

Ultrasonographic biometry of the ovaries and follicles in cyclic and non-cyclic kundhi buffalo



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Abstract Ultrasonographic and morpho-biometry of the ovaries and follicles of cyclic and non-cyclic Kundhi buffaloes was studied. The buffalos were measured for their left and right ovaries using ultrasonographic and morpho-biometry of the ovaries. The age of non-cyclic buffaloes was 10 ± 2.0 years, and cyclic buffaloes was 8.33 ± 1.87 years; body weight of non-cyclic Kundhi Buffaloes was 377.14 ± 52.19 kg and cyclic buffaloes was 380.77 ± 89.69 kg; the body condition score of non-cyclic buffaloes was 3.78 ± 0.395 and cyclic buffaloes was 4.25 ± 0.43 . Statistically, the differences for age and body condition score were significant ($P < 0.05$) and non-significant ($P > 0.05$) for body weight. The ultrasonographical biometry in the length of the left and right ovaries in Kundhi buffalo was 28.68 ± 4.80 and 31.44 ± 6.29 mm, 12.62 ± 2.20 and 12.61 ± 2.51 mm in width, 5.81 ± 1.11 and 5.94 ± 1.66 mm in thickness, 64.28 ± 10.40 and 71.73 ± 11.33 mm in circumference, and 2.61 ± 0.76 and 3.08 ± 0.75 cm² in volume, respectively. The differences in the length of the left and right ovaries, circumference, and volume were significant ($P < 0.05$) and non-significant ($P > 0.05$) for width and thickness. The morpho-biometry results indicated that the length of the left and right ovaries was 28.88 ± 5.30 and 30.31 ± 6.61 mm, 14.00 ± 1.83 and 14.00 ± 2.10 mm in width, 6.94 ± 1.12 and 7.06 ± 1.65 mm in thickness, 65.00 ± 7.75 and 68.44 ± 9.44 mm in circumference, and 5.88 ± 2.00 and 5.44 ± 1.63 gm in weight, respectively. The differences in the length, circumference, and weight of left and right ovaries were significant ($P < 0.05$) and non-significant ($P > 0.05$) for width and thickness of ovaries. The number of primary follicles on left and right ovaries was 1.00 ± 0.97 and 1.31 ± 1.08 , secondary was 3.31 ± 2.85 and 3.63 ± 3.01 , tertiary was 6.38 ± 1.59 and 6.81 ± 2.34 , circumference of follicle on the left and right ovaries was 17.58 ± 5.52 and 16.69 ± 4.20 mm, and volume of the follicle 0.24 ± 0.14 and 0.21 ± 0.10 cm². The differences in primary follicles, circumference of the follicle on the right and left ovaries were significant ($P < 0.05$) and non-significant ($P > 0.05$) for secondary, tertiary, and volume of follicles on left and right ovaries. The length ovaries in cyclic and non-cyclic Kundhi buffalo was 30.22 ± 6.85 and 29.89 ± 4.43 mm, ovaries 12.65 ± 1.68 and 12.57 ± 2.57 mm in width, 6.58 ± 1.61 and 5.58 ± 1.11 mm in thickness, 70.63 ± 13.06 and 65.38 ± 8.97 mm in circumference, 2.96 ± 0.79 and 2.72 ± 0.76 cm² in volume, 6.00 ± 2.06 and 5.31 ± 1.49 gm in weight, respectively. The number of primary follicles on ovaries of cyclic and non-cyclic Kundhi buffaloes was 2.31 ± 1.08 and 0, number of secondary was 5.25 ± 1.77 and 0, number of tertiary was 7.31 ± 1.69 and 3.06 ± 1.30 , 17.88 ± 4.93 and 12.30 ± 3.46 mm in circumference, and 0.25 ± 0.13 and 0.10 ± 0.08 cm² in volume, respectively. The differences in thickness, circumference (O), weight, number of primary, secondary, tertiary, circumference (F) and volume (F) of follicles of cyclic and non-cyclic Kundhi buffaloes were significant ($P < 0.05$) and non-significant ($P > 0.05$) for length and width of follicles of cyclic and non-cyclic buffaloes.

Keywords: ultrasonographic, ovaries, cyclic and non-cyclic, Kundhi Buffaloes, Tandojam

1. Introduction

Buffaloes make up 27.70% of the Pakistan livestock population and are the most important milk-producing animal, accounting for 67.21% of total milk production and 53.54% of total meat (Razzaque et al 2008). It also accounts for 26.64 % of the country's overall meat production (Razzaque et al 2008). The use of transrectal real-time ultrasonography to investigate bovine reproduction is a technical innovation that has transformed reproductive biology knowledge (Kumar et al 2008). The nature of complicated reproductive processes in cattle, such as ovarian follicular dynamics, corpus luteum function, and fetal development, has been elucidated thanks to new study information obtained by ultrasonic imaging (Kumar et al 2008).



Ultrasound was first used in the dairy sector for treatments including trans vaginal follicular aspiration and oocyte recovery (Madan 2006), as well as a complementing tool for embryo transfer procedures. Ultrasonography had a significant impact on our understanding of reproduction and its therapeutic management in many farms, but there is relatively little information on the subject in buffaloes (Khan et al 2007).

The Kundi breed is a milk type with a solid black hue. The male matures at a weight of 600 kg, while the female matures at a weight of 375 kg (Kachiwal et al 2012). From Kashmore to Shah Bandar, the Kundi breed of buffalo may be found on both banks of the Indus River (Sindh). These may be found in Hyderabad, Karachi, Larkana, Nawabshah, Mirpurkhas, and other regions of Sindh, as well as Quetta and the surrounding territories of Balochistan. The enormous jet-black body, broad horns at the base and taper up and inward (fish hook form), large forehead, short neck, and medium-sized ears are all physical characteristics of the breed (Kachiwal et al 2012). The head is tiny in comparison to the rest of the body. The brow is wide and prominent in appearance. Animals with white marks on the forehead are excluded from the competition (Kachiwal et al 2012). The dewlap is not present. Legs are straight and short. The udder is neatly tucked in and somewhat developed (Kachiwal et al 2012). Only in isolated areas can you observe typical Kundi creatures. Production Males attain maturity at the age of 30 months, whereas females reach maturity at the age of 36 months (Shah 2006).

Since there is little information about the follicular-ovarian biometrics of Kundhi buffaloes and knowing that an understanding of reproduction is essential for management in breeding a breed, the current study was designed in order to establish the echoic features and ultrasonographic biometry of ovaries and follicles in cyclic and non-cyclic Kundhi buffaloes.

2. Materials and Methods

2.1. Measurements

The current study was performed in the Department of Veterinary Surgery & Obstetrics, from the Faculty of Animal Husbandry & Veterinary Sciences, Sindh Agriculture University, Tandojam, Pakistan. Ovaries of slaughter Kundhi buffaloes were collected from a slaughtered house for anatomical study by ultrasonography. Ovaries (n = 16) of Kundhi buffaloes were brought from the slaughterhouse for ultrasound scanning. These ovaries were kept in a water-filled tray and ultrasound examinations were performed. Comparisons were made between ovaries measured by the ultrasound machine and actual length recorded after dissection. For the biometry of ovaries, it was weighted through balance are scanned all areas of the ovary by the ultrasound machine. Using the ultrasound machine, the measurement of actual length, width and thickness of ovaries, circumference calculated and number and size of primary, secondary and tertiary follicles, ruptured or not, were checked.

2.2. Statistical Analysis

Data were analyzed statistically for "T test". MSTATC computer software was used to carry out statistical analysis. The significance of differences among means were compared by using Least Significant Difference (LSD) test.

3. Results

The study on the ultrasonographic biometry of the ovaries and follicles in cyclic and non-cyclic Kundhi buffaloes was carried out (Figure 1). The Kundhi buffalos were examined to measure their left and right ovaries using ultrasonographic and morpho-biometry of the ovaries, which the results are presented in Tables 1 to 5.

3.1 Health and body condition scores of cyclic and non-cyclic Kundhi buffaloes

Health and body condition scores of cyclic and non-cyclic Kundhi buffaloes were compared, and the data (Table 1) indicate that the age of the non-cyclic buffaloes was 10 ± 2.0 years, while the age of cyclic buffaloes was in the of 8.33 ± 1.87 years. The bodyweight of non-cyclic Kundhi Buffaloes was 377.14 ± 52.19 kg, while the bodyweight of cyclic buffaloes was 380 ± 89.69 kg. The body condition score (BCS) of the non-cyclic Kundhi buffaloes was 3.78 ± 0.39 , while the cyclic Kundhi buffaloes the body condition score was also 4.25 ± 0.43 . Statistically, the differences for age and BCS were significant ($P < 0.05$) and non-significant ($P > 0.05$) for body weight.

Table 1 Health and body condition score of cyclic and non-cyclic Kundhi buffaloes.

Parameters	Cyclic Kundhi Buffaloes (Mean \pm SD)	Non-Cyclic Kundhi Buffaloes (Mean \pm SD)	P-value	Significance
Age (Years)	8.33 \pm 1.87	10 \pm 2	0.0003	**
Body Weight (Kg)	380.77 \pm 89.69	377.14 \pm 52.19	0.0932	NS
BCS	4.25 \pm 0.43	3.78 \pm 0.39	0.0016	**

** = highly significant. NS = non significant.

3.2 Ultrasonographic biometry

Ultrasonographic biometry of the ovaries of cyclic and non-cyclic Kundhi buffaloes was performed, and the results (Table 2) indicated that the length of left and right Kundhi buffalo ovaries were 28.68 ± 4.80 and 31.44 ± 6.29 mm. The width of the left and right ovaries was 12.62 ± 2.20 and 12.61 ± 2.51 mm, while the thickness of the left and right ovaries was 5.81 ± 1.11 and 5.94 ± 1.66 mm. Similarly, the measurements for circumference for left and right ovaries were 64.28 ± 10.40 and 71.73 ± 11.33 mm, while the volume of the left and right ovaries was 2.61 ± 0.76 and 3.08 ± 0.75 cm². It was observed that the length, circumference, and volume of the right ovaries were considerably higher than their left ovaries. At the same time, differences were tiny in the width and thickness of the left and right ovaries of Kundhi buffaloes. Statistically, the differences in length of the left and right ovaries, circumference, and volume were significant and non-significant ($P > 0.05$) for width and thickness.

Table 2 Ultrasonographic biometry of ovaries and follicles in cyclic and non-cyclic Kundhi buffaloes.

Measurements	Left ovary (Mean \pm SD)	Right ovary (Mean \pm SD)	P-value	Significance
Length (mm)	28.68 ± 4.80	31.44 ± 6.29	0.005	**
Width (mm)	12.62 ± 2.20	12.61 ± 2.51	0.093	NS
Thickness (mm)	5.81 ± 1.11	5.94 ± 1.66	0.163	NS
Circumference (mm)	64.28 ± 10.40	71.73 ± 11.33	0.001	**
Volume (cm ²)	2.61 ± 0.76	3.08 ± 0.75	0.003	**

** = highly significant. NS = non significant.

3.3 Morpho-biometry of ovaries

Morpho-biometry of the ovaries of cyclic and non-cyclic Kundhi buffaloes was studied, and the results (Table 3) showed that the length of left and right Kundhi buffalo ovaries were 28.88 ± 5.30 and 30.31 ± 6.61 mm, and the width of left and right ovaries was 14.00 ± 1.83 and 14.00 ± 2.10 mm. The thickness of the left and right ovaries was 6.94 ± 1.12 and 7.06 ± 1.65 mm, respectively. Similarly, the measurements for circumference for left and right ovaries were 65.00 ± 7.75 and 68.44 ± 9.44 mm, while the weight of the left and right ovaries was 5.88 ± 2.00 and 5.44 ± 1.63 gm, respectively. It was noted that the length, circumference, and square area of the right ovaries were relatively greater than their left ovaries. Minor differences in width and thickness of the left and right ovaries of Kundhi buffaloes were noted. Statistically, the differences in length, circumference, and weight of left and right ovaries were significant and non-significant ($P > 0.05$) for the width and thickness of ovaries.

Table 3 Morpho-biometry of ovaries and follicles in cyclic and non-cyclic Kundhi buffaloes.

Measurements	Left ovary (Mean \pm SD)	Right ovary (Mean \pm SD)	P-value	Significance
Length (mm)	28.88 ± 5.30	30.31 ± 6.61	0.0061	**
Width (mm)	14.00 ± 1.83	14.00 ± 2.10	0.0993	NS
Thickness (mm)	6.94 ± 1.12	7.06 ± 1.65	0.113	NS
Circumference (mm)	65.00 ± 7.75	68.44 ± 9.44	0.003	**
Weight (gm)	5.88 ± 2.00	5.44 ± 1.63	0.0062	**

** = highly significant. NS = non significant.

3.4 Ultrasonographic biometry of follicles

Ultrasonographic biometry of the follicles on left and right ovaries of cyclic and non-cyclic Kundhi buffaloes was examined, and the data (Table 4) suggested that the number of primary follicles on left and right ovaries of Kundhi buffaloes was 1.00 ± 0.97 and 1.31 ± 1.08 . The number of secondary follicles on the left and right ovaries was 3.31 ± 2.85 and 3.63 ± 3.01 , while the number of tertiary follicles on the left and right ovaries was 6.38 ± 1.59 and 6.81 ± 2.34 , respectively. Similarly, the examination of the circumference of follicles on the left and right ovaries was 17.58 ± 5.52 and 16.69 ± 4.20 mm, while the volume of the follicle on the left and right ovaries was 0.24 ± 0.14 and 0.21 ± 0.10 cm². It was observed that primary, secondary and tertiary follicles on right ovaries were relatively greater than those on left ovaries. The circumference and square area of the follicles on the left ovaries was relatively greater than the right ovaries of Kundhi buffaloes. Statistically, the differences in primary follicles, circumference of the follicles on the right and left ovaries were significant ($P < 0.05$) and non-significant ($P > 0.05$) for secondary, tertiary, and volume of follicles on left and right ovaries.

Table 4 Ultrasonographic biometry of follicles in cyclic and non-cyclic Kundhi buffaloes.

Measurements	Follicle on Left ovary (Mean \pm SD)	Follicle on Right ovary (Mean \pm SD)	P-value	Significance
Primary follicles (N ^o .)	1.00 ± 0.97	1.31 ± 1.08	0.0012	**
Secondary follicles (N ^o .)	3.31 ± 2.85	3.63 ± 3.01	0.093	NS
Tertiary follicles (N ^o .)	6.38 ± 1.59	6.81 ± 2.34	0.081	NS
Circumference (mm)	17.58 ± 5.52	16.69 ± 4.20	0.011	**
Volume (cm ²)	0.24 ± 0.14	0.21 ± 0.10	0.099	NS

** = highly significant. NS = non significant.

3.5 Comparison Ultrasonographic biometry of follicles for cyclic and non-cyclic Kundhi buffaloes

The comparative study of cyclic and non-cyclic Kundhi buffaloes for ultrasonographic biometry of follicles was carried out. The data (Table 5) showed that the length of ovaries of cyclic and non-cyclic Kundli buffalo, respectively, was 30.22 ± 6.85 and 29.89 ± 4.43 mm, ovaries width was 12.65 ± 1.68 and 12.57 ± 2.57 mm, thickness was 6.58 ± 1.61 and 5.58 ± 1.11 mm, circumference 70.63 ± 13.06 and 65.38 ± 8.97 mm, volume 2.96 ± 0.79 and 2.72 ± 0.76 cm², weight 6.00 ± 2.06 and 5.31 ± 1.49 gm, respectively. The number of primary follicles on ovaries of cyclic and non-cyclic Kundhi buffaloes was 2.31 ± 1.08 and 0.00 ± 0.00 , the secondary was 5.25 ± 1.77 and 0.00 ± 0.00 , and tertiary was 7.31 ± 1.69 and 3.06 ± 1.30 . The follicle circumference was 17.88 ± 4.93 and 12.30 ± 3.46 mm and volume was 0.25 ± 0.13 and 0.10 ± 0.08 cm². There were considerable differences in the biometric measurements of ovaries in cyclic and non-cyclic Kundhi buffaloes. Moreover, in non-cyclic Kundhi buffalos, the primary and secondary follicles did not exist, while tertiary follicles were more in cyclic buffalos than the non-cyclic buffaloes. Statistically, the differences in thickness, circumference (O), the weight of follicles, number of primary follicles, secondary follicles, tertiary follicles, circumference (F), and volume (F) of follicles of cyclic and non-cyclic Kundhi buffaloes were significant ($P < 0.05$), and non-significant ($P > 0.05$) for length and width of follicles of cyclic and non-cyclic buffaloes.

Table 5 Comparison of ultrasonographic biometry of follicles in cyclic and non-cyclic kundhi buffaloes.

Measurements	Cyclic Kundhi Buffaloes (Mean ± SD)	Non-Cyclic Kundhi Buffaloes (Mean ± SD)	P-value	Significance
Length (mm)	30.22 ± 6.85	29.89 ± 4.43	0.078	NS
Width (mm)	12.65 ± 1.68	12.57 ± 2.57	0.093	NS
Thickness (mm)	6.58 ± 1.61	5.58 ± 1.11	0.003	**
Circumference (O) (mm)	70.63 ± 13.06	65.38 ± 8.97	0.0101	**
Volume (O) (cm ²)	2.96 ± 0.79	2.72 ± 0.76	0.0913	NS
Weight (gm)	6.00 ± 2.06	5.31 ± 1.49	0.006	**
Primary follicles (Nos.)	2.31 ± 1.08	0.00 ± 0.00	0.000	**
Secondary follicles (Nos.)	5.25 ± 1.77	0.00 ± 0.00	0.000	**
Tertiary follicles (Nos.)	7.31 ± 1.69	3.06 ± 1.30	0.009	***
Circumference(F) (mm)	17.88 ± 4.93	12.30 ± 3.46	0.016	**
Volume (F) (cm ²)	0.25 ± 0.13	0.10 ± 0.08	0.003	**

** = highly significant. NS = non significant.

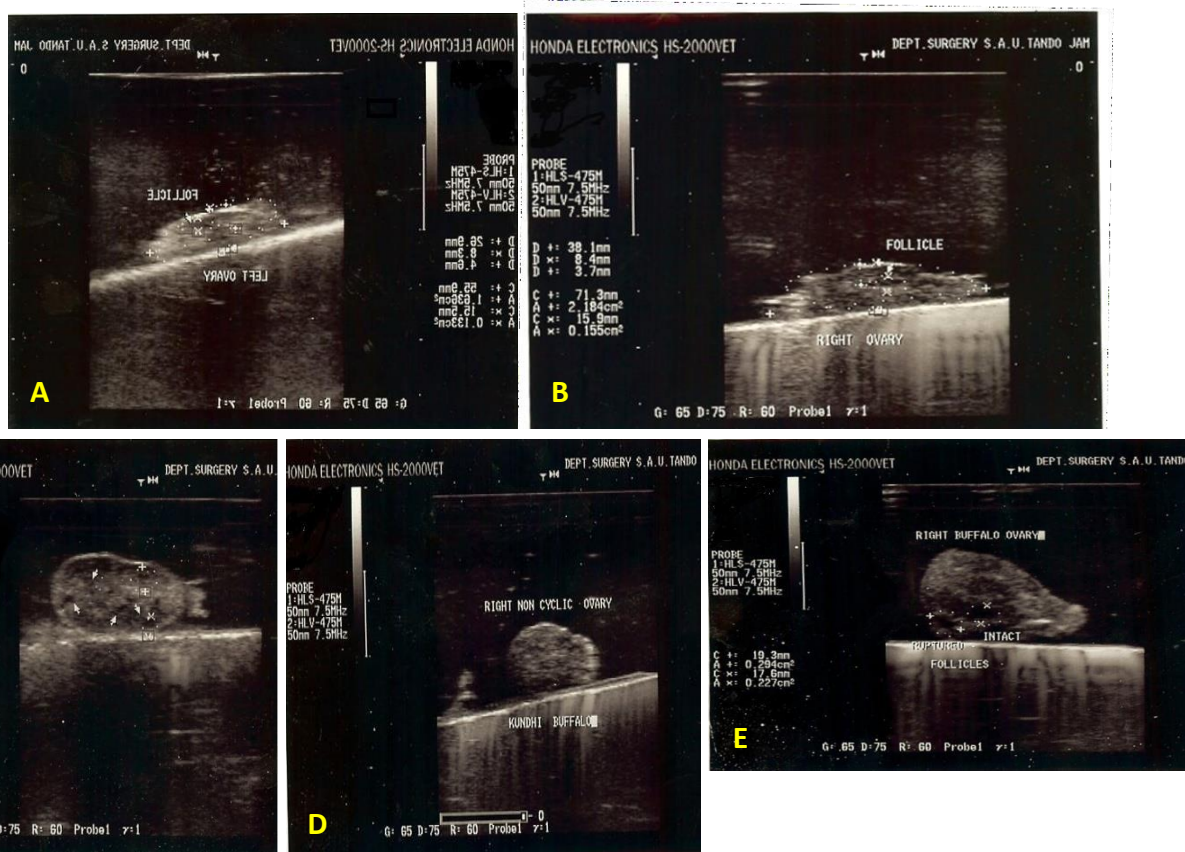


Figure 1 Ultrasound images of: A) Left cyclic ovary; B) Right cyclic ovary; C) Left non-cyclic ovary; D) Right non-cyclic; E) Ovary intacted and ruptured follicular ovary.



4. Discussion

The ovaries and follicles of cyclic and non-cyclic Kundhi buffaloes were investigated using ultrasonography and morpho-biometry, which the buffalos' left and right ovaries were measured using ultrasonography and morpho-biometry. In this study, non-cyclic Kundhi buffaloes had a bodyweight of 377.14 ± 52.19 kg, while cyclic buffaloes had a bodyweight of 380.77 ± 89.69 kg, and non-cyclic buffaloes had a body condition score of 3.78 ± 0.39 , while cyclic buffaloes had a body condition 4.25 ± 0.43 . These findings are fully supported by several researchers who performed studies in various regions of the world (Madan 2006; Lujan et al 2009; Kachiwal 2012).

The average size of the left and right ovary was 29.0 ± 1.2 mm and 20.01 ± 2.15 mm, respectively, while the average size of CL was 17.13 ± 3.15 mm, according to (Kachiwal et al 2012). As the pregnancy progressed, the weight, length, width, and height of the ovaries and corpus luteum increased much more than in non-pregnant buffaloes. During the oestrus stage, there were more ovarian structures (follicles) than during the anoestrus era.

According to (Rahman et al 2012), the ovarian biometry of cyclic and non-cyclic buffaloes differs considerably. The follicles of cyclic and non-cyclic buffalos and cows differed substantially, according to (Sadrkhanloo and Abbasi 2007). The breed, on the other hand, had an impact on the follicle dimensions. (Lujan et al 2009) assessed ultrasonographic characteristics of polycystic ovaries moderate to poor by quantifying ultrasonographic aspects of polycystic ovaries. Despite substantial heterogeneity in ultrasound diagnosis, (Maracek et al 2007) stated that there is rising acceptance of polycystic ovaries as an essential indication of polycystic ovarian syndrome. Patel et al (2009) investigated the biometry of ovarian structures and superovulatory response during superovulation and flushing in a few buffaloes using ultrasonography and found that the average size of the follicle increased on the day of flushing owing to cystic ovarian disease. Ultrasonographic discoveries of ovarian structures were compared to macroscopic findings by (Saini et al 2009), and ultrasonography revealed 14 mm diameter follicles and corpus luteum in an early and regressing stage. Low conception rates in buffalo cows relative to heifers, according to (Rahman et al 2012), maybe due to early ovulation and a less functioning CL.

Ultrasonography, according to (Giuseppina et al 2008), is a straightforward, reliable, and non-invasive imaging procedure with no side effects. Ultrasound's practical uses will be further enhanced by the development of integrated reproductive management systems that mix ultrasound with new and existing reproductive technologies. The number of tiny, medium, and big follicles, as well as the total number of follicles observed per animal each session, which were 2.2, 0.6, 0.9, and 3.7, respectively, did not change between animals or puncture sessions, according to (Gupta et al 2008). Small follicles made up the majority (59%) of the total number of follicles found. According to (Palta et al 1996), the number of visible surface follicles was 5.20 ± 0.97 per ovary, with mean counts of 2.5, 1.2, 0.82, and 0.62 per ovary for follicles sized 4, 8, 12, and 12 mm respectively.

In prepubertal buffaloes, histological investigations indicated a significant number of primordial follicles, while senile buffaloes had atretic follicles. They also discovered that oocyte diameter and follicular size had a biphasic development relationship. Biometry and follicular population on Nagpuri buffalo ovaries were investigated by (Awasthi et al 2006), who found that the average weights of ovaries in cycling and non-cycling buffaloes differed substantially ($P < 0.01\%$). In this study, the average number of small, medium, and big follicles observed in cycling buffaloes were 3.30 ± 0.30 , 1.77 ± 0.25 , and 1.22 ± 0.22 , respectively, compared to 3.43 ± 0.28 , 1.54 ± 0.18 , and 0.89 ± 0.11 follicles in non-cycling buffaloes. According to (Giuseppina et al 2008), the mean duration of intervals between ovulation (22.27 ± 0.89 vs. 24.50 ± 1.88 d; $P < 0.01$) and the mean length of luteal phases (10.40 ± 2.11 vs. 12.66 ± 2.91 d; $P < 0.05$) differed between two and three-wave cycles. These findings show that buffalo have 1, 2, or 3 follicular waves in their estrous cycles; that 2-wave cycles are the most prevalent, and that the number of waves in a cycle is related to the luteal phase and the length of the estrous cycle. Similar findings were reported by (Gupta et al 2008), who discovered substantial differences in morpho-biometrical measures of the ovaries of cyclic and non-cyclic buffaloes.

5. Conclusions

The length, circumference, and square area of the right ovaries were considerably higher than their left ovaries, while differences were minute in width and thickness of the left and right ovaries of Kundhi buffaloes. The primary, secondary and tertiary follicles on the right ovaries were relatively greater than those on the left ovaries. The circumference and square area of the follicles on the left ovaries was relatively greater than the right ovaries of Kundhi buffaloes. Considerable differences were observed in the biometric measurements of ovaries in cyclic and non-cyclic Kundhi buffaloes. In non-cyclic Kundhi buffalos, the primary and secondary follicles did not exist, while tertiary follicles were more in cyclic buffalos than the non-cyclic buffaloes. There was considerable variation in the range of age, weight, and body condition score between cyclic and non-cyclic Kundhi buffaloes.

Acknowledgements

The authors are grateful to the staff of the Department of Veterinary Surgery & Obstetrics, Faculty of Animal Husbandry & Veterinary Sciences Sindh Agriculture University Tandojam Pakistan and Slaughter House Hyderabad Sindh, for cooperation in the entire research. The authors are also thanks full to Hina Batool and Dua Zahra.

Conflict of Interest

The authors declare that they have no conflict of interest.

Funding

This research has not received funding support.

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