J. Animal and Poultry Prod., Mansoura Univ., Vol. 5 (9): 525-536, 2014

RELATIONSHIP BETWEEN FERTILITY AND SCROTAL-TESTICULAR ULTRASONOGRAMS IN YOUNG EGYPTIAN BUFFALO BULLS

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ABSTRACT

The present study aimed to evaluate some scrotal-testicular ultrasonography measurements in relation with semen quality of buffalo bulls at early ages. A total of 12 buffalo bull calves having 140-160 kg live body weight and aged 11-17 months were used in this study. Three ultrasonography examinations were performed at four age categories (11, 13, 15 and 17 mo) to estimate scrotal circumference (SC) and thickness of testicular mediastinum (MS) using B-mode ultrasound scanner. The testicular ultrasonograms were analyzed with the ultrasound machine using the spot metering technique, then mean pixel intensity values (PV, scale: 0-255) was calculated. Semen was collected at the same age categories and evaluated for ejaculate volume (EV), and percentage of mass motility (MM), dead sperm (DS) and abnormal sperm (AS) as well as sperm concentration (CN), then total sperm output (TSO) was calculated. Correlation coefficients for ultrasonography measurements and semen parameters were calculated. Results showed that SC, MS and PV were not affected significantly by age category, although there was a tendency of increase in SC and MS, and reduction in PV by increasing age category. EV and percentage of MM, DS and AS increased ($P<0.05$) by increasing age category, but all changes were significant ($P<0.05$) between 11 and 13 mo of age. SN showed an opposite trend of change, while TSO was not affected significantly by age category. There were insignificant differences in semen quality of bull calves with SC of ≤21or 22-30 cm, while semen quality was affected by both MS and PV. Bull calves having MS of >2 mm and PV of >141had better semen quality than those with ≤2 mm and ≤140 as MS and PV, respectively ($P>0.05$). The strongest correlation was positive between age and pixel value ($r = 0.776$, $P<0.01$).

Based on the obtained results in the current study, it would be valuable to evidence the relationship between scrotal-testicular ultrasonography examination and future fertility based on developmental parameters measured in the young buffalo bull calves at early postpubertal ages.

Keywords: Buffalo calves, ultrasonography, pixel intensity, semen quality.

NTROSUCTION

Bulls are usually examined for breeding soundness before purchase or use. In order for the veterinarians to identify pathological conditions, the normal architecture of the testes and accessory sex glands need to be elucidated (McGowan *et al*., 2002). It would be valuable to predict age at puberty and future fertility based on developmental parameters measured in the young calf. The development of the reproductive tract in bulls was studied previously by measuring scrotal circumference (Jimenez-Severiano, 2002). At the same time, scrotal and testicular measurements have been used to predict sperm production and semen quality (Kastelic *et al*., 2001).

Diagnostic ultrasonography of the testes has no effect on seminal quality or on sperm production (Coulter and Bailey, 1988), although the ultrasonography anatomy of the bull testis has been reported by Griffin and Ginther (1992). Ultrasonography has not been widely used as an adjunct to the standard breeding soundness examination. However, Powe *et al*. (1988) reported that ultrasound examination of the testes has proven to be a valuable, non-invasive technique for evaluation of testicular pathology in bulls.

It was postulated that there may be an association between ultrasonography testicular echo-texture and both seminal quality and sperm production. Image analysis of ultrasonograms can provide substantial information regarding the function and structure of tissues (Chandolia *et al*., 1997). An ultrasonogram is composed of an array of picture elements (pixels), with each pixel representing a determined tissue density that is displayed in a range of shades of gray (ranging from white to black). High-resolution ultrasonograms are necessary for accurate detection of extremely small variations in tissue density that can be neither appreciated nor measured by the human eye (Chandolia *et al*., 1997).

The present study aimed to evaluate scrotal circumference and pixel intensity of the testis in relation with semen quality of buffalo bulls at early ages to predict fertility before purchase or use.

MATERIALS AND METHODS

This study took place at Animal Production Experimental Station, Mehallet Mousa, belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture, in co-operation with Animal Production Department, Faculty of Agriculture, Mansoura University.

Animals:

A total of 12 buffalo bull calves having 140-160 kg live body weight and aged 11-17 months were used in this study. All animals were proved to be free from tuberculosis, brucellosis, trichomonas and vibriosis. A special attention was paid to the general health of these animals, which were examined regularly for external as well as internal parasites. Clinical examination of the external genitalia and accessory organs of these calves showed no abnormality and revealed their soundness.

Feeding system and management:

Throughout the experimental period, bull calves were fed formulated diets on the basis of recommendation of Animal Production Research Institute for buffalo bull calves requirements. Bull calves were housed individually under semi-open sheds. Feeds were given individually to all bull calves at 8 a.m. and 3 p.m., while water was available at all day times.

Experimental procedures:

Throughout an experimental period, three ultrasonography examinations were performed at 11, 13, 15 and 17 months of age to estimate scrotal circumference and thickness of testicular mediastinum using B-mode ultrasound scanner (ESAOEE Oie Medical Equila Pro Vet+Probe 6.0 /8.0

Mhz LA Rectal Veterinary Transducer) connected to a 8.0 MHz linear transducer. The ultrasound setting (focus, gains, brightness and contrast) was standardized. Gel was used as a coupling material between the transducer and the scrotum and minimum pressure was applied to obtain the image. Both testes of each bull calf were examined by placing the transducer vertically on the caudal aspects of the scrotum. Frozen images included visualization of the mediastinum in order to have an image across the middle of the testis, then thickness of the mediastinum was recorded. Ultrasonograms were analyzed with the ultrasound machine using the spot metering technique (Pierson and Adams, 1995) in two 1 cm 3 spots selected approximately 1 cm above the mediastinum and approximately 2 cm from the edge of the image. The mean pixel-intensity (scale: 0-255) from two spots of two tests was calculated.

Semen collection:

Semen was collected by means of an artificial vagina set up at optimal conditions to induce a good ejaculatory thrust. Buffalo bull was used as a teaser at the time of semen collection at 11, 13, 15 and 17 months of age. One false mount had been always allowed before collection of the first ejaculates. Two consecutive ejaculates with 5-10 minutes intervals were obtained from each bull calf on each day of collection.

Semen was collected once/week for one month early in the morning (7 a.m.). Immediately after collection, the ejaculates were transferred to the laboratory and were placed in a water bath at 37°C and care was taken to avoid exposure of the semen to any unfavorable conditions during or after collection.

Semen evaluation:

After recording the ejaculate volume, semen was evaluated for the percentage of mass motility at hot stage (37°C) microscope. A smear from diluted (1:1) semen was made on a glass slide and was stained by eosin (1.67%) and nigrosin (10%) mixture stain to determine percentage of live (Hackett and Macpherson, 1965) and abnormal (Blom, 1983) spermatozoa. Sperm cell concentration was determined by direct cell count using a microscope (x 200) and a Neubauer Heamocytometer. Total sperm output/ejaculate (TSOP) was calculated by multiplying sperm cell concentration/ml (SCC) by ejaculate volume (EV) as the following:

$$TSOP\ (x\ 10^6/ejaculate) = EV\ (ml) \times SCC\ (x\ 10^6/ml)$$

Statistical analysis:

The obtained results were statistically analyzed by the methods of least square analysis of variance using the general linear model procedures (GLMP) of SAS (2004). Duncan multiple range test was used to test the differences among means (Duncan, 1955). Correlation analysis was carried out using computer programme of SAS (2004). The 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.

RESULTS AND DISCUSSION

Ultrasonography examination at different age categories:

Data in Table (1) revealed that ultrasonography measurements including scrotal circumference, mediastinum thickness and pixel intensity value of the testes did not differ significantly as affected by age category, although there was a tendency of increase in scrotal circumference and mediastinum thickness, and reduction in pixel values by increasing age category. Such results my indicate a negative relationship between pixel value and each of scrotal circumference and mediastinum thickness by increasing age of bull calves.

Table (1): Mean and standard error of scrotal circumference, mediastinum thickness and testicular pixel value of calves at different age categories.

Age category	Scrotal circumference (cm)	Diameter of mediastinum (mm)	Pixel intensity
11 months	20.1±1.86	2.60±0.42	141.9±7.30
	20.1±1.92	2.66±0.53	140.5±5.74
	18.8±1.95	2.72±0.32	132.2±4.79
Mean	18.7±1.89	2.66±0.41	148.2±6.45
12-13 months	19.9±2.04	2.73±0.64	128.3±3.02
	20.2±2.18	2.74±0.52	128.9±5.15
	20.8±2.30	2.75±0.47	128.2±6.28
Mean	20.3±2.20	2.74±0.58	128.5±4.87
14-15 months	20.3±2.14	2.76±0.17	124.8±4.37
	21.0±1.73	2.80±0.26	126.7±3.76
	20.0±1.80	2.81±0.24	124.1±5.05
Mean	21.4±1.98	2.79±0.21	125.2±4.21
16-17 months	21.5±1.80	2.85±0.45	116.5±5.35
	22.3±1.97	2.86±0.43	119.3±4.50
	21.0±2.25	2.87±0.39	106.5±3.80
Mean	21.6±2.01	2.86±0.41	114.1±5.43

Physical semen characteristics at different age categories:

Data in Table (2) show that ejaculate volume, and percentage of mass motility, dead sperm and abnormal sperm significantly ($P<0.05$) increased by increasing age category. It is of interest to note that all changes were significant ($P<0.05$) almost between 11 and 13 months of age. However, all previous characteristics insignificantly increased from 13 up to 17 months of age. Meanwhile, sperm cell concentration showed an opposite trend of change. However, total sperm output was not affected significantly by age category.

In Egyptian buffalo bulls, the overall mean of ejaculate volume was 2.9 ml (Osman, 1988), 2.3 ml (El-Keraby *et al.,* 1995) or 3.5 ml (Ibrahim, 2003). Variation in semen volume was reported in buffalo bulls can be due to differences in age of bulls, being higher in adult and old bulls than in young buffalo bulls (Younis, 1996). However, Javed *et al.* (2000) observed no significant difference in the volume of semen between buffalo bulls of various age groups.

Table (2): Mean and standard error of physical semen characteristics of bull calves at different age categories.

Age category	Physical semen characteristics				Sperm concentration (x 10^9)	
	Ejac. volume (ml)	Mass motility (%)	Dead sperm (%)	normal sperm (%	Per ml	Per ejaculate
11 months	2.66±0.46	59.16±3.00	11.50±1.53	6.33±0.33	2.02±0.18	5.37±1.52
	2.91±0.21	60.83±3.74	11.83±0.44	6.33±1.80	2.00±0.16	5.82±0.75
	3.00±0.21	62.50±1.82	12.16±1.72	7.50±0.71	1.98±0.27	5.94±0.32
Mean	2.68±0.34^{b}	60.83±2.48^{c}	11.85±1.04^{b}	6.72±1.09^{b}	2.00±0.21^{a}	5.71±1.09
12-13 months	3.01±0.31	68.33±2.38	13.00±1.31	9.16±1.01	1.72±0.28	5.18±0.77
	3.03±0.23	69.16±1.19	13.50±1.20	9.16±1.10	1.71±0.26	5.18±0.76
	3.15±0.30	72.50±3.92	14.16±1.44	9.33±1.56	1.69±0.22	5.32±0.51
Mean	3.07±0.28^{a}	70.00±2.83^{b}	13.55±1.35^{a}	9.21±1.15^{a}	1.71±0.24^{ab}	5.23±0.71
14-15 months	3.25±0.13	74.16±2.14	14.16±1.68	9.50±1.25	1.61±0.11	5.23±1.51
	3.28±0.23	75.80±3.33	14.33±1.30	10.00±1.00	1.60±0.24	5.25±1.22
	3.31±0.23	77.50±2.14	15.16±1.30	10.16±1.30	1.55±0.13	5.13±1.44
Mean	3.28±0.21^{a}	75.82±2.89^{ab}	14.55±1.54^{a}	9.89±1.19^{a}	1.59±0.18^{ab}	5.20±1.47
16-17 months	3.48±0.24	77.50±2.14	15.50±1.23	10.33±1.28	1.50±0.32	5.22±1.02
	3.60±0.21	80.00±1.53	16.50±1.36	10.33±2.20	1.48±0.16	5.33±1.14
	3.80±0.37	80.83±2.38	17.33±1.14	11.33±1.08	1.32±0.26	5.02±1.62
Mean	3.63±0.28^{a}	79.44±2.22^{a}	16.44±1.42^{a}	10.66±1.89^{a}	1.43±0.29^{b}	5.19±1.34

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

Sperm motility has been considered as a major criterion in the assessment of male fertility (Lena Malmgren, 1997). Several authors reported that mass motility was higher (P<0.05) in adult than in older (Javed *et al.,* 2000) and younger (Younis, 1996). The higher mass motility in adult bulls was probably due to higher sperm concentration in these bulls, and low sperm abnormalities (Dhami and Kodagali, 1988).

Fitzpatrick *et al*. (2002) reported that bulls with <50% normal spermatozoa sired few calves while bulls with the highest calf output possessed >70% normal spermatozoa. Disturbances in spermatogenesis give rise to morphological sperm abnormalities. Sperm morphology is an important parameter for assessing semen quality (Hancock, 1952). In buffalo bulls, the sperm abnormal percentage was 11.67% at 14 years of age (Sajjad *et al,* 2007), ranging 6.1-7.9% (El-Azab, 1980), 14.6-16.9% (Osman, 1988) and 10.3-15.5% (El-Kishk, 2003) and averaged 11.08% (El-Sherbieny, 2004).

In Egyptian buffalo bulls, sperm cell concentration was 809.2 X 10^6 sperm/ml (Osman (1988), 1088 x 10^6 sperm/ml (El-Keraby *et al*., 1995), 1146 x10^6 sperm/ml (Abdel-Khalek *et al*., 2000) or 1.5 x10^9/ml (Ibrahim, 2003). Sperm concentration was lower (P<0.05) in old than in young buffalo bulls (Javed *et al.,* 2000). However, Younis (1996) reported insignificant differences in sperm concentration between bulls of young, adult and old ages. The lower sperm concentration and mass activity in old bulls could be due to senility (Javed *et al.,* 2000).

The best quality of semen from buffalo bulls has been obtained at 3-4 years of age. It has further been postulated that the age of the bull significantly affect semen characteristics including ejaculatory volume, sperm motility and sperm cell concentration. Variations in semen quality, however,

exist even in the same age at different localities (Saeed, 1988). At the time of puberty in buffalo bulls, sperm cell concentration of buffalo bulls are 70 x 10^6/ml (Ahmad *et al.,* 1989).

In comparing these results with ultrasonography measurements (Table 1), physical semen characteristics as indicator of semen quality, it could be suggested that the relationship of semen quality was positive with both scrotal circumference and mediastinum thickness and negative with pixel value of the testes.

Semen quality as affected by ultrasonography measurements:

Results presented in Table (3) showed insignificant differences in semen quality of bull calves as affected by different categories of scrotal circumference or mediastinum thickness, which may indicate no important role of both measurements at all ages studied in prediction of semen quality. On the other hand, semen quality was affected by pixel value. Bull calves having pixel value of >141 had better semen quality, in term of total sperm output, than those with ≤140 pixel value.

Scrotal circumference is often linked with seminal characteristics. Coe (1999) reviewed results from 1173 beef bulls (<15 mo of age). Among bulls with >30 cm scrotal circumference (SC) only 27% had <70% normal spermatozoa, whereas 70% of the bulls with <30 cm scrotal circumference produced <70% normal spermatozoa.

It would be valuable to predict age at puberty and future fertility based on developmental parameters measured in the young bull calf. The development of the reproductive tract in bulls was studied previously by measuring scrotal circumference (SC) (Jimenez-Severiano, 2002). At the same time, scrotal measurements have been used to predict sperm production and semen quality (Kastelic *et al*., 2001).

Scrotal circumference is an indirect measurement of testicular mass and there was significant increase in scrotal circumference starting from the third month till 24 months of age (Aravindakshan *et al*., 2000).

Scrotal circumference was considered as an accurate predictor of testicular size (Gabor *et al*., 1995), but did not correlate with ultrasonic measurement of testicles (Cartee *et al*., 1989). Also, there is a correlation between scrotal circumference and semen characteristics of Nili-Ravi buffalo bulls. Correlation coefficient of scrotal circumference was (r=0.348) with semen volume (Sajjad *et al.,* 2007).

Scrotal circumference of Nili-Ravi buffalo bulls was 34.6±0.9 cm (Sajjad *et al,* 2007) which is comparable to young bulls with normal semen picture (Younis, 1996; Javed *et al.,* 1998). These findings indicated that increasing age has little effect on the scrotal circumference of buffalo bulls.

Diagnostic ultrasonography of the testes has no effect on seminal quality or on sperm production (Coulter and Bailey, 1988). Ultrasonography has not been widely used as an adjunct to the standard breeding soundness examination. However, there may be an association between ultrasonographic testicular echotexture and seminal quality and sperm production (Griffin and Ginther, 1992).

Kastelic *et al*. (2001) hypothesized that ultrasonography testicular echotexture is associated with seminal quality because spermatogenesis is extremely temperature sensitive.

Several studies in pre- and peri-pubertal bulls and rams have demonstrated that changes in ultrasonography attributes of the testicular parenchyma are closely related to the histo-morphological characteristics of seminiferous tubules (Evans *et al*, 1996) and the onset and efficiency of spermatogenesis (Evans *et al*., 1996; Arteaga et *al*., 2005; Aravindakshan *et al*., 2000).

Image analysis of ultrasonograms pixel–intensity can provide detailed information about tissue changes in different organs including the testis (Chandolia *et al*., 1997). Computerized analysis of digital ultrasonography images provides a sensitive and objective means of quantifying tissue echogenicity, with the ability to detect changes in structures previously only visualized by histology.

Table (3): Mean and standard error of physical semen characteristics of bull calves at different scrotal circumference, mediastinum thickness and pixel value categories.

Variable	Physical semen characteristics				Sperm concentration (x 10^9)	
	Ejac. volume (ml)	Mass motility (%)	Dead sperm (%)	Abnormal sperm (%)	Per ml	Per ejaculate
Scrotal circumference (cm):						
≤21	3.15±0.18	71.89±1.81	14.20±0.65	8.91±0.60	1.78±0.90	5.61±0.49
22-30	3.26±0.18	71.14±1.58	13.94±0.60	9.34±0.50	1.58±0.90	5.15±0.42
Mediastinum thickness (mm):						
≤2	3.06±0.13	70.08±1.65	13.51±0.53	9.50±0.54	1.73±0.10	5.29±0.38
>2	3.35±0.15	72.95±1.69	14.63±0.57	8.75±0.51	1.63±0.83	5.46±0.41
Pixel value:						
≤140	2.80±0.19^b	72.37±1.89	13.72±0.75	8.20±0.56^b	1.66±0.12	4.74±0.49^b
141-202	3.64±0.15^a	70.46±1.51	14.56±0.53	10.28±0.51^a	1.71±0.75	6.22±0.41^a

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

The differences in ultrasonography characteristics of the testes are due mainly to the histo-morphology of the seminiferous tubules. Positive correlations were demonstrated between both the area and the lumen area of seminiferous tubules, and numerical pixel values (Giffin *et al*., 2009). Previously, the size of the seminiferous tubules (i.e., outer and inner diameters) has been shown to be positively and significantly correlated with mean pixel values in pre- and peri-pubertal bull calves (Evans *et al*, 1996). In rams, the size of the seminiferous tubules, which were seen to occupy 67%–83%, may be primarily responsible for changes in testicular echogenicity (Giffin *et al*., 2009).

The changes in testicular echogenicity may also be a consequence of histo-physiological changes in the interstitial tissue, which contains abundant testosterone producing Leydig cells. The reason for a lack of consistent significant correlations after the removal of the tunica vaginalis is difficult to explain, but could be due to the interruption of ultrasonic wave

projection by the high degree of vascularization of the tunica albuginea (Wrobel, 1998).

The mediastinum showed middle hyperechogenic spot in cross-section image. It also showed linear structure at the centre of the testicle in case of longitudinal image (Pechman and Eilts, 1987). Width of mediastinum was found to be varied with age and breed differences. After 12 months of age, the mediastinum width showed significant increase which is correlated with the increasing testicular width in disagreement with Eilts and Pechman (1988).

Correlation coefficients:

Correlation coefficients presented in Table (4) revealed significant positive correlation between age category and all ultrasonography measurements and semen quality, except that of mass motility and sperm cell concentration, which correlated negatively but insignificantly with age category. The strongest correlation was significantly (P<0.01) positive between age and pixel value (r = 0.776) indicating gradual increase in pixel values of testes of bull calves with age progress.

The correlation coefficients among all ultrasonography measurements were highly significant and positive. The strongest correlation was found between mediastinum and scrotal circumference (r = 0.890, P<0.01), while the correlation coefficient was 0.394 between pixel value and scrotal circumference and 0.297 between pixel value and mediastinum thickness (Table 4).

Table (4):Correlations coefficients among different traits in study

Item	Age	SC	MS	PV	EV	MM	DS	AS	SN
Scrotal circumference (SC)	0.406**								
Mediastinum thickness (MS)	0.360**	0.890**							
Pixel value (PV)	0.776**	0.394**	0.297**						
Ejaculate volume (EV)	0.509**	0.107	0.058	0.430**					
Mass motility (MM)	-0.165	-0.114	-0.058	-0.122	-0.263*				
Dead sperm (DS)	0.208*	-0.016	-0.003	0.101	0.159	-0.071			
Abnormal sperm (AS)	0.216*	0.137	0.101	0.302**	0.049	-0.066	0.028		
Sperm concentration (SN)	-0.027	-0.129	-0.165	0.014	0.101	-0.039	0.052	-0.043	
Total sperm output (TSO)	0.305**	-0.062	-0.111	0.278**	0.743**	0.147	0.158	0.049	0.705**

*** Significant at P<0.05. ** Significant at P<0.01.**

It is of interest to note that among ultrasonography only pixel value showed marked correlation with semen quality in term of significant and positive correlation with ejaculate volume (r = 0.430, P<0.01), abnormal sperm (r = 0.302, P<0.01) and total sperm output (r = 0.278, P<0.01, Table 4).

Additionally, the correlation coefficient of total sperm output was positively strong with each of ejaculate volume (r = 0.743, P<0.01) and sperm cell concentration (r = 0.705, P<0.01), while ejaculate volume negatively correlated with mass motility (r = -0.263, P<0.05, Table 4).

It has been well illustrated that there is a stronger relationship between sperm morphology and calf output than motility in multiple-sire pastures (Coulter and Kozub, 1989; Fitzpatrick *et al*., 2002; Whitworth *et al*.,

2002). Kastelic *et al*. (2001) noted that scrotal circumference was positively related to epididymal sperm reserves.

CONCLUSION

Based on the obtained results in the current study, it would be valuable to evidence the relationship between testicular ultrasonography, particularly pixel intensity values and future fertility based on developmental parameters measured in the young buffalo bulls at early postpubertal ages.

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العلاقة بين الخصوبة ومحيط الخصية بالسونار لطلائق الجاموس المصري الصغيرة العمر

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تهدف هذة الدراسة الى تقييم محيط كيس الصفن وكثافة البيكسل للخصية وعلاقتة بجودة السائل المنوى لطلائق الجاموس فى مراحل عمرية مبكرة للتنبؤ بالخصوبة قبل البيع او الاستخدام. استخدم فى هذة الدراسة ١٢ عجل جاموس وزن الجسم حى فى مدى ١٤٠-١٦٠ كجم والعمر فى مدى ١١-١٧ شهر. وتم فحص الطلائق اكلينيكيا للأعضاء التناسلية الخارجية والاعضاء المساعدة وكان ليس بها اى خلل او شواذ. التغذية والسكن لهذة العجول تحت ظروف واحدة . تم فحص العجول بجهاز الموجات فوق الصوتية ثلاث مرات خلال اربع مراحل عمرية ١١و ١٣ و١٥ و١٧ شهر لتقييم سمك ومحيط كيس الصفن والحبل الوسطى للخصية باستخدام جهاز السونار. وتم تحليل صور السونار ببرنامج تحليل الصورعلى الكومبيوتر.وتم حساب قيمة كثافة البيكسل عند مدى (. – ٢٥٥). تم جمع السائل المنوى وتقييمة (حجم القذفة- الحركة الجماعية- الاسبرمات الحية- الشواذ – والتركيز) وكذلك تم حساب حصيلة الاسبرمات الكلية. تم حساب معامل الارتباط والانحدار لقياسات السونار وصفات السائل المنوى. **وكانت النتائج المتحصل عليا كالتالى:-**

١- قياسات السونار (محيط كيس الصفن - سمك الحبل الوسطى للخصية وقيمة البيكسل) لم تتأثر معنويا عند المراحل العمرية المختلفة على الرغم من وجود اتجاه لزيادة محيط الخصية وسمك الحبل الوسطى للخصية ونقص فى البيكسل مع التقدم في العمر.
٢- زاد حجم القذفة ونسبة الحركة الجماعية والحيوانات المنويه الميتة والشاذه معنويا ($P<0.05$) بين ١١ و١٣ شهر من العمر. بينما كان تركيز الحيوانات المنويه عكس هذا الاتجاه ولم يتأثر العدد الكلى للحيوانات المنويه بدرجه معنوية بالمراحل العمرية.
٣- لم يكن هناك اختلافات معنوية فى جودة السائل المنوى للطلائق مع محيط الخصية أو سمك الحبل الوسطى للخصية وقيمة البيكسل للعجول .
٤- كان معامل الارتباط ايجابي بين كل من قياسات السونار مع جودة السائل المنوي وكان أعلى معاملات الأرتباط بين العمر وقيمة البيكسل ($r=0.776$) عند معنوية ($P<0.05$) .