Effects Of Different Ages On Testicular Measurements, Copulation Time, Semen Characteristics And Blood Components In The Dromedary Camels

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ABSTRACT

Forty five male dromedary camels (*Camelus dromedarius)* of 500 to 600 kg body weight, were used in the present study. The camels were divided into three groups according to their ages as follows : from 5 to 10, over 10 to 15 and over 15 to 20 years old in the first, second and third groups, respectively. Testicular measurements, copulation time, semen characteristics and some blood components were recorded.

The results showed that testes weight (gm) in the camels at 10 to 15 and 15 to 20 years was significantly (P<0.01) higher, while insignificantly lower in testes tone firmer score than camels at 5 to 10 years old. Testicular volume (cm^3) and scrotal circumference (cm) in the camels at 10 to 15 years increased significantly (P<0.01) as compared to camels at 5 to 10 and 15 to 20 years old. Copulation time (minutes) was significantly (P<0.05) longer in the camels at 5 to 10 and 10 to 15 years than camels at 15 to 20 years old. Semen colour was creamy white in the camels at 5 to 10 and 10 to 15 years and milky white in the camels at 15 to 20 years old. Semen consistency was viscous in the camels at 5 to 10 and 10 to 15 years and semi-viscous in the camels at 15 to 20 years old. Seminal hydrogen-ion concentration (pH) value showed insignificantly higher, while sodium concentration (mg/ 100 ml) was significantly (P<0.01) higher in the camels at 15 to 20 years than camels at 5 to 10 and 10 to 15 years of age. Semen-ejaculate volume (ml), total protein concentration (gm/100 ml), calcium and potassium concentrations (mg/100 ml) showed significantly (P<0.05 or 0.01) increased in the camels at 5 to 10 years as compared to camels at 15 to 20 years, while insignificantly increased in the camels at 5 to 10 years as compared to camels at 10 to 15 years of age. Percentage of sperm motility, sperm-cell concentration ($x10^6$ /ml) and total-sperm output ($x10^6$ /ejaculate) were significantly (P<0.01) higher, while the percentages of dead spermatozoa, sperm abnormalities and acrosomal damage of spermatozoa (%) were significantly (P<0.01) lower in the camels at 5 to 10 and 10 to 15 years than camels at 15 to 20 years old. Albumin and globulin concentrations (gm/100 ml) were insignificantly decreased in the camels at 15 to 20 years as compared to camels at 5 to 10 and 10 to 15 years old. Total cholesterol concentration (mg/100 ml) was significantly (P<0.01) higher in the camels at 10 to 15 years than camels at 5 to 10 and 15 to 20 years old. Activities of aspartate-aminotransferase (AST), alanine–aminotransferase (ALT) and alkaline phosphatase (ALP) enzymes (U/L) were significantly (P<0.01) higher in the camels at 15 to 20 years than camels at 5 to 10 and 10 to 15 years old. Inorganic phosphorus (mg/100 ml), zinc (µg/100 ml) and testosterone concentrations (ng/100 ml) were significantly (P<0.01) higher in the camels at 5 to 10 years than camels at 10 to 15 and 15 to 20 years old.

INTRODUCTION

The camel is an important source of food as well as of transport and draught for large communities in sub-sharian Africa, the Middle East and Indian subcontinent.

The camel plays also vital socio-economic roles and supports millions of the human beings in the dry and arid zones of the world. Camel's milk is the sole nourishment for many pastoralists for prolonged periods each year. The camel has proved to be the most fir domestic animal during severe drought periods, not only surviving such droughts, but also producing and reproducing *(1).*

In Egypt, increasing camel productivity can help to solve the insufficient amount of animal meat and milk and depends firstly and mostly on reproductive efficiency. A management strategy that promotes maximum reproductive efficiency depends, in turn, on an understanding of reproductive biology of the camel.

Testis is responsible for production of spermatozoa and secretion of androgens. These functions are catalyzed with the help of different enzymes. The spermatozoon is the result of a complex processes of cellular differentiation. During this processes, morphofunctional modifications occur based on biochemical and cytochemical changes *(2)*. This phenomenon involves the participation of several enzymes, including phosphatases. The activity of various enzymes in spermatozoa is important for sperm quality and fertility capacity *(3,4)*.

The present study aimed to investigate the effects of different ages of the dromedary camels (*Camelus dromedarius*) on testicular measurements, copulation time, semen characteristics and blood components.

MATERIALS AND METHODS

The present study was carried out in the Private Camel Farms, Belbies City, Sharkiya Province, Egypt. Forty five male dromedary camels (500 to 600 kg body weight), were used. The camels were divided into three groups according to their ages as follows : from 5 to 10 years (young, n: 13), over 10 to 15 years (adult, n :17) and over 15 to 20 years (senile, n:15) for the first, second and third groups, respectively.

The present study aimed to investigate the effects of different ages on testicular measurements, copulation time, semen characteristics and blood components of the dromedary camels, under Egyptian condition.

The camels were healthy and clinically free of external and internal parasites with a sound history of fertility in the herd. Palpation of the external genetalia showed that they were typically normal. The camels were fed an a diet consisting of grains and straw and grazed in the immediate area.

Testicular measurements included testis weight (gm), testicular volume (cm^3), scrotal circumference (cm) and testes tone firmer (score), were measured in the different ages of the camels. Copulation time and semen characteristics included semen colour, semen consistency, semen-ejaculate volume (ml), hydrogen- ion concentration (pH), percentages of sperm motility, dead spermatozoa, sperm abnormalities, acrosomal damage, sperm-cell concentration (x 10^6/ml) and total-sperm output (x 10^6/ejeculate), were estimated in the different ages of the camels.

Blood serum components included testosterone hormone, total protein, albumin, globulin, total cholesterol, aspartate – aminotransferase (AST)enzyme, alanine-aminotransferase (ALT)enzyme, alkaline-phosphatase (ALP)enzyme, sodium, calcium, potassium, zinc and inorganic phosphorus concentrations, were also estimated in the different ages of camels.

1. Testicular measurements

The testes weight was weighed to the nearest gram by an ordinary balance after slaughter.

Testicular volume (cm^3) was determined as the method described by *(5)* using the following formulae:

$$\text{Testicular volume} = \frac{\pi \times L \times B \times T}{6}$$

Where : π = 3.14, L= Length of the longitudinal axis of the testis, B = Breadth of the testis, T = Thickness of the testes.

Scrotal circumference was measured with a flexible cloth measuring tape around the largest diameter of the testes and scrotum placed after pushing the testes firmly into the scrotum *(6)*.

Testes tone firmer (score) was determined via manual palpation (scored from 1: very soft and 9: very firm) as described by *(7)*.

2. Camels semen collection by artificial vagina (AV)

Semen was collected from the dromedary camel between 08: 00 and 10: 00 a.m. using artificial vagina (AV). A modified artificial vagina (30 cm long and 5 cm internal diameter, IMV, France) as described by ***(8,9)***. Ejaculate contact with the rubber liner of the AV was avoided, since the most rubber liners have a deleterious effect on camel spermatozoa ***(10)***. An additional disposable plastic inner liner is inserted to avoid contact with the rubber material. After passing the liner through the AV, 8 cm of cylindrical form (cut longitudeinally) was placed between outer Jacket of the AV and liner at the end of the AV far from the water valve ***(11)***. This was performed to imitate the internal cervix and provide more stimulation for the penis for proper erection and ejaculation. A shortened AV without collection funnel was used, allowing the semen to pass directly into a collection flask. The AV was filled with water at 55-60 °C. The temperature inside the inner liner was stabilized at 45–50°C. Few drops of Vaseline were smeared on the inner liner at the entrance to the AV to provide lubrication. A sexually receptive female couching with her front legs tied and teased by the male camel should be used. The olfactory contact should be allowed. The male is left to mount the female from behind on the right side. As soon as, the male camel makes few thrusts, the operator who sits on the right side of the female grasps the males camel sheath and directs his penis into the AV. Ejaculation is completed after several thrusts and interspersed by periods of rest. The ejaculate usually comes in fractions. The collection flask containing the semen is protected by a towel or gauze. Immediately after semen collection, flask containing the semen was incubated in a water bath at 37 °C and then evaluated. Fresh camel semen that has a jelly–like consistency is left for liquefaction for about 30 – 60 minutes to make the sperm attain motility.

Duration of copulation was measured from the time of penile intromission into the artificial vagina until withdrawal ***(12)***.

3. Semen characteristics:

Semen colour was determined by direct visual examination from the collecting tube. Semen consistency was qualified as viscous when semen did not drop from a pasteur pipette, semi- viscous when some semen dropped from the pasteur pipette to glass slide and liquid when semen was fluid and dropped readily from the pasteur pipette according to ***(12)***. Semen–ejaculate volume was determined using a conical graduated tube. The pH semen was measured by Universal Indicator Paper and standard commercial stain.

Immediately after semen collection and liquefaction, advanced motility of spermatozoa (%) was estimated by diluting one drop of fresh semen with physiological saline (sodium chloride, 0.9%) on a dry, clean and pre-warmed (37°C) glass slide. Percentages of sperm motility, dead spermatozoa and sperm abnormalities were estimated ***(13)***.

The percentages of acrosomal damage were calculated for 100 spermatozoa observed at random on each slide using immersion lens ***(14)***.

Sperm-cell concentration ($x10^6$/ml) was estimated using haemocytometer ***(15)***. Total-sperm output ($x10^6$/ejaculate) was estimated by multiplying the semen- ejaculate volume by sperm- cell concentration per milliliter.

4. Blood serum components :

Blood samples from camels were collected from Jugular vein in the non – heparinized vacutainer tube for each camel, then centrifuged at 600 *g* (gravity) for 15 minutes. Serum samples harvested and stored frozen at-20°C until analysis. Testosterone hormone, total protein, albumin, globulin, total cholesterol, aspartate-aminotransferase (AST), alanine-aminotransferase (ALT), alkaline phosphatase (ALP) enzymes, sodium, calcium, potassium, zinc and inorganic phosphorus concentrations in blood serum of the camels at the different ages, were determined.

Total protein concentration was determined colourimetrically according to Biuret method as described by ***(16)***. Albumin

concentration was determined colourimetrically according to *(17)*. Globulin concentration was calculated by subtraction of albumin content from the total protein content. Total serum cholesterol concentration was determined *(18)*. Testosterone hormone concentration was determined by Radioimmunoassay Technique (RIA) of Cot-Ab-Count kits (Diagnostic Products Corporation – Los Angles, USA) according to *(19, 20)*.

The activity of AST and ALT enzymes in was determined colourimetrically using QCA kit, Amposta, Spain according to *(21)*. ALP enzyme was determined colourimetrically using commercial kits (Stanbio kit, Texas, USA) according to *(22)*.

Sodium, calcium, potassium and inorganic phosphorus concentrations were determined colourimetrically according to the method described *(23- 26)*.

Zinc was determined using 5 P9 Atomic Absorption Sepctrophotometry (Pye Unicam) *(27)*.

Data were statistically analyzed using least squares analysis of variance *(28)*. Percentage values were transformed to arc-sin values before being statistically analyzed. Duncan's New Multiple Range test *(29)* was used for the multiple comparisons.

RESULTS AND DISCUSSION

1. Testicular measurements

1.1. Testes weight (gm)

Table 1 showed that the effect of the different ages in the camels at 10 to 15 and 15 to 20 years on testes weight was significantly ($P<0.01$) increased as compared to 5 to 10 years old. However, the testes weight in the camels at 10 to 15 years was insignificantly higher than 15 to 20 years old. Similar trends were reported by several investigators *(30,31)* who confirmed that the highest value of testis weight was recorded in the camels at 6 to 11 years and the lowest value was recorded at 3 to 5 years old. These results may be attributed to increase activity of the mature Leydig cells and spermatogenesis process in the adult than in young or old male camels.

1.2. Testicular volume (cm^3)

Testicular volume in the camels at 10 to 15 years was significantly ($P < 0.01$) increased as compared to that at 5 to 10 and 15 to 20 years old. However, the testicular volume showed significantly ($P<0.01$) decreased in the camels at 5 to 10 years as compared to 15 to 20 years old (Table 1). The increase of the testicular volume may be attributed to complete spermatogenic cycle and increase activity in the amount of interstitial tissues in the adult than young or older camels. These results are in agreement with those reported by *(32)* in the dromedary camels. ***Ahmadi (31)*** found that, the highest value of testicular volume at 6 to 11 years and the lowest value was recorded at 3 to 5 years of age.

1.3. Scrotal circumference (cm)

Scrotal circumference in the camels at 10 to 15 years increased significantly ($P< 0.01$) as compared to 5 to 10 and 15 to 20 years old. However, the scrotal circumference was significantly ($P<0.01$) lower of the camels at 5 to 10 years than 15 to 20 years old (Table 1). These results are in agreement with those of *(32)* in the male dromedary camels.

1.4. Testes tone firmer (score)

Testes tone firmer score in the camels at 5 to 10 years was insignificantly higher than that at 10 to 15 and 15 to 20 years old. Similarly, testes tone firmer score showed insignificantly higher in the camels at 10 to 15 than 15 to 20 years old (Table 1).Abd El-Salaam *(32)* recorded that the testes tone firmer (score) was insignificantly higher in the dromedary camels at 5 to 10 years than camels either at 10 to 15 or 15 to 20 years of age.

2. Copulation time (minutes)

Data presented in Table 2 showed that, the effect of the different ages in the camels at 5 to 10 and 10 to 15 years on copulation time was significantly ($P < 0.05$) longer than 10 to 15 years old. However, copulation time in the camels at 5 to 10 years was insignificantly longer than 10 to 15 years old. The aging process has an affect on the rate of

reproduction rather than the rate of catabolism. It is generally considered that steroid hormone secretion by the testis is increased with the age until eleven years *(33)* and consequently, increased testosterone level which stimulate libido or copulation time then after decreased in old camels. These results are in agreement with those reported by *(32, 34)* who recorded that, copulation times were 14.76 minutes in the dromedary camels at 2.5-5 years, 6.35 minutes at over 5-10 years and 10.20 minutes at over 10-20 years.Mosaferi *et al. (9)* confirmed that, the average time of semen collection in the bactrian camels by artificial vagina was 5.3 minutes with range of 2.5-11 minutes.

3. Semen characteristics

3.1. Semen colour

Table 2 showed that semen colour in the camels was creamy white at 5 to 10 and 10 to 15 years, and milky white at 15 to 20 years old. These results are in agreement with those reported by *(35)* who found that, semen colour was yellowish white, creamy white and milky white of the dromedary camels at 2.5 to 5, over 5 to 10 and over 10 to 20 years of age, respectively. Similarly, Abd El-Salaam *(32)* found that, semen colour was creamy white in the dromedary camels either at 5 to 10 or 10 to 15 years and milky white in the camels at 15 to 20 years of age. The different colour of semen with different ages may be due to the different concentrations of spermatozoa and semen consistency *(34)*.

3.2. Semen consistency

Data presented in Table 2 showed that semen consistency was viscous in the camels at 5 to 10 and 10 to 15 years, while semi-viscous at 15 to 20 years old (Table 2). Similarly *(31, 32, 34)*, found that, semen consistency of the dromedary camels is semi-viscous at 2.5 to 5 years of age and viscous at 5 to 10 and 10 to 20 years of age. Viscosity of semen is usually attributed to the presence of mucopolysaccharides *(36,37)* which come only from secretion of the bulbourethral glands or the prostate gland. The physiological role of mucopolysaccharides is not clear.

3.3. Hydrogen-ion concentration (pH)

Hydrogen-ion concentration (pH) value showed insignificantly lower in the seminal camels at 5 to 10 years than 10 to 15 and 15 to 20 years old. (Table 2). These results are in agreement with those reported *(35)* who found that, the highest (8.12) and the lowest (7.82) values of seminal pH were recorded with the dromedary camels at over 5 to 10 and 2.5 to 5 years of age, respectively.

3.4. Semen-ejaculate volume (ml)

Semen-ejaculate volume showed significantly ($P < 0.05$) increased in the camels at 5 to 10 years as compared to 15 to 20 years old, while insignificantly higher in camels at 5 to 10 years than 10 to 15 years old. The differences in semen-ejaculate volume between camels at 10 to 15 and 15 to 20 years of ages were insignificant (Table 2). These results are in agreement with those reported by *(36)* in the alpaca and *(31, 32, 35)* in the dromedary camels.

3.5. Percentage of sperm motility (%)

The percentage of sperm motility was increased significantly ($P < 0.01$) in the camels at 5 to 10 and 10 to 15 years as compared to that at15 to 20 years old. However, the percentage of sperm motility was insignificantly higher in the camels at 5 to 10 years than 10 to 15 years old (Table 2). These results are in agreement with those reported by *(31,34,35)*.The advancement of age revealed hypoactive Leydig cells which are considered to be testosterone hormone producing factor, so this reflected on a bad semen characteristics produced by the aged animals *(38)*.

3.6. Percentage of dead spermatozoa (%)

Percentage of dead spermatozoa in the camels at 15 to 20 years was increased significantly ($P<0.01$) the as compared to that at 5 to 10 and 10 to 15 years old. Similarly, the percentage of dead spermatozoa showed significantly ($P<0.01$) higher in the camels at 10 to 15 years than 5 to 10 years old (Table 2). Similar trends were reported by *(32,34,35)* who found that, the highest value of the percentage of dead spermatozoa of the dromedary camels was recorded of the camels at over 10 to 20 years and the lowest value

was recorded at over 5 to 10 years of age. These results may be attributed to that the advancement of age which may cause disturbance in spermatogenesis or destruction or even death of spermmatozoa *(10)*.

3.7. Percentage of sperm abnormalities (%)

The percentage of sperm abnormalities was increased significantly ($P < 0.01$) in the camels at 15 to 20 years old as compared to that at 5 to 10 and 10 to 15 years old. Similarly, the percentage of sperm abnormalities showed significantly ($P<0.01$) higher in the camels at 10 to 15 years than 5 to 10 years old (Table 2). Similar trends were reported *(32,34)* who showed that, the lowest value of the percentage of sperm abnormalities was recorded in the camels at 5 to 10 years and the highest value was recorded with the in the camels at 15 to 20 years old. ***Tingari et al. (38)*** concluded that testosterone hormone producing cells reflecting in a bad semen characteristics produced by aged male camels. ***Hemeida et al. (39)*** also reported that incidence of testicular degeneration increased 10.9 – 15.0% in camels at 4 to 15 years to 25% at 5 to 20 years of age and to 50% in senile (over 20 years) camels and consequently, sperm production rates decline (32.2 – 92.4%).

3.8. Percentage of acrosomal damage (%)

The percentage of acrosomal damage of spermatozoa was increased significantly ($P < 0.01$) in the camels at 15 to 20 years as compared to that at 5 to 10 and 10 to 15 years old. Similarly, the percentage of acrosomal damage showed significantly ($P<0.01$) higher in the camels at 10 to 15 years than 5 to 10 years old (Table 2). ***Zeidan et al. (35)*** found that, the lowest value of the percentage of acrosomal damage of spermatozoa was recorded in the male dromedary camels at 6 to 11 years and the highest value was recorded in the camels at 3 to 5 years of age. Similar trends were recorded by *(32)*.

3.9. Sperm-cell concentration ($x10^6$/ml)

The sperm-cell concentration in the camels at 5 to 10 and 10 to 15 years was significantly ($P < 0.01$) higher than that at 15 to 20 years old. However, sperm-cell concentration was insignificantly higher in the camels at 5 to 10 years than camels at 10 to 15 years old (Table 2). The highest value of sperm-cell concentration was recorded in the dromedary camels at over 5 to 10 years and the lowest value was recorded at 2.5 to 5 years old *(32,35)*.

3.10. Total-sperm output ($x10^6$/ejaculate)

The total-sperm output in the camels at 5 to and 10 to15 years was significantly ($P < 0.01$) higher than that at 15 to 20 years old. However, total-sperm output was insignificantly higher of the 5 to 10 years than 10 to 15 years old (Table 2). These results are in agreement with those reported by *(34)* who found that, the highest value of total-sperm output was recorded in the male dromedary camels at over 5 to 10 years and the lowest value was recorded at 2.5 to 5 years old.

Generally, the cause of lowered reproductive efficiency in the males with advancing age is not known. It may be due to hormonal imbalance or deficiency, which contributes to reduce and abnormal spermatogenesis processes.

4. Blood serum components

4.1.Total protein concentration (gm/100 ml)

Data presented in Table 3 showed that total serum protein concentration was significantly ($P < 0.01$) higher in the camels at 5 to 10 years than 15 to 20 years old. However, the camels at 5 to 10 years was insignificantly higher in total serum protein concentration than 10 to 15 years old. Similarly, total serum protein concentration was insignificantly higher in the camels at 10 to 15 years than 15 to 20 years old. Such decrease in serum total protein concentration with older age of camels was attributed to the difference in metabolic activity and total body water content in juvenile, as compared to older animals, in addition may be attributed to stress factors and differences in their rates of protein synthesis, catabolism and / or distribution with the body *(40)*. Moreover, the decrease in total protein with advancement of age may attributed to the increased levels of cortisol. Since, there are some evidence that the increased concentration of cortisol causes

catabolism of protein leading to negative balance and increased urinary elimination of nitrogen *(41)*. Finally, the drastic reduction in total serum protein may be attributed also to the decrease in serum albumin levels, hence to decrease in serum total protein is always due to a low albumin levels *(42)*. Similar trend was reported by *(43)*. In addition, ***Ahmadi (31)*** showed that, the total serum protein concentration of the camels at 3 to 5 years was insignificantly higher than 6 to 11 or 12 to 20 years of age.

4.2. Albumin and globulin concentrations (gm/100 ml)

Serum albumin and globulin concentrations were insignificantly higher in the camels at 5 to 10 years than 10 to 15 and 15 to 20 years old and insignificantly higher in the camels at 10 to 15 years than 15 to 20 years old (Table 3). These results are in agreement with the previously results *(32,43)*. The highly significant decrease in the serum albumin concentration in the present study was followed by a compensatory increase in the β globulin levels . ***Abdou et al (44)*** stated that globulins appears in the usual pattern as α, β and γ subfractions. On the other hand, ***Husseini et al. (45)*** cited that total globulins tend to be more stable than albumin although elevations were occasionally recorded in calf camels during the first years of life.

4.3.Total cholesterol concentration (mg/100 ml)

Total serum cholesterol concentration was significantly (P<0.01) lower in the camels at 5 to 10 years than 10 to 15 and 15 to 20 years old. The total serum cholesterol concentration was significantly (P<0.01) higher in the camels at 10 to 15 years than 15 to 20 years old (Table 3). Total cholesterol concentration in the serum markedly depends on the environmental and seasonal variation. ***Abd El-Aziem (46)*** showed that, the highest value of cholesterol concentration was recorded in the male dromedary camels at 5 to 10 years and the lowest value was recorded in the camels at 1 to 4 years old. Similarly, ***Helal (43)*** showed that the young camels have the lowest levels of the total serum cholesterol in comparison with the adult camels. Although it has been proved that serum cholesterol reaches its maximum concentration at one year old *(47)*.

4.4. Enzymatic activities (U/L)

Table 3, showed that serum aspartate-aminotransferase (AST), alanine-aminotransferase (ALT) and alkaline phosphatase (ALP) enzymes activities were significantly (P < 0.01) increased in the camels at 15 to 20 years as compared to that at 5 to 10 and 10 to 15 years old. However, serum AST, ALT and ALP enzymes activities were significantly (P < 0.01) lower in the camels at 5 to 10 years than 10 to 15 years old. Similar trends were recorded by *(32)*. While, ***Ahmadi (31)*** showed that, AST, ALT and ALP enzymes activities of the camels at 3 to 5 years were significantly higher than that at 6 to 11 or 12 to 20 years old. These results may be attributed to the decrease of metabolism and anabolism at older of camel which attachment increase of enzymes transaminase.

Generally, the blood enzymes are easily and often influenced by the external environment including feeding practices, type of shelter and many other aspects of herd management, since they are ultimately related to metabolism. In addition, it is also important to control carefully all experimental conditions, especially environmental ones, when measuring the enzyme activity in any animal *(48)*.

4.5. Minerals concentration (mg/100 ml)

Data presented in Table 3 showed that serum sodium concentration was significantly (P < 0.01) lower in the camels at 5 to 10 years than 10 to 15 and 15 to 20 years old. ***Ahmadi (49)*** found that the level of sodium concentration was increased at over 5 to 8 years old. Similarly, *(31)* found that, sodium concentration in the male dromedary camels was significantly higher at 6 to 11 years than 3 to 5 or 12 to 20 years old. Similar trends was recorded by *(32)*. Serum calcium and potassium concentrations were significantly (P < 0.01) lower in the camels at 15 to 20 years than that at 5 to 10 years old. Similarly, calcium and potassium concentrations were in significantly higher in the camels at 5to 10

than 10 to 15 yearsold and insignificantly higher in the camels at 10 to 15 than 15 to 20 years old.

Serum inorganic phosphorus and zinc concentrations were significantly (P<0.01) higher of the camels at 5 to 10 years than 10 to 15 and 15 to 20 years old. Similarly, inorganic phosphorus and zinc concentrations were significantly (P<0.01) higher of the camels at 10 to 15 years than 15 to 20 years old (Table 3). Similar trend was reported by *(32)* who found that, the highest value of inorganic phosphorus concentration of the dromedary camels was recorded in the camels at 6 to 11 years and the lowest value was recorded at 12 to 20 years old. ***Abd El-Azim (46)*** confirmed that, the highest value of zinc concentration was recorded in the male dromedary camels at 5 to 10 years and the lowest value was recorded in the camels at 1 to 4 years old. Similar trends were reported by *(32,50)*.

4.6. Testosterone concentration (ng/ 100ml)

Table 3 showed that, serum testosterone concentration was significantly (P<0.01) higher in the camels at 5 to 10 years than 10 to 15 and 15 to 20 years old. Similarly, testosterone concentration showed significantly (P<0.01) higher in the camels at 10 to 15 years than 15 to 20 years old. The highest (P<0.01) value of serum testosterone concentration was recorded of the camels at 5 to 10 years and the lowest value was recorded in the camels at 15 to 20 years old. Similar trend was reported by *(34,51,52)* these found that, the highest value of testosterone concentration was recorded in the male camels at over 5 to 10 years and the lowest value was recorded in the camels at 2.5 to 5 years old. Similarly, *(31)* showed that, the highest value of testosterone concentration was recorded in the male dromedary camels at 6 to 11 years and the lowest value was recorded in the camels at 3 to 5 years old. It is generally considered the steroid secretion by the testis is increased with age until eleven years old camel and then decrease *(33)*. These results may be due to the relative activity of several enzymes associated with testosterone synthesis and secretion in the adult than older camels *(53)*.

In conclusion, the male dromedary camels (*Camelus dromedarius*) at 5 to 10 years of age showed better testicular activity, copulation time, semen characteristics and blood components than that camels at 10 to 15 or 15 to 20 years of age. Therefore, it would be recommended to use the male dromedary camels at the age of 5 to 10 years for breeding as it reaches its maximum reproductive efficiency.

Table 1. Effects of the different ages of the male dromedary camels on testes weight, testicular volume, scrotal circumference and testes tone firmer score.

Testicular measurements	Age (years)		
	5-10	10-15	15-20
Testes weight (gm)	125.38 ± 12.65^{b}	196.74 ± 13.91^{a}	179.24 ± 15.38^{a}
Testicular volume (cm^3)	116.21 ± 2.67^{c}	130.43 ± 2.90^{a}	122.38 ± 2.79^{b}
Scrotal circumference (cm)	26.12 ± 0.74^{c}	30.74 ± 0.55^{a}	29.37 ± 0.67^{b}
Testes tone firmer (score)	6.20 ± 0.17^{a}	6.13 ± 0.19^{a}	5.87 ± 0.25^{a}

Means bearing different letters within the same classification, differ significantly (P<0.05).

Table 2. Effects of the different ages of the male dromedary camels on copulation time and semen characteristics.

Items	Age (years)		
	5-10	10-15	15-20
Copulation time (minutes)	5.92±0.46^{a}	5.45±0.32^{a}	4.83±0.22^{b}
Semen colour	Creamy white	Creamy white	Milky white
Semen consistency	Viscous	Viscous	Semi-viscous
Hydrogen-ion concentration (pH)	7.52±0.10^{a}	7.63±0.12^{a}	7.85±0.15^{a}
Semen-ejaculate volume (ml)	6.45±0.32^{a}	5.76±0.32^{ab}	5.24±0.18^{b}
Sperm motility (%)	68.42±2.21^{a}	65.27±2.62^{a}	59.13±2.75^{b}
Dead spermatozoa (%)	22.17±1.72^{c}	26.53±1.62^{b}	31.20±1.24^{a}
Sperm abnormalities (%)	12.14±1.67^{c}	15.87±1.45^{b}	24.13±1.16^{a}
Acrosomal damage (%)	4.18±0.68^{c}	5.58±0.69^{b}	11.7±1.19^{a}
Sperm–cell concentration (x10^{6}/ml)	328.64±9.67^{a}	320.53±10.31^{a}	274.20±8.18^{b}
Total-sperm output (x10^{6}/ ejaculate)	2119.73±28.16^{a}	1846.25±35.19^{a}	1436.81±37.25^{b}

Means bearing different letters within the same classification, differ significantly (P<0.05).

Table 3. Effects of the different ages of the male dromedary camels on some blood serum components.

Items	Age (years)		
	5-10	10-15	15-20
Total protein (gm/100ml)	7.49±0.29^{a}	6.87±0.03^{ab}	6.58±0.48^{b}
Albumin (gm/100ml)	4.63±0.36^{a}	4.36±0.45^{a}	4.15±0.31^{a}
Globulin (gm/100ml)	2.86±0.50^{a}	2.51±0.29^{a}	2.43±0.47^{a}
Total cholesterol (mg/100ml)	51.43±1.50^{c}	63.05±3.83^{a}	56.96±2.98^{b}
Aspartate-aminotransferase (U/L)	34.86±1.32^{c}	36.75±0.85^{b}	42.75±1.11^{a}
Alanine-aminotransferase (U/L)	40.23±1.32^{c}	43.25±1.38^{b}	46.75±1.65^{a}
Alkaline phosphatase (U/L)	17.86±1.20^{c}	26.25±1.11^{b}	41.25±1.25^{a}
Sodium (mg/100ml)	65.81±8.64^{c}	93.65±15.6^{b}	114.05±12.75^{a}
Calcium (mg/100ml)	10.65±0.98^{a}	9.88±0.29^{ab}	8.87±0.37^{b}
Potassium (mg/100ml)	13.15±0.74^{a}	12.01±0.50^{ab}	10.96±0.46^{b}
Inorganic phosphorus (mg/100ml)	6.85±0.24^{a}	6.04±0.16^{b}	5.18±0.25^{c}
Zinc (µg/100ml)	126.33±3.71^{a}	115.98±3.25^{b}	102.10±3.35^{c}
Testosterone concentration (ng/ 100ml)	4.88±0.35^{a}	3.79±0.42^{b}	2.28±0.28^{c}

Means bearing different letters within the same classification, differ significantly (P<0.05).

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الملخص العربى

تأثير الأعمار المختلفة على القياسات الخصوية ، فترة الإيلاج، صفات السائل المنوى ومكونات الدم فى الإبل العربية وحيدة السنام

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أجريت هذه الدراسة على عدد ٤٥ ذكر إبل وحيدة السنام بمتوسط الوزن من ٥٠٠-٦٠٠كجم قسمت هذه الذكور إلى ثلاثة مجاميع طبقاً لاعمارها كالتالى من ٥-١٠ ، أكثر من ١٠ إلى ١٥ ، أكثر من ١٥-٢٠ سنة فى المجموعة الأولى والثانية والثالثة على التوالى . تم دراسة القياسات الخصوية ، فترة الايلاج ، صفات السائل المنوى ، بالإضافة إلى بعض مكونات الدم .

وقد أوضحت النتائج أن هناك زيادة فى وزن الخصية (جم) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ١٠ – ١٥ و ١٥ – ٢٠ سنة بينما انخفض ملمس كيس الصفن مقارنة بالإبل عند عمر ٥ – ١٠ سنوات. زيادة حجم الخصية (سم^{٣}) ومحيط كيس الصفن (سم) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ١٠-١٥ سنة عن ذكور الإبل عند عمر ٥ – ١٠ و ١٥ – ٢٠ سنة. زيادة الوقت اللازم لقذف السائل المنوى أو الإيلاج (دقيقة) معنوياً (على مستوى ٠,٠٥) فى ذكور الإبل عند عمر ٥-١٠ و ١٠-١٥ سنة عن الذكور عند عمر ١٥-٢٠ سنة. كان لون السائل المنوى أبيض كريمى فى ذكور الإبل عند عمر ٥-١٠ و ١٠-١٥ سنة بينما كان لون السائل المنوى أبيض بلون اللبن فى ذكور الإبل عند عمر من ١٥-٢٠ سنة. زيادة لزوجة السائل المنوى فى ذكور الإبل عند عمر ٥-١٠ و ١٠-١٥ ، بينما كان السائل المنوى شبه لزج فى ذكور الإبل عند عمر ١٥ – ٢٠ سنة. زيادة تركيز أيون

الهيدروجين (pH) للسائل المنوى بدرجة غير معنوية فى ذكور الإبل عند عمر ١٥-٢٠ سنة عن عمر ٥-١٠ و ١٠ – ١٥ سنة مع زيادة تركيز الصوديوم (ملجم/١٠٠ مللى) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ١٥-٢٠ سنة عن ذكور الإبل عند عمر ٥-١٠ و ١٠-١٥ سنة. زيادة حجم قذفة السائل المنوى (مللى) وتركيز البروتين الكلى (ملجم / ١٠٠ مل) والكالسيوم والبوتاسيوم (ملجم / ١٠٠ مل) فى ذكور الإبل عند عمر ٥-١٠ سنة معنوياً (على مستوى ٠,٥ ، أو ٠,١) عن ذكور الإبل عند عمر ١٥ – ٢٠ سنة ، بينما كانت هذه الزيادة غير معنوية فى ذكور الإبل عند عمر ٥ – ١٠ سنة. زيادة النسبة المئوية لحيوية الحيوانات المنوية (%) ، تركيز الحيوانات المنوية (× ١٠ ^{٦} /مللى) وحجم القذفة الكلية للحيوانات المنوية (× ١٠ ^{٦} / قذفة) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ٥-١٠ و ١٠-١٥ سنة عن ذكور الإبل عن عمر ١٥-٢٠ سنة مع انخفاض النسبة المئوية للحيوانات المنوية الميتة والشاذة وشواذ الأكروسوم (%) معنوياً (على مستوى٠,٠٥ أو ٠,٠١) فى ذكور الإبل عند عمر ٥ – ١٠ و ١٠ - ١٥ سنة عن عمر ١٥ – ٢٠ سنة. انخفاض تركيز الألبيومين والجلوبيولين (جم / ١٠٠ مللى) بدرجة غير معنوية فى ذكور الإبل عند عمر ١٥-٢٠ عن ذكور الإبل عند عمر ٥-١٠ أو ١٠-١٥ سنة. زيادة تركيز الكوليسترول الكلى (ملجم/١٠٠ مللى) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ١٠-١٥ عن ذكور الإبل عند عمر ٥ - ١٠ أو ١٥-٢٠ سنة. زيادة النشاط الأنزيمى لكلا من إنزيم AST ، ALT ، ALP (وحدة/لتر) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ١٥-٢٠ سنة عن ذكور الإبل عند عمر ٥-١٠ أو ١٠-١٥ سنة ، بينما انخفض النشاط الإنزيمى لكلا من إنزيم AST, ALT, ALP معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ٥ – ١٠ سنة عن ذكور الإبل عند عمر ١٠ – ١٥ سنة. زيادة تركيز الفوسفور الغير عضوى (ملجم/ ١٠٠ مللى) والزنك (ميكروجرام/١٠٠ مللى) وهرمون التستسترون (نانو جرام / ١٠٠ مللى) معنوياً (على مستوى ٠,٠١) فى ذكور الإبل عند عمر ٥ – ١٠ سنة عن ذكور الإبل عند عمر ١٠ – ١٥ و ١٥ – ٢٠ سنة.