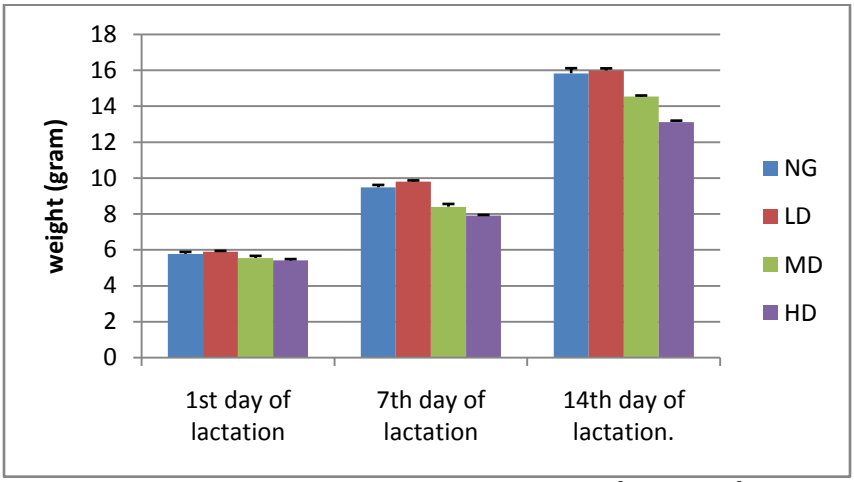

Fig. 3: Effect of Se NPs on Neonate body weight at the 1st, 7th and 14th of Lactation

Sunde *et al.* (2009) showed that no effect of dietary Se level on body mass on the weanling mice fed 0, 0.05 and 0.2 µg Se/g diet, after 35 days.Also, Raines *et al* .(2011) reported that Male weanling ratsweresupplementedwith0to5 µgSe/gdietfor28dayandweighedbi-weekly. rats fed 5 µg Se/g diet had significantly lower body weight as compared to all other diet groups.

3.1 . Biochemistry Changes

3.1.1 Effect of Se NPs on Liver enzyme

The major characteristics of liver function is Liver enzyme activities, According to (Table 4) for mothers and neonates a significant increase in ALT& AST. These results further demonstrate that Se NPs cause liver damage that confirms the morphological changes were caused by apoptosis.

Table 4: Effect of Se NPs on Mothers and Neonates Biochemical Markers

Parameters	NG	LG	MG	HG
ALT u/L**(Mother)**	26.00±4.93	29.66±4.84	63.66±3.28**a,b	63.66±4.66**a,b
AST u/L**(Mother)**	82.66±4.48	77.33 ± 6.35	122.66±5.81**a,b	148.33±10.03**a,b
ALT u/L **(neonates)**	17.66±2.60	20.66±2.18	29.30±2.16**a,b	39.33±4.84**a,b,c
AST u/L**(neonates)**	56.33±4.66	57.66±2.84	65.00±2.51	72.00±3.21**a,b

The present results is in agreement with those of Hasegawa *et al.* (1996**)** who reported that ALT and AST was increased significantly in 5 µg Se/g diet rats as compared to all other diet groups, and was approximately twice that of Se-adequate (0.24 µg Se/g) rats in his experiment.

1.2 Effect of Se NPs on Antioxidant levels (Glutathione Peroxidase)

In the current study, **Table (5)** represents the mother rats GPx activity for each group. GPx level in LD was (10.97±0.18) higher than GPx activity (10.69±0.09) found in control group, indicating improvement in redox status especially in level of GPX activity. However, GPx levels in mothers of MD and HD were 8.10±0.30 and 4.46±0.29, respectively, decreased significantly in comparing with control group, indicating elevating oxidative stress in our experimental rats due to toxicant dose of Selenium (Fig. 4).

For neonate the GPX levels of MD and HD were 8.20±0.35 and 7.30±0.45, respectively, non-significant decreased in comparing with control group (8.70±0.58).

Table 5: Effect of Se NPs on Mothers and Neonates Biochemical Markers

Parameters	NG	LD	MD	HD
GPx (Mother)	10.69±0.09	10.97±0.18	8.10±0.30**a,b	4.46±0.29**a,b,c
GPx (neonates)	8.50±0.30	8.70±0.58	8.20±0.35	7.30±0.45

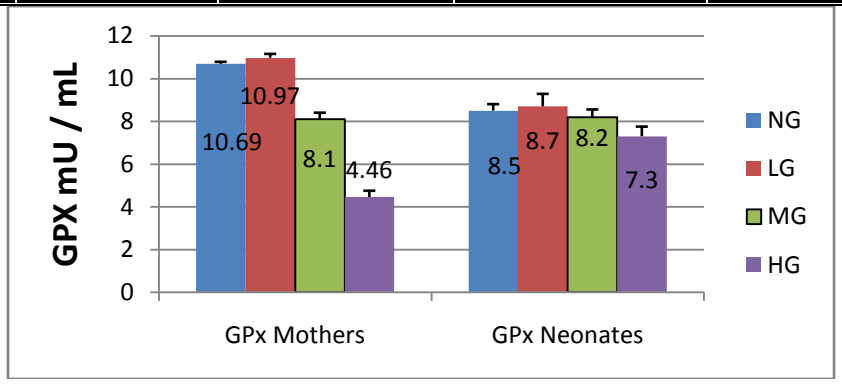

Fig. 4: Effect of Se NPs on GPX level.

Wang *et al.* (2007) reported that Se NPs present excellent biological activity and low toxicity compared with selenocyanates, selenites, and selenocysteine. The level of Gpx in the present results was in agreement with Raines *et al.* (2011) who found that Gpx activity was not further increased by super nutritional Se, and slightly decreased by 5 μg Se/g as compared to the Se adequate diet (0.24 μg Se/g). These changes may be varying of doses of Se. Indeed, Gpx results were nearly similar to Zhang *et al.* (2013). In his study, Gpx level of mice treated with an excess dose of Se orally was decreased compared to those in the Se adequate group.

1.3 Histological Changes

1.3.1 Effect of Se NPs on the structure of Neonates liver by Light Microscopy

In the present investigation, it was observed that the structure of liver in control neonates group was normal where hepatic cords arranged normally around central vein (Fig. 5 A & B).In neonates group received moderate and high dose blood vessels were congested and there was mild degeneration in hepatocytes (Fig. 5 C & D).

He *et al.* (2014) reported that histopathological changes were observed in the groups given doses of 2.0, 4.0, and 8.0 mg Se/kg-bw, particularly in the 8.0 mg Se/kg-bw group. Liver mainly consisted of focal hepatocyte necrosis and degeneration (He *et al.*, 2014).

Under selenium toxicity Wang *et al.*, (2007) found that of selenium caused liver injury. In addition to comparing with normal liver architecture SeMet caused irreversible and serious pathological change in the form of pyknosis, that comes before necrosis and apoptosis, whereas Nano-Se caused degeneration, which belongs to reversible and moderate pathological change.

Jia *et al.* (2005) noted that the major changes observed were different degrees of vacuolar degeneration of liver cells at higher doses of Se, while mild degeneration of liver cells was observed consuming lower Se doses.

On the other hand, in control neonates group have normal seminiferous tubules and interstitial tissue in testes sections (Fig. 6, A & B). In contrast there was marked interstitial edema (black arrows), vacuolation in tubular epithelium (red arrows) and desquamation of tubular epithelium (yellow arrows) in both Neonates group received moderate and high doses (Fig. 6 C & D).

Kaur *et al.* (2000) reported that excess of dietary Se caused dose-time-dependent increase in number of morphologically abnormal spermatozoa .The weight of the testis of rats treated with 8.0 mg Se/kg-bw decreased significantly and atrophied seminiferous tubules were observed. Also Histopathological studies of the testes and caudal epididymis have revealed that Se-rich diets cause disintegration of cellular associations in the seminiferous tubules.

1.3.2 Effect of Se NPs on ovary and testes by Electron Microscopy

Instead, both normal control group and group received low dose and have a normal ovary distribution patterns components with Normal structure of Surface epithelium, Cortex and inner medullary region and Primordial follicles defined as an oocyte surrounded by a layer of squamous (flattened) granulosa cells with large eccentric nucleus mainly found at periphery, Primary follicles possessed an oocyte surrounded by a single layer of cuboidal granulosa cells and the Secondary follicles were surrounded by more than one layer of cuboidal granulose (Fig. 7 A and B).

At moderate group (MD) the ovary primordial follicle is slightly deviated from the control group squamous epithelium and

is not normal and the position of oocyte is disturbed. Oocytes are also not in normal shape and reduced in size, Primary follicles are compact, compressed, shows disorder in arrangement of granulosacells (Fig. 7 C).

The extent of pathological changes in the ovarian tissues shows in Figure (7D), where ovary had more severity damage where, the surface epithelium was highly damaged and detached and few parts absent. The cortical area was filled with numerous primordial follicles extends to the medullary region, however, most of them were distorted, exhibits disintegrated nuclei with damaged squamous epithelium. There few secondary follicles were damaged.

The follicles are the functional unit of the ovary. They are present within the ovary in various stages of development. The primordial follicle develops into the primary follicle, which consists of a primary oocyte surrounded by a single layer of more cuboidal granulosa cells. This follicle develops into the preantral follicle, which consists of a single oocyte surrounded by at least two layers of granulosa cells and a newly formed theca cell layer encasing the oocyte and granulosa cells. Any toxicant can affect follicle numbers, follicle growth and development (Hood, 2016).

The ultra-structural characteristics of the investigated ovary of 14 day old albino rat control group and group of low dose showed normal typical Gonocytes (G) which was elongating and reaching the basement membrane. And 7 B The cytoplasm in case of division due to its activity represent a transient and finite phase of development involves successive phases of proliferation and differentiation for the first spermatogenic wave (Fig. 8 A& B).

At moderate dose group, Gonocytes have vacuolization in its cytoplasm (#), Multinucleated gonocytes and Early apoptosis of gonocytes were chromatin beginning to condense and Swollen mitochondria (M), with the degeneration or loss of cristae in these phases, cytoplasmic organelles still appear normal (Fig. 8 C).

Figure (8 D) show typical nuclear condensation that represent advanced states of apoptosis of gonocytes (G) were condensation and margination of nuclear chromatin around the nuclear periphery occur. Vacuolated cytoplasm, electron-dense bodies, concentric lamellar formations and irregular shaped nuclei till complete degeneration.

Transmission electron micrographs of Primordial follicle of ovary are described in Figure (.9 A & B) control group and low dose group showing: Normal primordial follicle with typical flattened granulosa cells (GC), the dictyate oocyte with its germinal vesicle (GV) or nucleus,, all the mitochondria (M) normal and gathered at one pole of the GV, and basal lamina (BL),but in Figure (9 C & D)moderate dose and high dose, respectively, the shape of most of the Primordial follicles distorted, reduced in size and lost their normal distribution and It exhibits oval nuclei losing their original round shape with damaged squamous epithelium , it is altered giving oval to squeezing appearance to follicular structure, with slightly hypertrophied and dispersed granulosa cells. Vacuolation and irregular shape of oocyte is hallmark beside that There is increase in the number of damage follicles.

As show in Figure (10 A & B) preantral secondary follicle of ovary at PND 14 albino rat of varies treatment doses of selenium nanoparticles are described. The control group and low dose group had : A typical healthy secondary follicle contains a fully grown oocyte (O) ,The granulosa cell processes traversing surrounded by the well-developed regular zonapellucida, layers of granulosa cells (GC), a basal lamina (BL), and developing and distinct separation between granulosa cells. Also Oocyte

granulosa cells in a preantral secondary follicle. The zonapellucida (ZP) makes small gap junctions with the oocyte plasma membrane. Larger gap junctions are evident between coronas radiate.

As seen in Figure 10 (C & D) shape of preantral secondary follicles in Normal is altered and looks like shrined or suppressed and it became oblong and blunt in shape. The granulosa cells severely affected, it clumped compactly and attached to each other, the numbers of atretic follicles slightly increased showing pyknosis in granulosacells; Atretic secondary follicles contained degenerated oocyte

So by increasing dose of Se NPs the severity of damage of ovarian tissue is more pronounced associated with histo-architecture and growth of the follicles and Oocytes of all the follicles are in degenerated stage, far away from their adjacent granulosa cells also the Zonapellucida surrounding the oocyte is damaged in most of the follicles, normal development of theca is disturbed and granulosa cells stick to oocyte's zonapellucida is apparent.

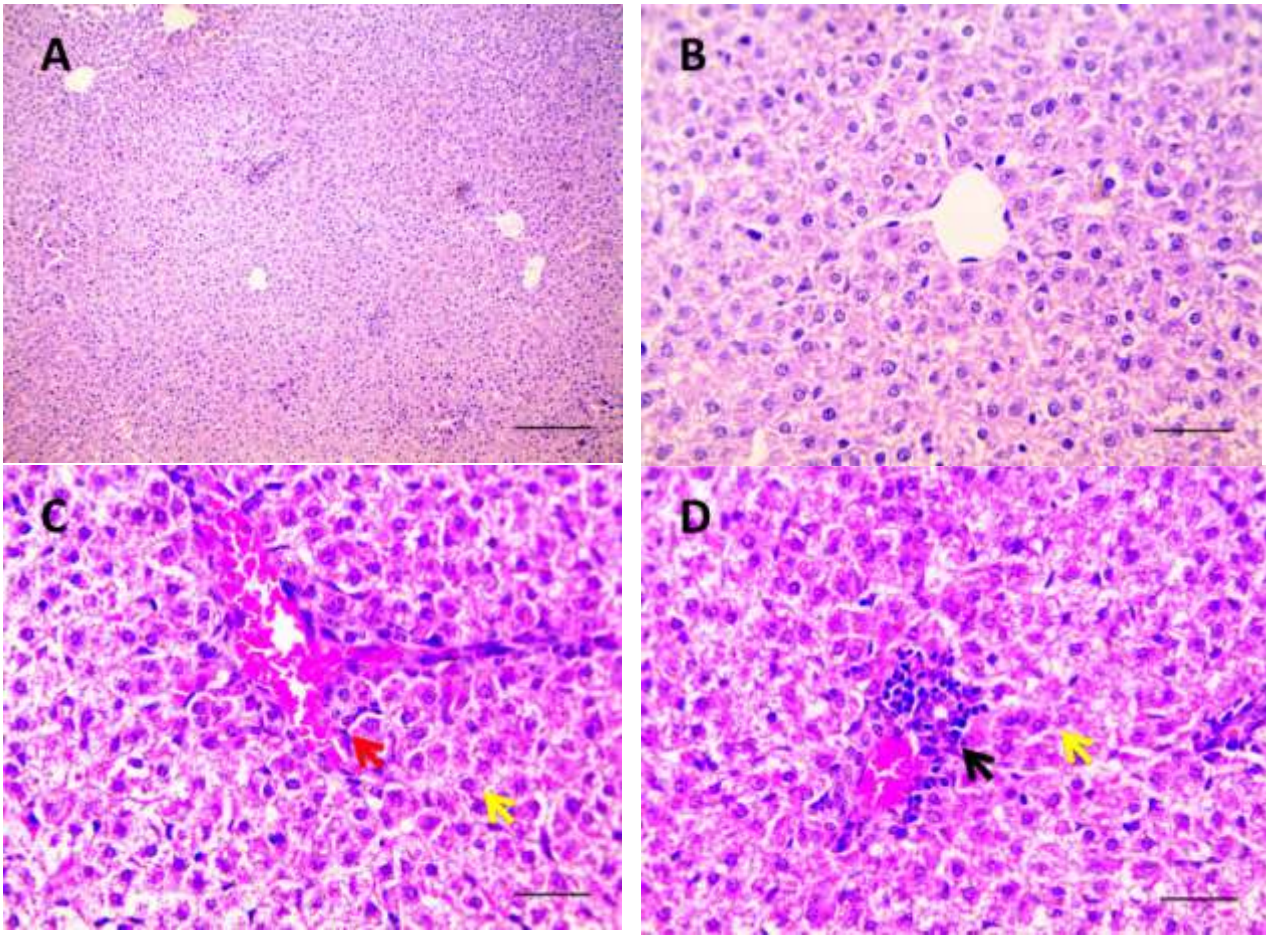

Fig. (5): Microscopic pictures of H&E stained Liver sections of 14 old age neonates for the four groups (A=NG, B=LD, C=MD and D=HD). (A) X: 100 and (B,C,D) X: 400 Bar 50.

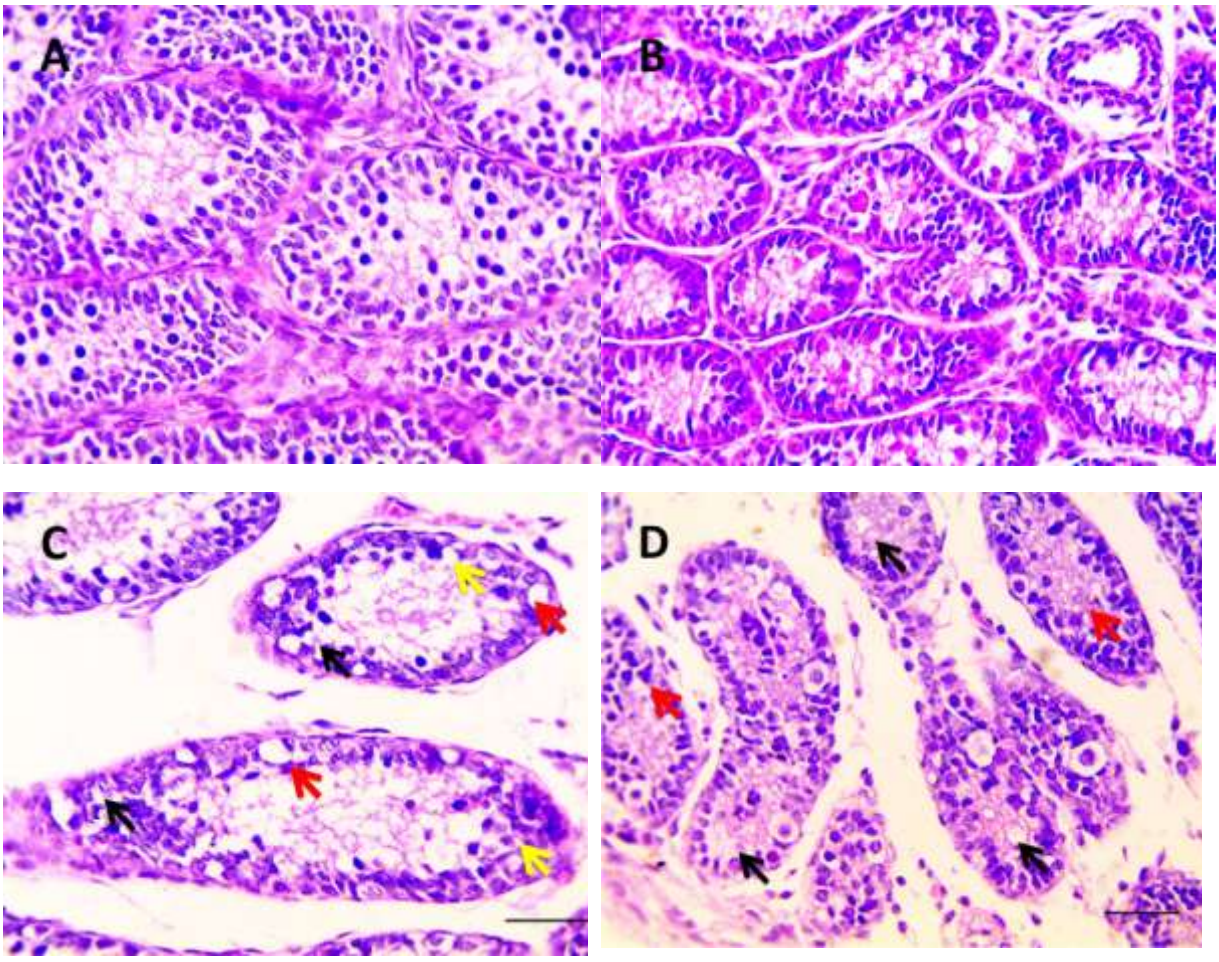

Fig (6): **Microscopic pictures of H&E stained testes sections of 14 old age neonates for the four groups (A=NG, B=LD, C=MD and D=HD) .X:400 Bar 50.**

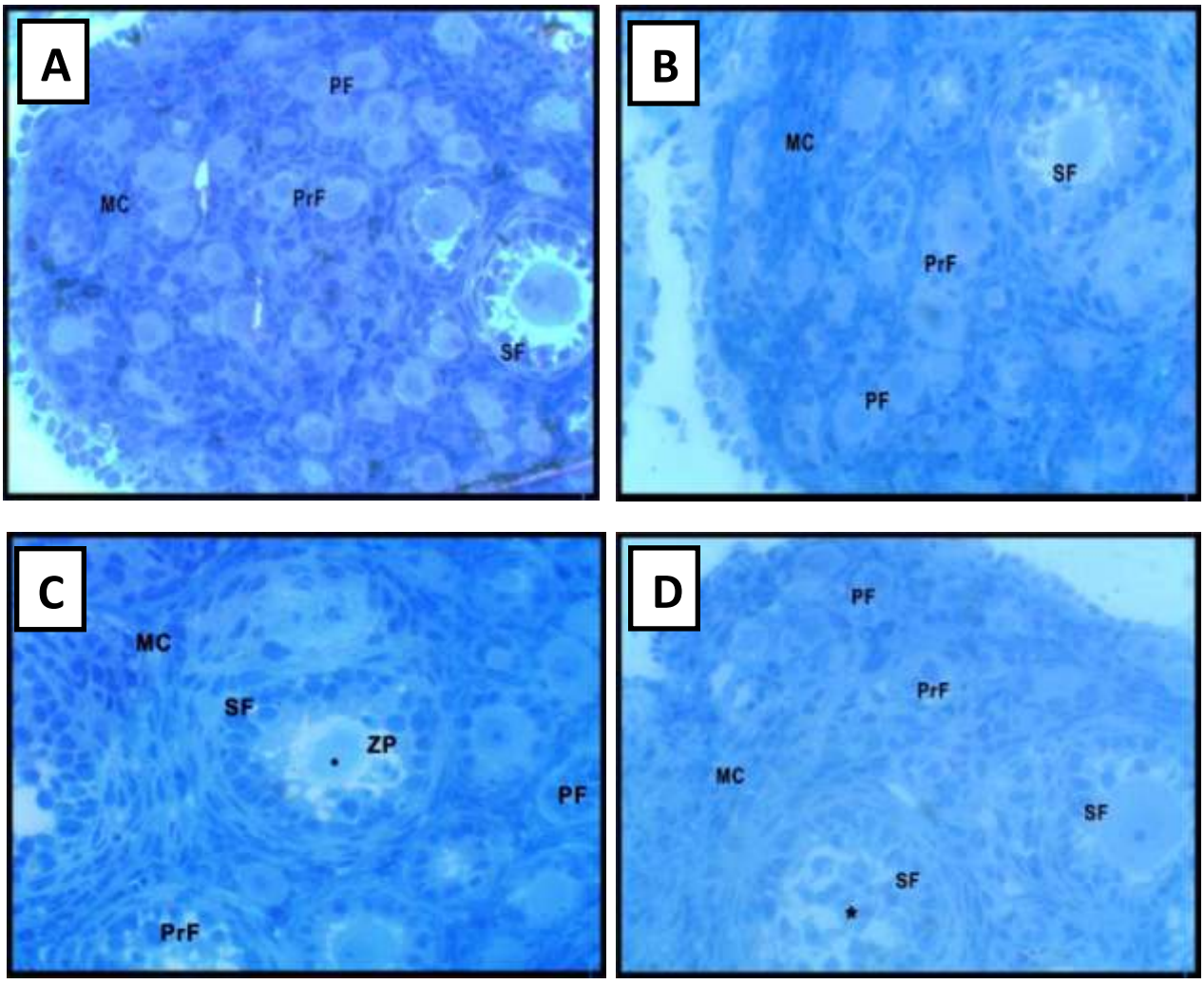

Fig. (7): Microscopic pictures of Semi thin Section of ovariesstained with toluidine blue of 14 old age neonates for the four groups (A=NG, B=LD, C=MD and D=HD) .X:400 Bar 50.

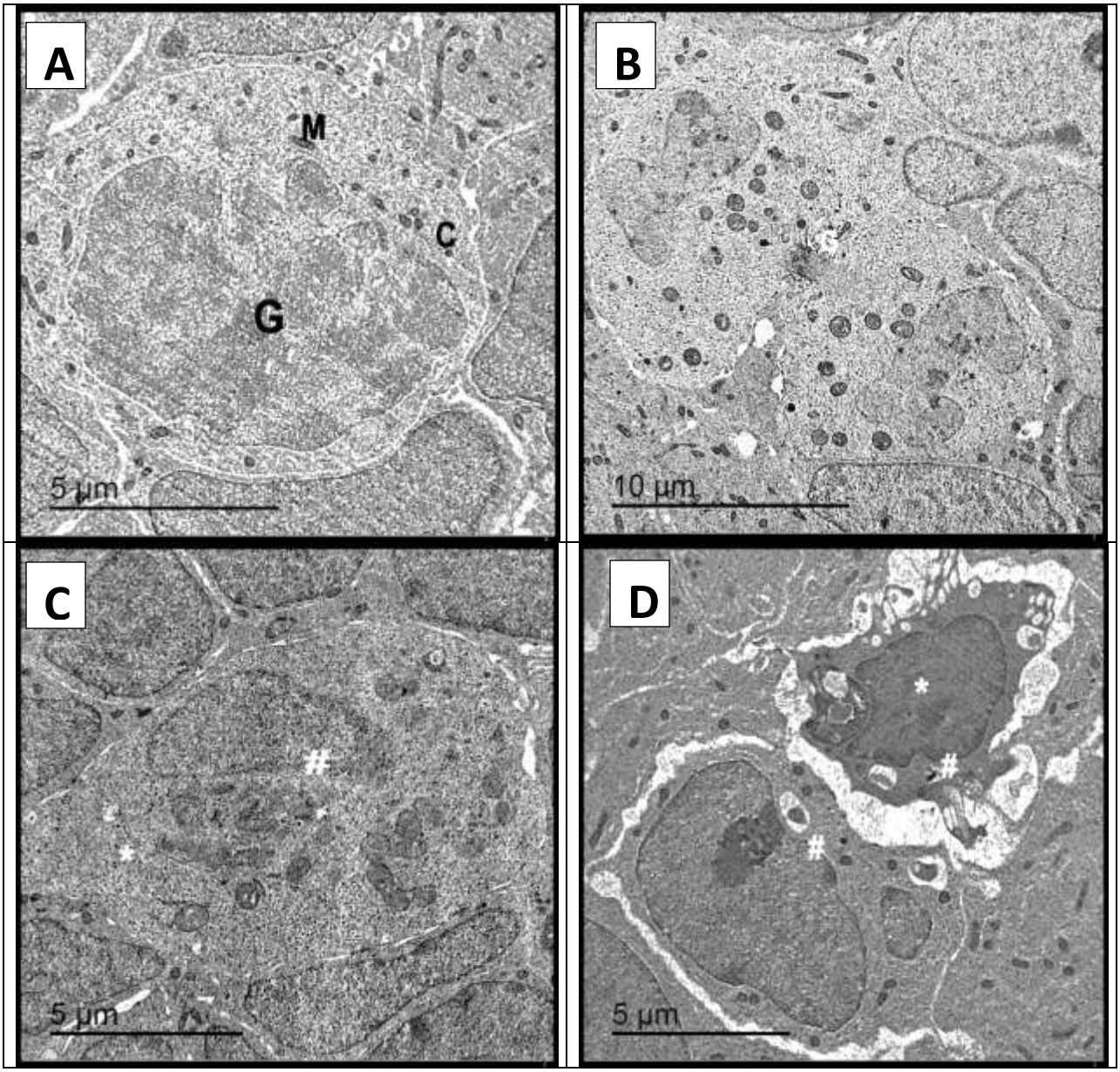

Fig.(8):transmission electron micrograph of 14 day old albino rat control group show: Gonocytes (G), cytoplasm (C) and mitochondria (M). (A=NG, B=LD, C=MD and D=HD).

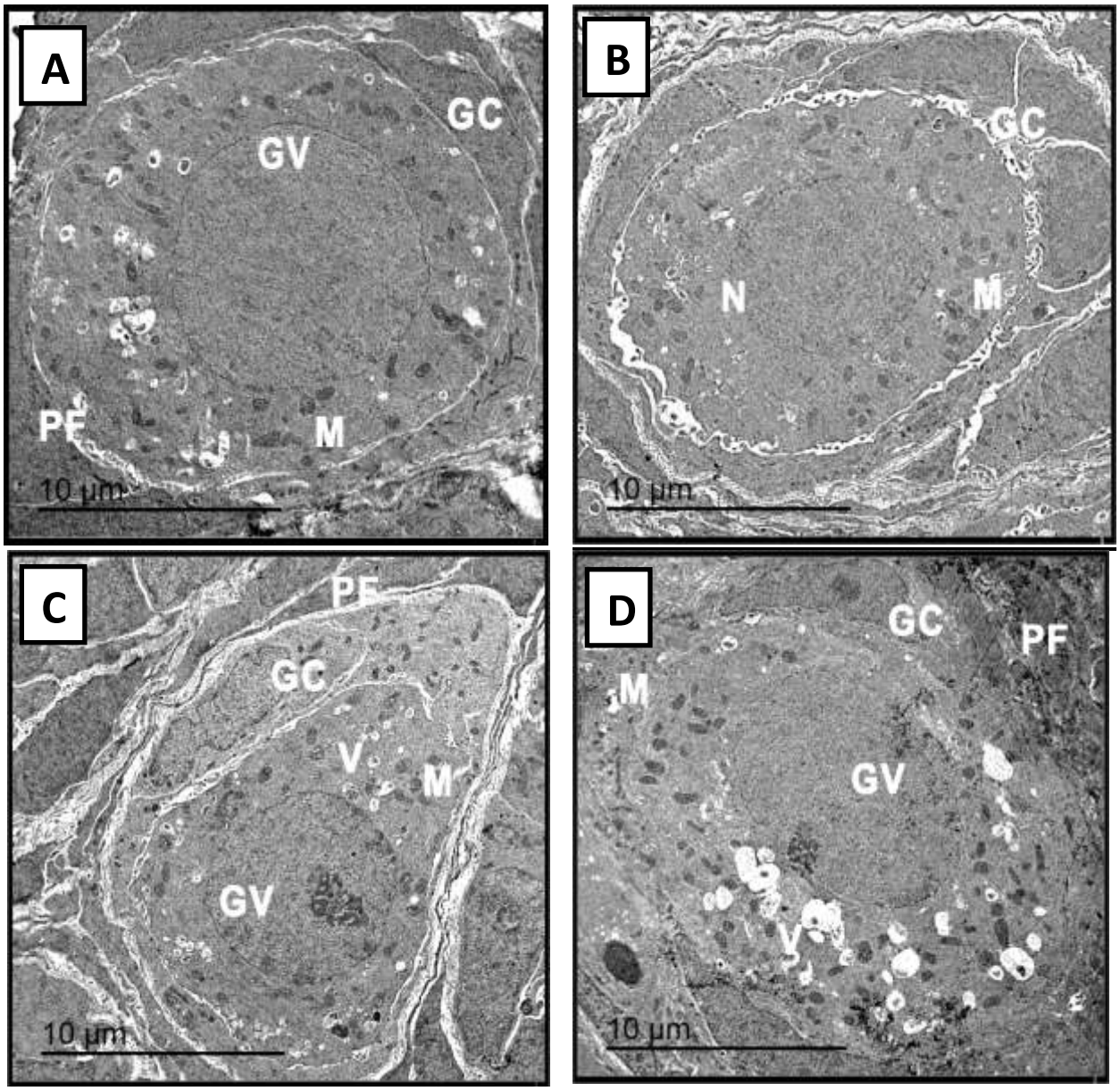

Fig.(9): Transmission electron micrographs of **Primordial follicle** of ovary at PND 14 albino rat of different treatment doses of selenium nanoparticles described flattened granulosa cells (GC), germinal vesicle (GV) or nucleus, and mitochondria (M). A = Normal group, B= Low Group, C = Moderate Group and D= High group.

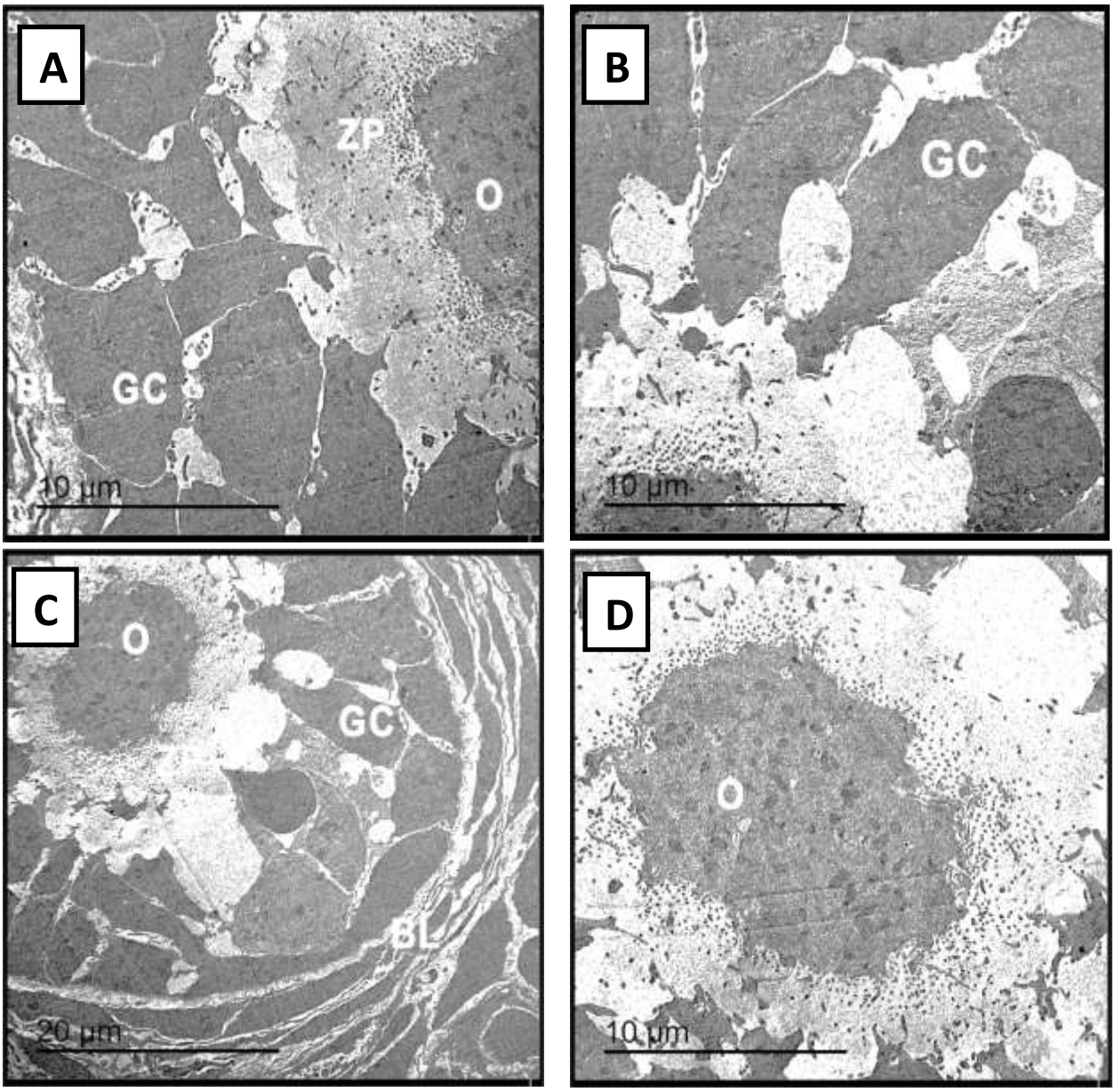

Fig. (10): Transmission electron micrographs of preantral secondary follicles of ovary at PND 14 albino rat of different treatment doses of selenium nanoparticles described.A = Normal group, B= Low Group, C = Moderate Group and D = High group.

CONCLUSION

In the present study, we found that Se NPs are not toxic at supranutritional levels and may be suitable. They may have a positive effect on both neonate rats health at a dose of 0.5 µg Se/kg-bw and in mother rats growth, while the chronic toxicity will be induced by Se NPs greater than 1.7 µg Se/kg-bw. More studies are required to get a deep insight into the toxicity mechanism of the Se NPs.

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سمية جزيئات السيلينيوم على تطور حديثي الولادة

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المستخلص

الهدف من هذه الدراسة تقييم آثار النانو سيلينيوم على بعض انسجة للأعضاء التناسلية (للذكور وللإناث) ، وكذلك لتحديد سميتة ايضا في جرعات مختلفة على الكبد الذي يؤدي المهام الأساسية مثل إزالة السموم من الجسم والكلى التي تشارك في الاتزان الفسيولوجي للجسم. من ناحية أخرى ، توضيح دوره في حماية الجسم في تقليل ومنع التأكسد غير المرغوب فيه .لذلك أجريت الدراسة التجريبية الحالية على 32 انثي من الفئران البيضاء الحوامل (سبراغ داولي) تزن 150-200 جرام من مركز البحوث الطبية التجريبية (كلية الطب،جامعة المنصورة). ولغرض الاخصاب للإناث وضعت ذكور مثبتة الخصوبة بنسبة (3: 1) ليله كاملة تحت ظروف بيئية محكومة من درجة الحرارة والرطوبة والضوء . تم تحديد الحمل في صباح اليوم التالي من خلال وجود الحيوانات المنوية في المسحة المهبلية ويعتبر اليوم صفر من الحمل وبداية التجربة. تم اعطاء جرعات مختلفه من جزيئات النانو سيلينيوم عبرأنبوب تصل للمعدة . حيث كانت الجرعات يوميا بدءا من يوم الحمل حتى اليوم الثالث عشرمن الرضاعة للإناث البالغات. تم تقسيم الفئران الحوامل (ن = 32) بشكل عشوائي إلى أربع مجموعات (8 الفئران الحوامل في كل مجموعة). وكانت المجموعات التجريبية على النحو التالي:

- مجموعة المحكمة (NG): تلقت الفئران الماء المقطر.
- مجموعة منخفضة الجرعة (LD): الجرعه 0.5 ملغم / كغم من وزن الجسم نانو سيلينيوم.
- مجموعة متوسطة الجرعة (MD): الجرعه 1.7 ملغم / كغم من وزن الجسم نانو سيلينيوم.
- المجموعة عالية الجرعة (HD): الجرعه 6.0 ملغ / كغ من وزن الجسم نانو سيلينيوم.

خلال فترة التجربة تم وزن الجسم للام و صغارها و ايضا سجلت وفيات الاجنة و التشوهات. تم ذبح الفئران الامهات وصغارها في اليوم 14 من الرضاعه و اخذ عينات الدم لعمل اختبارات كيمياء الدم و مضادات الاكسده و ايضا استخراج انسجه من الكبد و الكلي و المبيض لفحصها باستخدام الميكرسكوب الضوئي و ايضا عينات الكبد و الكلي و الخصيه و المبيض للصغار عمر 14 يوم لدراسة التراكيب الدقيقة بالميكرسكوب الالكتروني النافذ . تشير النتائج الي انه عند تناول جرعات تبلغ 1.7 و 6.0 مجم / كجم من وزن الجسم ، يحدث انخفاض في وزن الجسم بالمقارنة مع مجموعات التحكيم .انخفاض في كلا من الجلوتاثيون بيروكسيديز (GPX) و السوبر اوكيسد ديسميوتيز (SOD)في مجموعات الجرعة المتوسطة (MD) ومجموعات الجرعة العالية (HD) بسبب زيادة ذرات الأكسجين النشطة في أنسجة الجسم .كانت هناك زيادة في الحالة المؤكسدة (GPX) من الجرعة المنخفضة (LD) مقارنة مع مجموعة التحكيم .لم تكن هناك تغييرات النسيجية في الكبد والمبيضين والخصيتين في كلا من فئران المجموعه قليلة الجرعة LD و التغيرات النسيجية حدثت للمجموعتين MDو HD.

لذلك يمكننا القول بان لم تحدث تاثير سلبي على حالة الأكسدة والبنية التحتية للمبايض والخصي عند مستويات منخفضة 0.5 ملغ / كغ ولكن ظهرت مع درجات من التفاوت عند مستويات عالية من 6.0 - 1.7) مجم من النانو سيلينيوم. بذلك يكون النانو سيلينيوم غير سام علي المستوي الاضافي في التغذية كعنصر محسن للنمو ويمكن أن يكون لها تأثير إيجابي على صحة فئران الولدان بجرعة 0.5 ميكروغرام / كيلوغرام من وزن الجسم وفي نمو الفئران الأم ، في حين ستحدث السمية المزمنة بأكثر من 1.7ميكروغرام / كيلوغرام من وزن الجسم.