# SEMEN QUALITY, MORPHO-HISTOMETRY OF TESTIS AND EPIDIDYMIS, AND BLOOD BIOCHEMICALS OF RABBIT BUCKS TREATED WITH TONYPHOSPHAN

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## SUMMARY

*Total number of 12 NZW rabbit bucks with average live body weight of 3.25±0.41 kg and 7 months of age were divided into 2 groups, 6 animals in each group. Bucks in the 1st group were served as a control (untreated), while those in the 2nd group was weekly intramuscularly injected with one ml from Tonyphosphan (140 mg phosphorous). Semen was collected from all bucks in each group with an artificial vagina once weekly for 13 wk (4 wk as primarily period and 9 wk as a main semen collection period). The ejaculate volume (ml) was measured, semen mass motility, progressive sperm motility, livability, abnormality, sperm cell concentration were evaluated and concentration of fructose and phosphorus was determined in raw semen. Also, concentrations of total proteins, albumin, phosphorous and testosterone were determined in blood plasma. At the end of the collection period, three bucks from each group were slaughtered and morphometric characteristics of testes and epididymal regions (length, width and thickness) were estimated. Also, histometric characteristics were determined. Results show that ejaculate semen volume slightly increased in treated than the control group (0.704 vs. 0.771 ml). Percentage of mass motility (44.3 vs. 57.3%), progressive motility (53.75 vs. 69.6%), live sperm (76.2 vs. 90.0%) and sperm cell concentration (310.6 vs. 493.3 x106/ml) increased (P<0.001) in phosphorus as compared to the control group. Total sperm abnormalities were lower (P<0.05) in phosphorus than that in control group (7.2 vs. 12.9%). Sperm outputs in term of total, motile, live and normal spermatozoa were higher (P<0.001) in phosphorus than that in control group. Fructose and phosphorus concentration in raw semen increased (P<0.001) in treated than that in control group (472.1 vs. 223.3 mg/dl and 30.5 vs. 28.6 mg/dl, respectively). Phosphorus treatment resulted in increase (P<0.001) in concentration of total protein (4.53 vs. 6.41 g/dl), albumin (2.18 vs. 3.56 g/dl), globulin (2.38 vs. 2.84 g/dl), phosphorous (6.98 vs. 9.10 mg/dl) and testosterone (1.666 vs. 2.214 ng/ml) compared with control group. Only averages of absolute weight and relative weight of epididymal caput as well as average length of epididymal cauda were higher (P<0.05) in treated than in control group. However, all testicular measures, averages length and thickness of epididymal caput, and averages absolute and relative weight, and thickness of epididymal cauda were not significantly affected by phosphorus injection Proportional area occupied by epididymal tubules was significantly (P<0.05) higher by about 71% and proportional area of stroma was significantly lower by about 104% in treated than in control group. However, all histometric measures of the testis and epididymal caput*

*as well as mean diameter, lumen and density of epididymal tubules in caput were not affected significantly by phosphorus injection. The current study indicated beneficial effects of weekly injection with one ml from Tonyphosphan (140 mg phosphorous) on semen quality of rabbits in term of improving most semen physical characteristics, total sperm of motile, normal and live outputs.*

***Keywords: Rabbits, semen, phosphorus, testicular and epididymal measures, blood***

## INTRODUCTION

It is well known that the reproductive efficiency of animal is markedly affected by environmental factors (ambient temperature, relative humidity and photoperiod), nutritional factors (energy, protein, vitamins and minerals) and managerial factors (Yousri 1970, Yousef, 1979 and Johnson, 1982). Nutritional deficiency has long been known to exert deleterious effect on reproduction in the male (Jackson, 1925). Semen may vary quantitatively and qualitatively with diet and nutritional status of the animal (Mann and Lutwok- Mann, 1981). Phosphorous is the second most abundant mineral in the animal body and about 80% was found in the bones and teeth. Phosphorous is a component of deoxy– and ribonucleic acids, which are essential in cell growth and differentiation. It contributes to cell-membrane fluidity and integrity as phospholipids and helps to maintain osmotic and acid-base balance as phosphate (Wang *et al.*, 1985). The requirements of caecocolonic micro flora are also important, and microbial protein synthesis may be impaired on low-phosphorous diets (Petri *et al.*, 1989 and Temouth, 1990).

Indoor experiments were conducted to confirm and quantify the need for phosphorus synergism with calcium whereby the skeleton could develop while maintaining its strength. As the story unfolded, Its came parent that phosphorus had equally important roles to play in the soft as well as the hard tissues of the body and that exchanges between them influenced the development of clinical abnormalities, just as much as the dietary supply (De Waal *et al.*, 1996). However, no information are available on the effect of phosphorus on semen quality of ruminants or rabbits. The main objective of the present study was to evaluate physical semen characteristics, anatomical and histological structure of testes and epididymis, and some blood biochemical parameters of New Zealand White rabbit bucks injected with phosphorus.

## MATERIALS AND METHODS

The present study was planed at the Animal Production Department, Faculty of Agriculture, Tanta University during the period from the 1st October to 8th December 2007.

*Animals and management:*

Total number of 12 NZW rabbit bucks with average live body weight of 3.25±0.41 kg and 7 months of age were used in this study. Rabbits were divided into 2 equal groups. In the 1st group, bucks were served as a control (untreated). While, each buck in the 2nd group was weekly intramuscularly injected with one ml Tonyphosphan (140 mg phosphorous). Rabbit bucks were housed individually in flat-

deck cages (50x60x40 cm) made from galvanized wire and supplied with automatic drinking system.

Diets were formulated to meet or exceed all the essential nutrient requirements of growing rabbits according to the recommendation of NRC (1977) allowances. The ingredients and chemical composition are shown in Table (1).

The complete feed diet was in pelleted form (3.5 mm diameters) and animals were fed ad libitium. The experimental diets were offered to animals in both groups at 8 a.m. and 4 p.m. Chemical analysis of different feedstuffs was determined according to A.O.A.C. (1980).

**Table 1. Ingredients (%) and chemical analysis of diet used in feeding the experimental rabbits**

| Ingredient (%) | % | Ingredient (%) | % |
|---|---|---|---|
| Berseem hay | 15 | Wheat bran | 24 |
| Barley | 24 | Molasses | 2 |
| Yellow corn | 20 | Premix* | 0.5 |
| Soybean meal (44%) | 14 | Sodium chloride | 0.5 |

**Chemical analysis (%) on DM basis**

| DM% | OM | CP | CF | EE | NFE | Ash |
|---|---|---|---|---|---|---|
| 91.4 | 89.6 | 18 | 12.6 | 1.9 | 57.1 | 10.4 |

DM = Dry matter OM = Organic matter CP = Crude protein
CF = Crude fiber EE = either extract NFE = Nitrogen free extract

***Semen collection and evaluation:***

Semen was collected from 6 bucks in each experimental group with an artificial vagina once weekly for 13 weeks (4 weeks as primarily period and 9 weeks as a main semen collection period). The ejaculate volume (ml), semen mass motility, progressive sperm motility, livability, abnormality, sperm cell concentration were microscopically evaluated according to Smyth and Gordon (1967) and El-Gaafary (1991).

The ejaculate volume was directly measured, then immediately a drop of freshly ejaculated semen was examined at 37°C to estimate percentages of mass motility, progressive forward motility, live/dead sperm count (Hancock (1951). Also, different types of abnormality were calculated as a percentage of total count of spermatozoa and sperm cell concentration (Herman and Madden, 1953) were determined in fresh diluted semen. Total output as a total count of spermatozoa (TSO) as well as motile (MSO), live (LSO), normal (NSO) and live normal (LNSO) spermatozoa ($x10^6$/ejaculate) were calculated by the following equations:

*TSO = Ejaculate volume (ml) x sperm cell concentration ($x10^6$/ml)*
*MSO = TSO x progressive sperm motility (%)*
*LSO = TSO x live sperm (%)*
*NSO = TSO x {100- sperm abnormality (%)}*

Initial fructose concentration in row semen of the last collection week was determined calorimetrically (Bamsch and lamb spectronic 20 spectrophotometer) according to modification adopted by Mann (1964), for the technique described earlier by Mann (1948).

At the end of collection period, blood samples were taken from all bucks in each group during slaughtering in test tub containing anticoagulant (Heparin). Blood plasma were separated by centrifugation on 1500 rpm and stored at -20°C until subsequent analysis. Concentration of plasma total proteins and albumin were estimated by spectrophotometer using commercial kites. Concentration of total proteins (Gonal *et al.*, 1949), albumin (Weichselbaum, 1946), while globulin was calculated by the differences between total proteins and albumin concentration according to Doumas *et al.* (1971). Also, phosphorous concentration (mg /100 ml) was determined in blood plasma and raw semen by using atomic absorption spectrophotometer (Philips, Pug 100, wave length: 213.9 nm, flam type: air-acetylene) according to the method of Smith *et al.* (1979).

In addition, concentration of testosterone was determined in blood plasma by radioimmunoassay technique using commercial kit (Coat, total testosterone Diagnostic products, Corporation, Los-Angeles, U.S.A) according to Rawlings *et al.* (1972).

At the end of the experimental period, three rabbits in each group were slaughtered after fasting for 16 hours. Fasting body weight was recorded before slaughter. After slaughter, both testes within scrotum were immediately removed, weighed for right and left side and estimated for its dimensions (length, width and thickness). Thereafter, epididymis of each testis was removed, weighed and estimated for length and width of each portion (caput, corpus and cauda). Small specimens from the median portion of each testis and each epididymal portion was taken for the histological examination.

Testicular and epididymal samples taken at slaughtering were immediately fixed by putting in 10% buffered formalin solution (900 ml distilled water + 100 ml commercial formalin, 38- 40% plus 9 g sodium chloride) and left for 24-48 hours. Then, they were washed by running tap water for 18-24 hours. Water was gradually removed from the samples by putting them in ascending grades of alcohol (60, 70, 80, 90, 95% and absolute alcohol). Thereafter, the sampling was placed in toloul (as a clearing agent) for 8-10 hors.

The samples were placed in three successive baths of melted paraffin wax (55 – 58°C) for 2 hours each. Pieces of the samples were placed in melted wax blocks. The paraffin blocks were cut into thin sections (6-8 μ) by a microtome. The sections were stained by Haematoxyline and Eosin using the routine method after Bancroft and Stevens (1982).

The slides were examined by means of light microscope and all aspects of tunica mucosa and musculosa were taken into consideration during slides examination. A standard micrometer eye-piece was used for measuring the following items:

- Mean of total diameter of seminiferous tubules, its lumen.
- Density of seminiferous tubules/mm$^2$.
- Parenchymal area (%)/mm$^2$.
- Thickness of basal laminae and spermatogenic layers

Results were statistically analyzed according to Snedecor and Cochran (1982) using computer program of SAS system (1985). The obtained percentage values were subjected to arcsine transformation before performing the analysis of variance. Means were presented after being recalculated from the transformed values to percentages. However, the significant differences were carried out using Multiple Range Test of Duncan (1955).

## RESULTS AND DISCUSSION

*Physical semen characteristics:*

The effect of Tonyphosphan injection on physical semen characteristics of rabbit bucks at successive collection weeks is shown in Table (2). Mean of ejaculate semen volume was not affected by phosphorus treatment, although it slightly increased in treated than in control group (0.704 vs. 0.771 ml).

However, percentage of mass motility significantly ($P<0.01$) increased by about 29% in Tonyphosphan group as compared to the control group (44.3 vs. 57.3%). Also, percentage of sperm progressive motility was significantly ($P<0.01$) increased (53.75 vs. 69.6%), percentage of live spermatozoa increased from 76.2 to 90.0%, percentage of total sperm abnormalities significantly ($P<0.01$) reduced (7.2 vs. 12.9%) and sperm cell concentration significantly ($P<0.01$,) increased by about 59% in phosphorus as compared to the control group (310.6 vs. 493.3 $x10^6$/ml).

**Table 2. Effect of Tonyphosphan treatment on physical semen characteristics of rabbits**

| Semen characteristics | Control group | Tonyphosphan group | Sign. |
|---|---|---|---|
| Ejaculate volume (ml) | 0.704±0.01 | 0.771±0.09 | NS |
| Mass motility (%) | $44.3±0.03^B$ | $57.3±0.06^A$ | ** |
| Progressive motility (%) | $53.1±0.80^B$ | $69.6±1.50^A$ | ** |
| Live sperm (%) | $76.2±0.50^B$ | $90.0±0.70^A$ | ** |
| Abnormal sperm (%) | $12.9±1.70^A$ | $7.20±1.20^B$ | ** |
| Sperm concentration ($x10^6$/ml) | $310.6±11.3^B$ | $493.3±21.3^A$ | ** |

A and B: Means denoted within the same row with different superscripts are significantly different at $P<0.001$.

The recorded pronounced increase in sperm viability of treated group may be attributed to that phosphorous plays on active role in the development of the flagellar system of the sperm which is reflected on the sperm motility through its passage and stay in the epididymis for complete maturation and/or phosphorous may active enzymes controlling flagellar system. The observed improvement in sperm motility and livability of treated group was mainly related to that Tonyphosphan affects the metabolism of testicular tissue through its active role in metabolic enzymes. Phosphorous is a component of deoxy- and ribo-nucleic acids, which are essential in cell growth and differentiation as phospholipids it contributes to cell membrane fluidity and integrity (Under Wood *et al.*, 1977). Also, it activates enzymes, including energy utilization and transfer via AMP, ADP and ATP and protein synthesis (Wang *et al.*, 1985).

The effect of collection week on overall mean of ejaculate volume (from 0.688 to 0.925 ml), live sperm percentage (from 79.1 to 85.1%), percentage of sperm abnormality (from 8.3 to 12.3%) and sperm cell concentration (from 383.3 to 439.2 $x10^6$/ml) at all collection week were not significant. The effect of collection week was significant ($P<0.05$) only on percentage of semen mass motility and progressive motility percentage. Generally, all physical semen characteristics were improved in treated than in control group at most collection weeks (Figs. 1-6).

*Total sperm output:*

Sperm outputs per ejaculate in term of total, motile, live and normal sperm output were significantly (P<0.01) higher in Tonyphosphan than in control group by about 73, 132, 105 and 86%, respectively (Table 3). It is of interest to note that values of sperm outputs per ejaculate were mainly associated with insignificant increase in ejaculate volume and significant increase in sperm cell concentration, progressive motility, livability and normality of spermatozoa. One the other hand, means of total, motile live and normal sperm outputs per ejaculate were not affected by collection week.

**Table 3. Effect of Tonyphosphan treatment on total, motile, live and normal sperm outputs per ejaculate of rabbits**

| Sperm output ($x 10^6$/ejaculate) | Control Group | Tonyphosphan group | Sign. |
|---|---|---|---|
| Total sperm | $217.8\pm18.9^B$ | $381.3\pm23.4^A$ | ** |
| Motile sperm | $114.1\pm10.7^B$ | $265.1\pm16.8^A$ | ** |
| Live sperm | $166.3\pm0.80^B$ | $342.0\pm1.70^A$ | ** |
| Normal sperm | $189.9\pm 21.3^B$ | $353.2\pm25.3^A$ | ** |

A and B: Means denoted within the same row with different superscripts are significantly different at P<0.001.

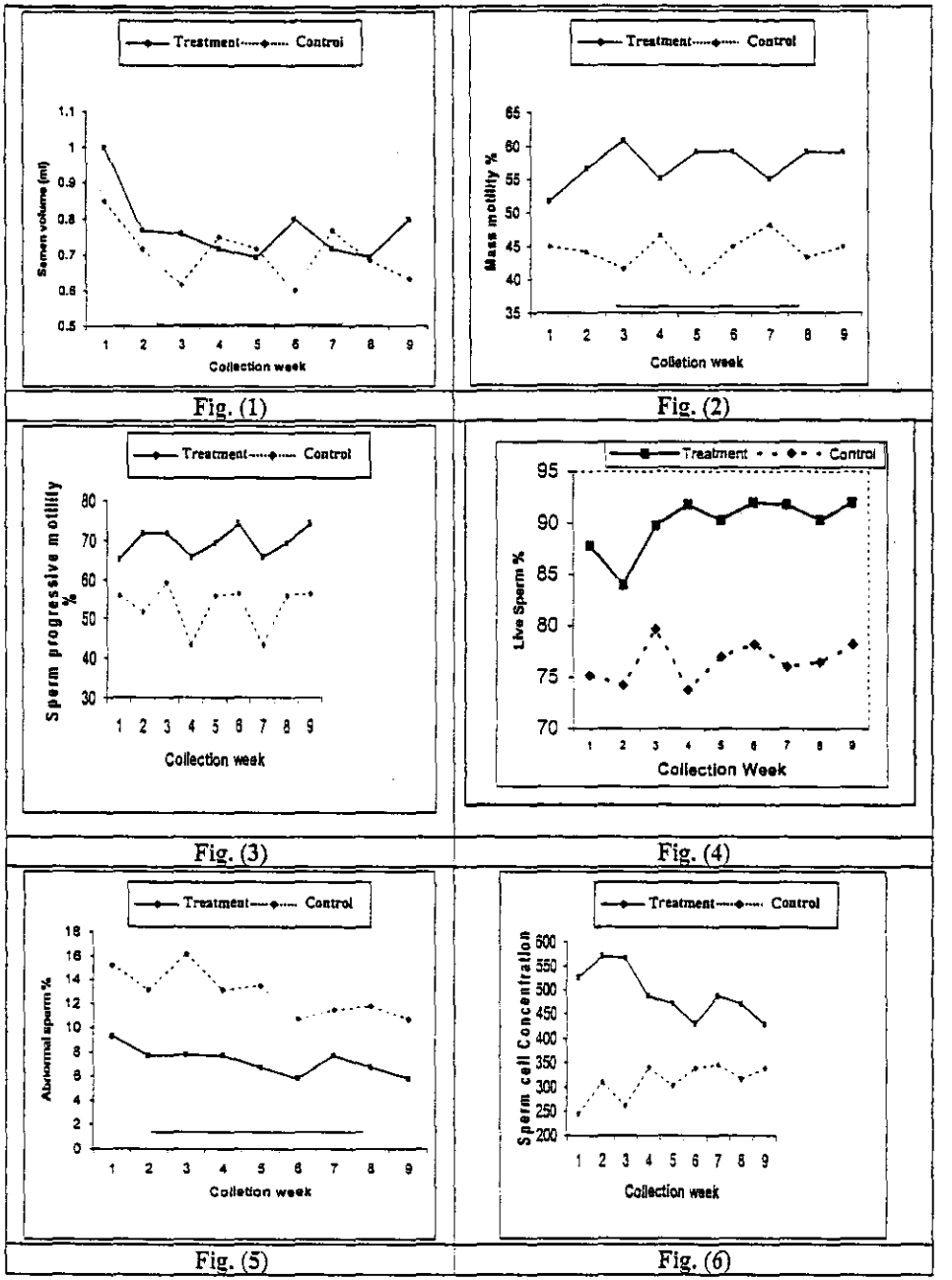
*Chemical characteristics of in raw semen and blood plasma:*

Data in Table (4) show that phosphorus treatment significantly increased fructose (P<0.001) and phosphorus (P<0.01) concentrations in raw semen by about 111.4 and 6.6% and concentrations of total protein, albumin and globulin in blood plasma by about 41.46, 63.3 and 19.37% as compared to the control group, respectively. Also, phosphorus and testosterone concentrations in blood plasma were higher by about 30% (P<0.05) and 33% (P<0.01) in phosphorus than in control group, respectively.

**Table 4. Effect of Tonyphosphan treatment on concentration of some biochemicals in raw semen and blood plasma of rabbits**

| Biochamichal | Control group | Tonyphosphan group | Sign. |
|---|---|---|---|
| **Raw semen:** | | | |
| Initial fructose (mg/dl) | $223.3\pm14.1^B$ | $472.1\pm16.6^A$ | *** |
| Phosphorus (mg/dl) | $28.57\pm0.10^B$ | $30.47\pm0.09^A$ | ** |
| **Blood plasma:** | | | |
| Total proteins (g/dl) | $4.531\pm0.09^B$ | $6.41\pm0.01^A$ | ** |
| Albumin (g/dl) | $2.183\pm0.007^B$ | $3.565\pm0.011^A$ | ** |
| Globulin (g/dl) | $2.385\pm0.05^B$ | $2.847\pm0.08^A$ | ** |
| Phosphorus (mg/dl) | $6.988\pm0.38^b$ | $9.108\pm0.30^a$ | ** |
| Testosterone (ng/ml) | $1.666\pm0.05^B$ | $2.214\pm0.07^A$ | ** |

A and B: Means denoted within the same row with different superscripts are significantly different at P<0.01 or P<0.001.




Figs. (1-6). Effect of Tonyphosphan treatment on different physical semen characteristics of rabbit bucks at successive collection weeks

Fructose is secreted mainly from the seminal vesicles (Hafez and Hafez, 2000), so the observed increase in fructose concentration in raw semen of treated group may be attributed to direct effect of phosphorus on function of the seminal vesicles and/or indirectly by increasing testosterone concentration, which had vital role on accessory sex gland function (Abdel-Khalek *et al.*, 2005). Also, Blocky and Galloway (1978) and Bone (1979) reported that libido of male mammals is under the control of androgens and testosterone hormone. So, the observed increase in testosterone concentration in blood plasma of treated bucks is considered as the main effect on testicular and accessory sex glands function leading to pronounced improvement in all physical semen characteristics. Furthermore, phosphorous is essential for energy utilization, phosphorelation and amino acid and protein synthesis (Wang *et al.*, 1985), which was in relation with increasing concentration of total proteins and their fractions in phosphorus group.

***Morphometric characteristics of the testis and epididymis:***

For all morphometric characteristics studied (Table 5), the effect of phosphorus treatment was significant ($P<0.05$) only on averages of absolute weight and relative weight of epididymal caput as well as average length of epididymal cauda, being higher in treated than in control group. However, all testicular measures, averages length and thickness of epididymal caput, and averages absolute and relative weight, and thickness of epididymal cauda were not affected significantly by phosphorus injection.

**Table 5. Effect of Tonyphosphan treatment on morphometric characteristics of the testes and epididymis of rabbits**

| Item | Control group | Tonyphosphan group |
|---|---|---|
| **Testes:** | | |
| Average weight (g) | 2.54±0.17 | 2.75±0.19 |
| Relative weight g/kg LBW | 0.67±0.07 | 0.70±0.03 |
| Average length (cm) | 3.08±0.16 | 3.00±0.14 |
| Average thickness (cm) | 1.09±0.07 | 1.25±0.05 |
| **Epididymal caput:** | | |
| Average weight (g) | 0.563±0.06[a] | 0.393±0.08[b] |
| Relative weight g/kg LBW | 0.014±0.005[a] | 0.010±0.007[b] |
| Average length (cm) | 1.30±0.06 | 1.08±0.08 |
| Average thickness (cm) | 0.62±0.07 | 0.60±0.06 |
| **Epididymal cauda:** | | |
| Average weight (g) | 0.870±0.08 | 0.713±0.10 |
| Relative weight g/kg LBW | 0.022±0.01 | 0.018±0.01 |
| Average length (cm) | 1.55±0.090[a] | 1.14±0.050[b] |
| Average thickness (cm) | 1.21±0.050 | 1.21±0.040 |

a and b: Means denoted within the same row with different superscripts are significantly different at $P<0.05$.

The significant ($P<0.05$) increase in absolute weight and relative weight of epididymal caput by about 43 and 40%, and in length of epididymal cauda by about 36%, for treated than control groups may indicate higher ability of epididymis to storage higher number of spermatozoa for numerous ejaculates. This trend may indicate the effect of phosphorus on morphometric development of the epididymis of

NZW rabbit bucks. Unfortunately, there are no information in the literature on the effect of phosphorus on morphometric characteristics of testo-epididymis or reproductive tract of males.

**Histometric characteristics of the testis and epididymis:**

All histometrics of the testis and epididymal caput as well as mean diameter, lumen and density of epididymal tubules in caput (Table 6) were not significantly affected by Tonyphosphan injection (Plates 1 and 2). However, the effect of Tonyphosphan treatment was significant ($P<0.05$) only on proportional area occupied by epididymal tubules and stroma in cauda region, being significantly ($P<0.05$) higher by about 71 and 41% in treated than in control group (Table 6 and Plate 3).

The significant ($P<0.05$) increase in proportional area of epididymal tubules (ET) and tendency of larger lumen of ET (Plate 3) in cauda indicated the superiority of treated rabbit bucks in morphometric and histometric characteristics as compared to the control group. This superiority of treated group was associated with increasing semen quality and sperm outputs per ejaculate of different types of spermatozoa (motile, live and normal sperm output). Based on the foregoing results concerning physical semen characteristics, total sperm outputs, biochemical concentration of seminal and blood plasma, as well as morphometric and histometric characteristics.

**Table 6. Effect of tonyphosphan treatment on histometric characteristics of the testes and epididymis of rabbits**

| Item | Control group | Tonyphosphan group |
|---|---|---|
| **Testes:** | | |
| Mean diameter of ST (µm) | 339±0.015 | 317±0.010 |
| Thickness of SL (µm) | 146±0.070 | 143±0.060 |
| Mean diameter of ST lumen (µm) | 42.4±0.002 | 40.3±0.002 |
| Density of ST /mm$^2$ | 10.36±0.49 | 10.24±0.69 |
| Area occupied by ST (%) | 89.20±6.00 | 81.90±6.10 |
| Proportional area of stroma (%) | 10.80±0.35 | 18.1±0.510 |
| **Epididymal caput:** | | |
| Mean diameter of ET (µm) | 480.0±43 | 404.0±34 |
| Thickness of ET (µm) | 41.0±2.5 | 35.0±3.50 |
| Mean diameter of ET lumen (µm) | 345.0±34 | 324.0±42 |
| Density of ET/mm2 | 7.93±0.9 | 7.26±0.50 |
| Area occupied by ET (%) | 0.742±0.08 | 0.502±0.07 |
| Proportional area of stroma (%) | 0.258±0.03 | 0.498±0.02 |
| **Epididymal cauda:** | | |
| Mean diameter of ET (µm) | 311.0±24 | 316.0±34 |
| Thickness of ET (µm) | 34.1±7.30 | 30.8±5.10 |
| Diameter of ET lumen (µm) | 232.5±32 | 227.8±25 |
| Density of ET /mm$^2$ | 21.42±0.02 | 21.11±0.02 |
| Area occupied by ET (%) | 71.4±5.7$^a$ | 41.7±4.20$^b$ |
| Proportional area of stroma (%) | 28.6±8.17$^b$ | 58.3±5.54$^a$ |

a and b: Means denoted within the same row with different superscripts are significantly different at $P<0.05$. ST: Semineferous tubules SL: spermatogenic layer. ET: epididymal tubules.

The current study indicated beneficial effects of weekly injection with one ml from Tonyphosphan (140 mg phosphorous) on semen quality of rabbits in term of

improving most semen physical characteristics, total sperm of motile, normal and live outputs.

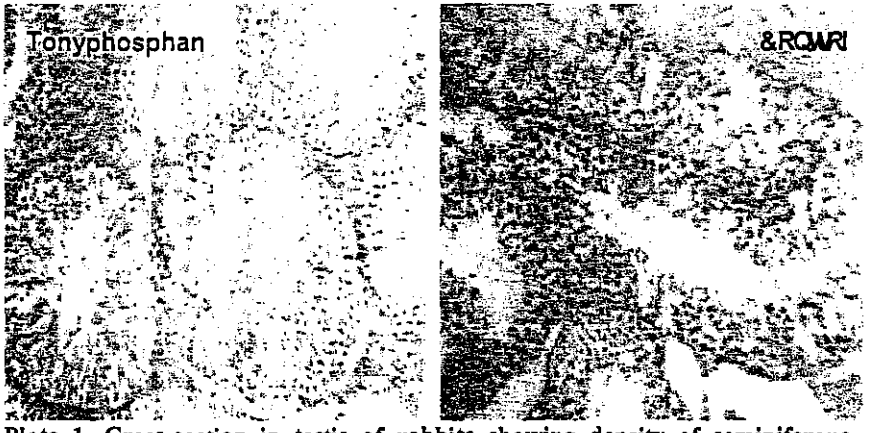



**Plate 1. Cross-section in testis of rabbits showing density of seminiferous tubules in control and Tonyphosphan group**

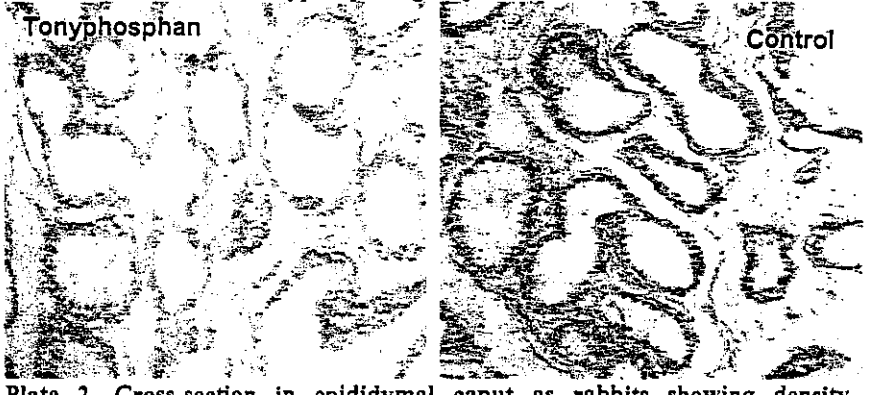



**Plate 2. Cross-section in epididymal caput as rabbits showing density epididymal tubules in control and Tonyphosphan group**

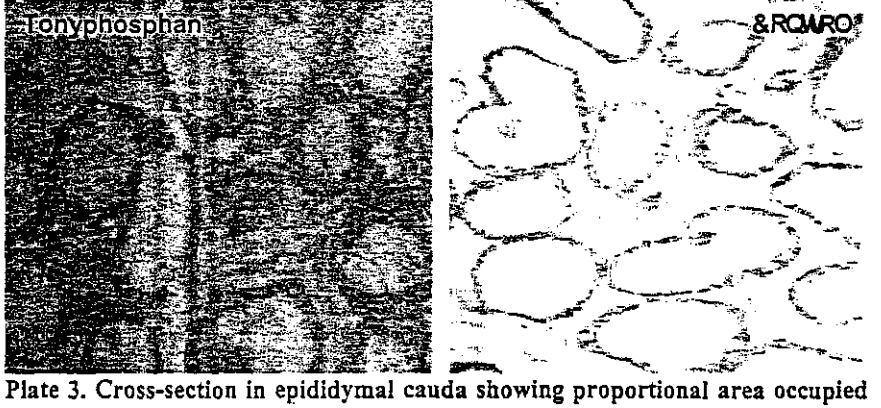



**Plate 3. Cross-section in epididymal cauda showing proportional area occupied by epididymal tubules in Tonyphosphan and control group**

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# جودة السائل المنوى، التغيرات الشكلية والتشريحية للخصية والبربخ والمكونات البيوكميائية للدم لذكور الارانب المعاملة بالتونى فوسفان

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استخدم فى هذه الدراسة 12 ذكر من أرانب النيوزلاندي الأبيض بمتوسط وزن 3.25 كجم وعمر7 أشهر قسمت الى مجموعتين متساويتين. المجموعة الاولى مجموعة مقارنة بدون معاملات ،المجموعة الثانية تم حقنها بمعدل 1 مل تونى فوسفان أسبوعيا، تم تجميع السائل المنوى لمدة أربعة أسابيع من المعاملة كفترة تمهيديه واستمر التجميع لمدة 9 أسابيع. تم تجميع السائل المنوى من جميع الحيوانات التجريبية باستخدام المهبل الصناعى مرة واحدة أسبوعيا وتم تقديرحجم القذفة، النسبة المئوية للحركة الكلية ،الحركة الفردية ،الحيوانات المنوية الحية،الحيوانات المنوية الطبيعية ،تركيز الحيوانات المنوية. وخلال الأسبوع الأخير تم تقديرتركيز الفركتوز والفوسفور فى السائل المنوى. أيضا تم تقدير البروتين الكلى والالبيومين ،الفوسفور وهرمون التستستيرون فى بلازما الدم . فى نهاية فترة التجميع تم ذبح 3 ذكور من كل مجموعة لأخذ القياسات الشكلية لكلا من الخصية والبربخ .

أظهرت النتائج أن حجم السائل المنوى لم يتأثر معنويا بالمعاملة حيث وجدت فروق بين المعاملة والمجموعة المقارنة (0.704 الى 0.771 مل)، زادت النسبه المؤيه للحركة الجماعية (44.3 الى 57.3 %) ،الحركة الفردية (53.73الى 69.6 %) ،الحيوانات المنوية الحية (76.2 الى 90.0%) ، تركيز الحيوانات المنوية (310.6 الى 493.3 $10^6$x) معنويا فى المجموعة المعاملة عن المجموعة المقارنة(P<0.001). بينما انخفضت النسبه المؤيه للحيوانات المنوية الغير الطبيعية معنويا (P<0.05) فى المجموعة المعاملة عن المجموعة المقارنة ( 7.2 الى 12.9 %) و ارتفع تركيز الفركتوز والفوسفور معنويا (P<0.001) فى المجموعة المعاملة بالفوسفور عن المجموعة المقارنة ( 472.1الى 223.3 ملجم/ديسليتر) و ( 30.5الى 28.6ملجم/ديسليتر) على التوالى. المعاملة بالفوسفور أدت الى زيادة معنوية (P<0.001 ) فى تركيز البروتين الكلى (4.53 الى6.41 جم/ديسليتر) ،الالبيومين (2.18الى 3.56جم/ديسليتر)، الجلوبيولين (2.38الى2.84 جم/ديسليتر) ،الفوسفور(6.98 الى9.10 ملجم/ديسليتر) والتستستيرون (1.666الى 2.214 نانوجم/مل) فى بلازما الدم بالمقارنة بالمجموعة المقارنة. فقط متوسطات الوزن الفعلى والوزن النسبى لراس البربخ وكذلك متوسط طول ذيل البربخ كانت أعلى فى المجموعة المعاملة عنها فى المجموعة المقارنة (P<0.05) بينما لم تتاثرجميع قياسات الخصية، متوسط طول وسمك راس البربخ ومتوسطات الوزن الفعلى والنسبى وسمك ذيل البربخ معنويا بالمعاملة بالفوسفور. المساحة النسبية التى تشغلها قنيات البربخ كانت أعلى معنويا (P<0.05 ) بمقدار 71% وكذلك انخفضت المساحة النسبية التى يشغلها النسيج البينى معنويا بمقدار 104% فى المجموعة المعاملة عن المجموعة المقارنة، بينما لم تتأثر جميع القياسات التشريحية

للخصية ورأس البربخ مثل متوسط القطر ،التجويف والكثافة لقنيات البربخ فى راس البربخ معنويا بالحقن بالفوسفور.

نستنتج من هذه الدراسة أن الحقن الاسبوعى بالفوسفورفى صورة تونى فوسفان(1 مل) له فوائد على جودة السائل المنوى للأرانب من حيث تحسين معظم الخصائص الطبيعية والمحتوى الكلى للقذفة من الحيوانات المنوية المتحركة والحية والطبيعية.