



Complete Morphometry of Normal and Dysplastic Hip Joint in Large Breeds of Dogs

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Abstract

Data on measurements of the proximal femur, acetabulum with special reference to CHD in large breed young dogs is relatively limited. The present study recorded complete morphometric of hip joint in healthy as well as dysplastic hip joint in large breed young dogs. Hip morphometrics were not significantly different between right and left limbs in normal hip joint or CHD in Doberman, Labrador, German shepherd and Rottweiler breeds. AA, EAA, DI, SI were significantly higher in CHD whereas HNI, AHI, PC, NA were higher in healthy hip joint in all the four breeds under study. Many proximal femoral and acetabular measurements were significantly different between male and female dogs. DI and SI were not significantly different between male and female dogs of Group I and II in Doberman, Labrador, German shepherd breeds. Many proximal femoral measurements and acetabular measurements were significantly different between unilateral and bilateral CHD. Other measurements like PC, NA, DI and SI were similar in unilateral and bilateral CHD in Doberman and Labrador breeds.

Keywords: Hip Morphometric Measurements; Normal Hip Joint; CHD; Large Breed Dogs; Doberman Pinscher; Labrador Retriever; German Shepherd; Rottweiler

Introduction

Canine Hip Dysplasia (CHD) is one of the most commonly diagnosed orthopaedic diseases in dogs. Imaging of the canine pelvis coupled with physical examination findings are the principle methods used to screen and diagnose CHD. Determination of hip joint metrics will aid in early detection of CHD and facilitate a better outcome in hip pathologies.

Materials and Methods

The present study was conducted on large breed dogs presented to Department of Surgery and Radiology over a period of one year.

Design of the study

Young dogs of Doberman pinscher (n = 24), Labrador retriever (n = 24), German shepherd (n = 24) and Rottweiler breed young dogs (n = 24) with healthy hip joints (n = 8) or with a history and clinical symptoms suggestive of hip dysplasia (n = 16) in each breed were selected and divided equally into two groups based on the age. Dogs confirmed radiologically as CHD were only included in the study while dogs with other orthopaedic problems like spinal injuries or fractures were excluded from the study.

- Group I: Dogs aged below six months.
- Group II: Dogs aged between six to twelve months.

All the dogs (n = 96) were subjected to radiographic evaluation to measure hip joint morphometric parameters using The CARESTREAM vita flex CR system with added IMAGE SUITE software version 4.0. The research work was carried out after Institutional Animal Ethics Committee’s approval 281/GO/ReBi/S/2000/CPC-SEA/CVSc/TPTY/007/ Surgery/2020 dated 30.01.2020.

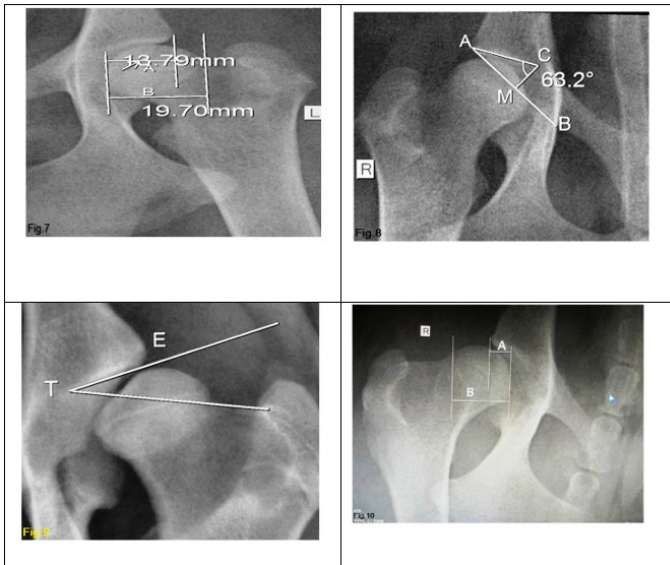
Radiographs of all the dogs were taken under Xylazine (1mg/kg body weight I/M) and Ketamine (5mg/kg body weight I/V) anaesthesia following premedication with Atropine sulphate (0.02 mg/kg body weight). Proximal femoral measurements, acetabular measurements and other measurements of the hip joint were recorded. Proximal femoral measurements included hip axis length (HAL) - length from junction of femoral neck axis and lateral aspect of the greater trochanter to the pelvis, femoral axis length (FNALa)-length along the femoral neck axis from junction of femoral neck axis and lateral aspect of the greater trochanter to the caput femoris, FNALb- length along the femoral neck axis from junction of femoral neck axis and lateral aspect of the greater trochanter centre of the caput femoris, acetabular width (AW), femoral shaft cortex width (FSC) - cortical thickness just below the trochanter minor and perpendicular to the femoral diaphysis, femoral head diameter (HD) - distance between the intersection point of femoral head centre and femoral neck axis and perpendicular to femoral neck axis; femoral neck diameter (ND) - shortest distance within the femoral neck, perpendicular to the femoral neck axis, trochanteric width (TW)-distance between just above the trochanter minor and the most lateral point of trochanter major; femoral shaft diameter (FSD) - distance between just below the trochanter minor and perpendicular to the femoral diaphysis, femoral inclination angle (FIA) - the angle formed at the proximal femoral diaphysis, halfway between trochanter minor and the most lateral point of trochanter major along the line of femoral diaphysis and head- neck index of Heyman and Herndon (Figure 1-4). Acetabular measurements recorded in the study were, acetabular angle (AA), external acetabular angle

(EAA) and acetabulum head index (AHI) (Figure 5-10). Percentage coverage (PC), norberg angle (NA), distraction index (DI) and subluxation index (SI) were the other measurements of hip recorded in the present study (Figure 11-18). The data collected on hip joint metrics were statistically analyzed using SPSS- software version 17.0, TWO WAY ANOVA, and Tukey’s Post Hoc test.

Radiographic views followed during the study

Ventro Dorsal View with extended hip positioning was accomplished by following AVMA Panel’s directions on Hip Dysplasia [1] to measure proximal femur, acetabulum and other parameters (Figure 19,20). Distraction view was accomplished using a distracter allowing proper stance-phase distance between the knees during force application and distraction was maintained for a short duration sufficient enough to permit exposure of the radiographic film (Figure 21-24). In stress radiographic view, as more muscle tissue had to be penetrated, exposure was increased by 30% compared to the standard technique. The degree of laxity was quantified identical to the DI method but was termed subluxation index (SI) instead, to separate the results of the two dislocation techniques from each other [2] (Figure 25,26).





Other morphometric parameters



Fig. 11



Fig. 12



Fig. 13



Fig. 14

Other Morphometric Parameters



Fig. 15



Fig. 16



Fig. 17



Fig. 18



Fig. 19



Fig. 20

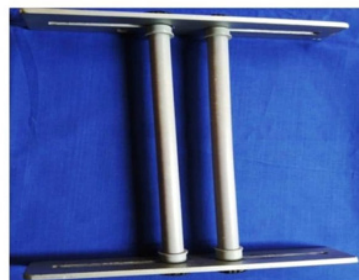
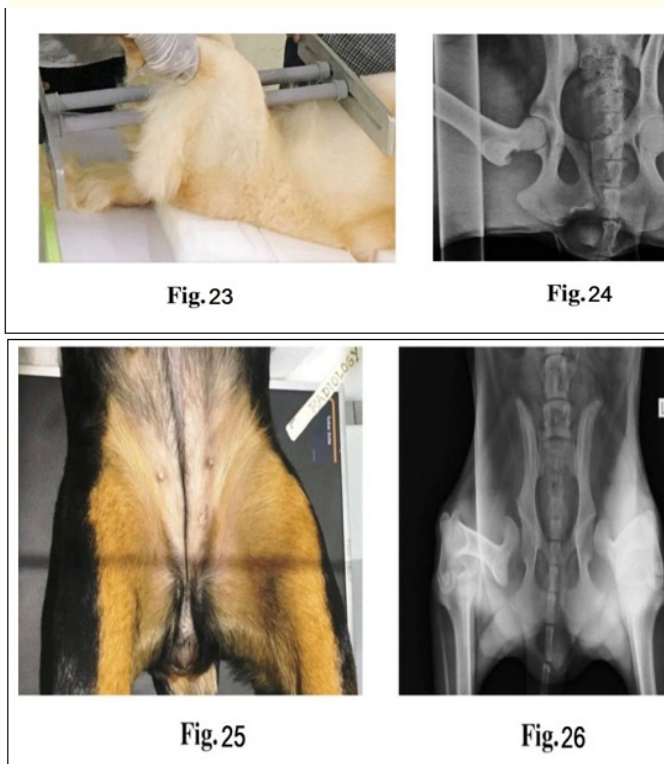


Fig. 21



Fig. 22



- Figure 1:** Skiagram showing Proximal femoral measurements in dogs with healthy hip joint.
- Figure 2:** Skiagram showing Proximal femoral measurements in CHD.
- Figure 3:** Skiagram showing HNI measurement in dogs with healthy hip joint.
- Figure 4:** Skiagram showing HNI measurement in CHD.
- Figure 5:** Skiagram showing Acetabular Angle measurement in dogs with healthy hip joint.
- Figure 6:** Skiagram showing EAA measurement in dogs with healthy hip joint.
- Figure 7:** Skiagram showing AHI measurement in dogs with healthy hip joint.
- Figure 8:** Skiagram showing Acetabular Angle measurement in CHD.
- Figure 9:** Skiagram showing EAA measurement in CHD.
- Figure 10:** Skiagram showing AHI measurement in CHD.
- Figure 11:** Skiagram showing percentage coverage of femoral head in healthy hip joints in dogs.
- Figure 12:** Skiagram showing percentage coverage of femoral head in CHD.
- Figure 13:** Skiagram showing Norberg Angle measurement in healthy hip joint in dogs.
- Figure 14:** Skiagram showing Norberg Angle measurement in CHD.
- Figure 15:** Skiagram showing Distraction view.
- Figure 16:** Skiagram showing measurement of Distraction Index

- (DI).
- Figure 17:** Skiagram showing Stress view.
- Figure 18:** Skiagram showing measurement of Sub-luxation Index (SI).
- Figure 19:** Radiographic positioning of dog for Ventro Dorsal View with Extended hip.
- Figure 20:** Skiagram showing Ventro Dorsal View with Extended hip.
- Figure 21:** Distraction device used.
- Figure 22:** Positioning of distraction device on the animal for distraction View.
- Figure 23:** Radiographic positioning of dog for Distraction View.
- Figure 24:** Skiagram showing Distraction View.
- Figure 25:** Radiographic positioning of dog for Stress Radiographic View.
- Figure 26:** Skiagram showing Stress Radiographic View.

Results and Discussion

In dogs, different types of hip dysplasia require different types of treatment based on the location of the main hip abnormalities involving either the proximal femur or the acetabulum. Data on hip morphology on the breed would provide an opportunity for more sensitive treatment planning and better outcome in CHD. Complete hip joint metrics in Doberman pinscher, Labrador retriever, German shepherd and Rottweiler breed young dogs are discussed in the present study.

Large breed Dogs below 6 months of age (Group-I)

Mean ± S.E values of hip joint metrics and *p*-values showing only significant difference (*p* < 0.05) are presented in Tables 1-9 and Table 19. The proximal femoral measurements, acetabular measurements and other measurements of the hip joint did not vary significantly between the right and left limbs within the group of dogs with healthy hip joint or CHD in Doberman pinscher, Labrador retriever, German shepherd and Rottweiler breed young dogs.

Proximal femoral measurements

Higher HAL value was associated with increased femoral neck width and HAL is related to femoral strength. HAL had greater sensitivity and specificity for predicting fracture risk [3]. HAL was found to be significantly higher in CHD in Doberman pinscher and Labrador retriever breed dogs whereas no such difference was observed in Rottweiler breed dogs. HAL value was not significantly different between male and female dogs in healthy hip as well as in CHD all the three breeds. HAL was significantly higher in male Sivas Kangal dogs with healthy hip joints [4]. HAL was significantly high-

| Group I (Dogs below 6 months of age) | N | Proximal femoral measurements | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|-------------|
| | | HAL | FNALa | FNALb | AW | FSC |
| A. Healthy Hip Joint | 8 | 55.67 ± 0.89 | 44.06 ± 0.67 | 34.97 ± 0.75 | 11.60 ± 0.54 | 1.88 ± 0.01 |
| Male | 4 | 54.36 ± 1.09 | 43.95 ± 1.06 | 33.93 ± 0.89 | 10.42 ± 0.30 | 1.87 ± 0.01 |
| Female | 4 | 56.99 ± 1.15 | 44.18 ± 0.98 | 36.01 ± 1.06 | 12.77 ± 0.59 | 1.90 ± 0.01 |
| Right limb | 4 | 56.01 ± 1.08 | 43.87 ± 0.83 | 34.39 ± 0.21 | 12.11 ± 0.90 | 1.89 ± 0.01 |
| Left limb | 4 | 55.34 ± 1.55 | 44.26 ± 1.17 | 35.56 ± 0.97 | 11.08 ± 0.61 | 1.88 ± 0.01 |
| Right limb-Male | 2 | 55.07 ± 1.14 | 44.29 ± 1.61 | 32.64 ± 1.16 | 10.80 ± 0.46 | 1.88 ± 0.03 |
| Right Limb-Female | 2 | 56.96 ± 2.00 | 43.45 ± 1.08 | 36.14 ± 1.16 | 13.43 ± 1.11 | 1.90 ± 0.01 |
| Left Limb- Male | 2 | 53.66 ± 2.20 | 43.61 ± 1.97 | 35.23 ± 0.27 | 10.05 ± 0.23 | 1.86 ± 0.02 |
| Left Limb-Female | 2 | 57.02 ± 2.00 | 44.90 ± 1.88 | 35.89 ± 2.32 | 12.12 ± 0.12 | 1.90 ± 0.01 |
| B. Dysplastic Hip Joint (CHD) | 16 | 60.52 ± 0.76 | 46.19 ± 0.82 | 37.20 ± 0.47 | 13.05 ± 0.54 | 2.14 ± 0.03 |
| Male | 8 | 59.31 ± 1.27 | 45.20 ± 1.13 | 37.22 ± 0.78 | 14.21 ± 0.39 | 2.14 ± 0.05 |
| Female | 8 | 61.73 ± 0.66 | 47.17 ± 1.13 | 37.18 ± 0.57 | 11.89 ± 0.85 | 2.14 ± 0.05 |
| Right Limb | 8 | 59.92 ± 1.07 | 46.31 ± 1.22 | 37.71 ± 0.65 | 13.46 ± 0.70 | 2.18 ± 0.05 |
| Left Limb | 8 | 61.11 ± 1.11 | 46.06 ± 1.16 | 36.69 ± 0.67 | 12.64 ± 0.86 | 2.09 ± 0.04 |
| Unilateral | 8 | 59.34 ± 1.34 | 43.54 ± 0.54 | 36.96 ± 0.83 | 13.23 ± 0.73 | 2.22 ± 0.05 |
| Unilateral Male | 4 | 56.16 ± 0.67 | 42.86 ± 0.99 | 36.78 ± 1.41 | 13.51 ± 0.29 | 2.19 ± 0.09 |
| Unilateral Female | 4 | 62.53 ± 1.07 | 44.22 ± 0.20 | 37.14 ± 1.09 | 12.96 ± 1.54 | 2.25 ± 0.05 |
| Bilateral | 8 | 61.70 ± 0.52 | 48.83 ± 0.75 | 37.44 ± 0.49 | 12.87 ± 0.85 | 2.06 ± 0.03 |
| Bilateral Male | 4 | 62.46 ± 0.67 | 47.54 ± 1.16 | 37.66 ± 0.86 | 14.92 ± 0.56 | 2.08 ± 0.03 |
| Bilateral Female | 4 | 60.93 ± 0.67 | 50.12 ± 0.41 | 37.22 ± 0.60 | 10.82 ± 0.49 | 2.04 ± 0.05 |

Table 1: Mean ± S.E values of proximal femoral measurements in Doberman pinscher breed dogs below 6 months of age.

| Group I (Dogs below 6 months of age) | N | Proximal femoral measurements | | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|---------------|----------------|
| | | HD | ND | TW | FSD | FIA° | H and N INDEX |
| A. Healthy Hip Joint | 8 | 21.12 ± 0.49 | 17.44 ± 0.40 | 34.06 ± 1.18 | 18.12 ± 0.48 | 127.56 ± 0.70 | 153.63 ± 3.82 |
| Male | 4 | 21.24 ± 0.53 | 17.73 ± 0.25 | 31.03 ± 0.28 | 17.23 ± 0.24 | 126.10 ± 0.74 | 160.10 ± 6.12 |
| Female | 4 | 21.01 ± 0.92 | 17.14 ± 0.80 | 37.09 ± 0.59 | 19.02 ± 0.68 | 129.01 ± 0.54 | 147.15 ± 1.65 |
| Right limb | 4 | 20.67 ± 0.56 | 17.38 ± 0.70 | 33.76 ± 1.79 | 17.97 ± 0.66 | 127.94 ± 1.08 | 151.60 ± 5.88 |
| Left limb | 4 | 21.57 ± 0.83 | 17.49 ± 0.51 | 34.35 ± 1.81 | 18.28 ± 0.78 | 127.17 ± 1.00 | 155.65 ± 5.56 |
| Right limb-Male | 2 | 20.96 ± 0.95 | 17.90 ± 0.45 | 30.82 ± 0.59 | 17.33 ± 0.45 | 126.10 ± 0.30 | 157.21 ± 11.81 |
| Right Limb-Female | 2 | 20.39 ± 0.91 | 16.87 ± 1.49 | 36.71 ± 1.23 | 18.61 ± 1.27 | 129.79 ± 0.32 | 146.00 ± 2.30 |
| Left Limb- Male | 2 | 21.52 ± 0.79 | 17.56 ± 0.35 | 31.24 ± 0.17 | 17.13 ± 0.37 | 126.10 ± 1.80 | 163.00 ± 8.30 |
| Left Limb-Female | 2 | 21.63 ± 1.87 | 17.42 ± 1.21 | 37.47 ± 0.55 | 19.43 ± 0.92 | 128.24 ± 0.66 | 148.30 ± 2.90 |
| B. Dysplastic Hip Joint (CHD) | 16 | 22.39 ± 0.40 | 18.30 ± 0.31 | 36.22 ± 0.58 | 20.55 ± 0.45 | 132.78 ± 0.69 | 125.61 ± 1.25 |
| Male | 8 | 23.08 ± 0.37 | 18.64 ± 0.22 | 37.74 ± 0.33 | 21.40 ± 0.60 | 134.20 ± 0.54 | 123.46 ± 2.08 |
| Female | 8 | 21.70 ± 0.63 | 17.97 ± 0.58 | 34.71 ± 0.82 | 19.71 ± 0.54 | 131.36 ± 1.07 | 127.76 ± 1.03 |
| Right Limb | 8 | 22.55 ± 0.60 | 18.38 ± 0.47 | 37.23 ± 0.74 | 20.57 ± 0.67 | 132.95 ± 0.96 | 125.36 ± 2.15 |
| Left Limb | 8 | 22.22 ± 0.56 | 18.22 ± 0.44 | 35.22 ± 0.78 | 20.54 ± 0.64 | 132.61 ± 1.04 | 125.86 ± 1.44 |
| Unilateral | 8 | 22.63 ± 0.42 | 18.40 ± 0.31 | 36.59 ± 0.77 | 20.60 ± 0.52 | 134.08 ± 0.68 | 126.58 ± 1.11 |
| Unilateral Male | 4 | 22.53 ± 0.42 | 18.28 ± 0.34 | 37.43 ± 0.27 | 20.41 ± 0.87 | 134.35 ± 0.90 | 126.71 ± 1.78 |
| Unilateral Female | 4 | 22.72 ± 0.80 | 18.52 ± 0.56 | 35.74 ± 1.48 | 20.80 ± 0.70 | 133.80 ± 1.13 | 126.45 ± 1.59 |
| Bilateral | 8 | 22.15 ± 0.69 | 18.21 ± 0.56 | 35.86 ± 0.90 | 20.51 ± 0.76 | 131.49 ± 1.04 | 124.64 ± 2.28 |
| Bilateral Male | 4 | 23.63 ± 0.52 | 19.00 ± 0.15 | 38.05 ± 0.61 | 22.40 ± 0.49 | 134.05 ± 0.71 | 120.20 ± 3.01 |
| Bilateral Female | 4 | 20.68 ± 0.72 | 17.43 ± 1.03 | 33.68 ± 0.49 | 18.62 ± 0.29 | 128.93 ± 0.37 | 129.08 ± 1.13 |

Table 2: Mean ± S.E values of proximal femoral measurements in Doberman pinscher breed dogs below 6 months of age.

| Group I (Dogs below 6 months of age) | N | Acetabular measurements | | Other measurements | | | | |
|---|----|-------------------------|--------------|--------------------|--------------|---------------|--------------|--------------|
| | | AA° | EAA° | AHI | PC % | NA° | DI | SI |
| A. Healthy Hip Joint | 8 | 43.47 ± 0.80 | 20.58 ± 0.62 | 71.64 ± 1.40 | 59.33 ± 2.38 | 106.49 ± 0.67 | 0.243 ± 0.03 | 0.245 ± 0.03 |
| Male | 4 | 43.18 ± 0.87 | 20.98 ± 1.23 | 69.75 ± 1.99 | 61.19 ± 5.54 | 107.50 ± 1.09 | 0.195 ± 0.05 | 0.208 ± 0.04 |
| Female | 4 | 43.76 ± 1.48 | 20.18 ± 0.45 | 73.53 ± 1.68 | 57.47 ± 1.84 | 105.48 ± 0.50 | 0.290 ± 0.03 | 0.283 ± 0.03 |
| Right limb | 4 | 43.04 ± 1.46 | 20.00 ± 0.52 | 71.13 ± 2.14 | 61.33 ± 3.53 | 106.52 ± 1.30 | 0.263 ± 0.04 | 0.265 ± 0.03 |
| Left limb | 4 | 43.89 ± 0.86 | 21.16 ± 1.15 | 72.16 ± 2.10 | 57.34 ± 3.35 | 106.46 ± 0.66 | 0.223 ± 0.06 | 0.225 ± 0.04 |
| Right limb-Male | 2 | 42.41 ± 1.03 | 20.12 ± 1.21 | 69.88 ± 4.51 | 64.55 ± 6.65 | 107.88 ± 2.51 | 0.260 ± 0.09 | 0.260 ± 0.05 |
| Right Limb-Female | 2 | 43.67 ± 3.31 | 19.89 ± 0.42 | 72.38 ± 2.00 | 58.10 ± 3.10 | 105.15 ± 0.25 | 0.265 ± 0.06 | 0.270 ± 0.04 |
| Left Limb- Male | 2 | 43.95 ± 1.53 | 21.85 ± 2.80 | 69.62 ± 1.81 | 57.83 ± 7.54 | 107.13 ± 0.74 | 0.130 ± 0.01 | 0.155 ± 0.01 |
| Left Limb-Female | 2 | 43.84 ± 1.46 | 20.48 ± 0.92 | 74.69 ± 3.20 | 56.84 ± 3.16 | 105.80 ± 1.10 | 0.315 ± 0.04 | 0.295 ± 0.05 |
| B. Dysplastic Hip Joint (CHD) | 16 | 53.63 ± 1.29 | 33.20 ± 0.41 | 50.23 ± 0.98 | 32.80 ± 2.30 | 86.60 ± 3.07 | 0.798 ± 0.02 | 0.791 ± 0.02 |
| Male | 8 | 50.82 ± 2.01 | 32.49 ± 0.62 | 47.52 ± 1.06 | 30.86 ± 2.39 | 85.59 ± 5.27 | 0.824 ± 0.02 | 0.791 ± 0.03 |
| Female | 8 | 56.44 ± 0.94 | 33.91 ± 0.45 | 52.94 ± 0.93 | 34.74 ± 3.99 | 87.61 ± 3.49 | 0.773 ± 0.03 | 0.790 ± 0.04 |
| Right Limb | 8 | 52.94 ± 2.17 | 33.38 ± 0.61 | 50.07 ± 1.54 | 32.68 ± 3.81 | 87.71 ± 3.68 | 0.825 ± 0.03 | 0.815 ± 0.03 |
| Left Limb | 8 | 54.32 ± 1.52 | 33.01 ± 0.59 | 50.39 ± 1.31 | 32.92 ± 2.86 | 85.49 ± 5.13 | 0.771 ± 0.03 | 0.766 ± 0.03 |
| Unilateral | 8 | 51.02 ± 2.18 | 33.93 ± 0.44 | 49.60 ± 0.99 | 35.31 ± 2.96 | 88.16 ± 3.71 | 0.786 ± 0.03 | 0.800 ± 0.03 |
| Unilateral Male | 4 | 45.90 ± 1.30 | 33.28 ± 0.72 | 48.25 ± 1.66 | 32.33 ± 3.69 | 90.00 ± 5.23 | 0.815 ± 0.04 | 0.793 ± 0.05 |
| Unilateral Female | 4 | 56.15 ± 1.72 | 34.58 ± 0.32 | 50.94 ± 0.80 | 38.30 ± 4.63 | 86.33 ± 5.87 | 0.758 ± 0.04 | 0.808 ± 0.05 |
| Bilateral | 8 | 56.24 ± 0.68 | 32.46 ± 0.62 | 50.86 ± 1.73 | 30.28 ± 3.48 | 85.03 ± 5.08 | 0.810 ± 0.03 | 0.781 ± 0.03 |
| Bilateral Male | 4 | 55.75 ± 0.94 | 31.69 ± 0.92 | 46.79 ± 1.46 | 29.40 ± 3.42 | 81.18 ± 9.45 | 0.833 ± 0.03 | 0.790 ± 0.03 |
| Bilateral Female | 4 | 56.72 ± 1.05 | 33.23 ± 0.73 | 54.93 ± 0.86 | 31.17 ± 6.65 | 88.90 ± 4.61 | 0.788 ± 0.05 | 0.770 ± 0.06 |

Table 3: Mean ± S.E values of acetabular measurements and other measurements in Doberman pinscher breed dogs below 6 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Proximal femoral measurements | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|-------------|
| | | HAL | FNALa | FNALb | AW | FSC |
| A. Healthy Hip Joint | 8 | 64.13 ± 0.79 | 50.34 ± 1.03 | 40.63 ± 0.56 | 13.54 ± 0.30 | 2.19 ± 0.02 |
| Male | 4 | 65.81 ± 1.00 | 52.36 ± 1.42 | 40.03 ± 1.10 | 13.45 ± 0.56 | 2.21 ± 0.02 |
| Female | 4 | 62.44 ± 0.18 | 48.31 ± 0.46 | 41.22 ± 0.19 | 13.63 ± 0.33 | 2.18 ± 0.02 |
| Right limb | 4 | 64.29 ± 1.36 | 50.89 ± 1.30 | 40.78 ± 0.86 | 13.40 ± 0.16 | 2.20 ± 0.02 |
| Left limb | 4 | 63.96 ± 1.03 | 49.78 ± 1.75 | 40.47 ± 0.85 | 13.68 ± 0.62 | 2.19 ± 0.02 |
| Right limb-Male | 2 | 66.36 ± 1.61 | 52.83 ± 1.55 | 40.40 ± 2.03 | 13.53 ± 0.06 | 2.21 ± 0.03 |
| Right Limb-Female | 2 | 62.23 ± 0.25 | 48.96 ± 0.59 | 41.16 ± 0.23 | 13.28 ± 0.34 | 2.19 ± 0.05 |
| Left Limb- Male | 2 | 65.27 ± 1.70 | 51.90 ± 3.06 | 39.66 ± 1.70 | 13.37 ± 1.36 | 2.20 ± 0.04 |
| Left Limb-Female | 2 | 62.65 ± 0.20 | 47.66 ± 0.27 | 41.27 ± 0.41 | 13.99 ± 0.54 | 2.18 ± 0.04 |
| B. Dysplastic Hip Joint (CHD) | 16 | 64.60 ± 0.57 | 48.62 ± 0.95 | 43.72 ± 0.55 | 14.59 ± 0.31 | 2.21 ± 0.03 |
| Male | 8 | 65.52 ± 0.89 | 50.29 ± 1.53 | 44.55 ± 0.83 | 13.79 ± 0.34 | 2.20 ± 0.02 |
| Female | 8 | 63.68 ± 0.59 | 46.94 ± 0.87 | 42.88 ± 0.64 | 15.39 ± 0.35 | 2.22 ± 0.06 |

| | | | | | | |
|-------------------|---|--------------|--------------|--------------|--------------|-------------|
| Right Limb | 8 | 64.29 ± 0.89 | 48.28 ± 1.39 | 43.52 ± 0.88 | 15.10 ± 0.37 | 2.25 ± 0.04 |
| Left Limb | 8 | 64.90 ± 0.75 | 48.95 ± 1.39 | 43.91 ± 0.72 | 14.08 ± 0.45 | 2.18 ± 0.04 |
| Unilateral | 8 | 63.10 ± 0.60 | 45.61 ± 0.39 | 43.50 ± 0.78 | 14.69 ± 0.34 | 2.18 ± 0.03 |
| Unilateral Male | 4 | 63.69 ± 0.97 | 46.39 ± 0.27 | 43.44 ± 1.38 | 14.43 ± 0.31 | 2.21 ± 0.02 |
| Unilateral Female | 4 | 62.51 ± 0.70 | 44.83 ± 0.47 | 43.55 ± 0.97 | 14.94 ± 0.62 | 2.14 ± 0.06 |
| Bilateral | 8 | 66.09 ± 0.62 | 51.62 ± 1.08 | 43.94 ± 0.83 | 14.49 ± 0.55 | 2.25 ± 0.05 |
| Bilateral Male | 4 | 67.34 ± 0.75 | 54.20 ± 0.82 | 45.67 ± 0.72 | 13.14 ± 0.39 | 2.19 ± 0.02 |
| Bilateral Female | 4 | 64.84 ± 0.44 | 49.05 ± 0.56 | 42.22 ± 0.83 | 15.83 ± 0.22 | 2.30 ± 0.09 |

Table 4: Mean ± S.E values of proximal femoral measurements in Doberman pinscher breed dogs between 6 to 12 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Proximal femoral measurements | | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|---------------|---------------|
| | | HD | ND | TW | FSD | FIA° | H and N INDEX |
| A. Healthy Hip Joint | 8 | 23.24 ± 0.42 | 18.76 ± 0.50 | 36.70 ± 0.42 | 21.97 ± 0.37 | 132.13 ± 0.77 | 153.33 ± 1.65 |
| Male | 4 | 23.95 ± 0.20 | 19.88 ± 0.21 | 37.30 ± 0.55 | 22.64 ± 0.41 | 133.48 ± 1.14 | 155.34 ± 2.89 |
| Female | 4 | 22.54 ± 0.66 | 17.64 ± 0.52 | 36.10 ± 0.51 | 21.31 ± 0.42 | 130.78 ± 0.51 | 151.33 ± 1.32 |
| Right limb | 4 | 23.22 ± 0.66 | 18.76 ± 0.88 | 36.87 ± 0.63 | 21.95 ± 0.67 | 130.93 ± 0.61 | 152.24 ± 2.17 |
| Left limb | 4 | 23.26 ± 0.61 | 18.76 ± 0.61 | 36.53 ± 0.62 | 21.99 ± 0.43 | 133.33 ± 1.20 | 154.42 ± 2.69 |
| Right limb-Male | 2 | 24.02 ± 0.46 | 20.19 ± 0.18 | 37.53 ± 1.00 | 22.99 ± 0.51 | 131.90 ± 0.40 | 154.93 ± 3.63 |
| Right Limb-Female | 2 | 22.43 ± 1.07 | 17.33 ± 0.74 | 36.20 ± 0.72 | 20.92 ± 0.56 | 129.95 ± 0.45 | 149.55 ± 0.82 |
| Left Limb- Male | 2 | 23.87 ± 0.09 | 19.57 ± 0.19 | 37.07 ± 0.86 | 22.29 ± 0.73 | 135.05 ± 1.65 | 155.74 ± 6.04 |
| Left Limb-Female | 2 | 22.66 ± 1.22 | 17.95 ± 0.94 | 36.00 ± 1.02 | 21.70 ± 0.66 | 131.60 ± 0.10 | 153.11 ± 1.88 |
| B. Dysplastic Hip Joint (CHD) | 16 | 22.11 ± 0.22 | 18.57 ± 0.23 | 36.10 ± 0.60 | 20.80 ± 0.20 | 129.58 ± 1.02 | 124.89 ± 1.80 |
| Male | 8 | 22.20 ± 0.31 | 18.80 ± 0.29 | 35.89 ± 0.66 | 20.99 ± 0.17 | 129.04 ± 1.48 | 123.92 ± 2.32 |
| Female | 8 | 22.01 ± 0.33 | 18.35 ± 0.35 | 36.13 ± 1.04 | 20.61 ± 0.37 | 130.13 ± 1.49 | 125.87 ± 2.87 |
| Right Limb | 8 | 22.04 ± 0.36 | 18.67 ± 0.21 | 34.85 ± 0.95 | 21.07 ± 0.34 | 129.98 ± 1.54 | 125.27 ± 3.22 |
| Left Limb | 8 | 22.17 ± 0.28 | 18.48 ± 0.42 | 37.17 ± 0.49 | 20.53 ± 0.20 | 129.19 ± 1.44 | 124.52 ± 1.86 |
| Unilateral | 8 | 22.01 ± 0.38 | 18.75 ± 0.25 | 34.90 ± 1.05 | 21.07 ± 0.31 | 132.26 ± 1.46 | 127.40 ± 2.14 |
| Unilateral Male | 4 | 21.99 ± 0.58 | 18.68 ± 0.39 | 34.50 ± 0.77 | 21.16 ± 0.17 | 132.00 ± 2.00 | 127.33 ± 3.09 |
| Unilateral Female | 4 | 22.03 ± 0.58 | 18.82 ± 0.37 | 35.29 ± 2.12 | 20.98 ± 0.63 | 132.53 ± 2.42 | 127.47 ± 3.44 |
| Bilateral | 8 | 22.20 ± 0.24 | 18.40 ± 0.39 | 37.12 ± 0.23 | 20.53 ± 0.25 | 126.91 ± 0.57 | 122.39 ± 2.74 |
| Bilateral Male | 4 | 22.41 ± 0.30 | 18.92 ± 0.48 | 37.29 ± 0.42 | 20.81 ± 0.29 | 126.08 ± 0.64 | 120.51 ± 2.79 |
| Bilateral Female | 4 | 22.00 ± 0.40 | 17.87 ± 0.55 | 36.96 ± 0.25 | 20.24 ± 0.40 | 127.73 ± 0.80 | 124.28 ± 4.99 |

Table 5: Mean ± S.E values of proximal femoral measurements in Doberman pinscher breed dogs between 6 to 12 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Acetabular measurements | | | Other measurements | | | |
|---|---|-------------------------|--------------|--------------|--------------------|---------------|--------------|--------------|
| | | AA° | EAA° | AHI | PC % | NA° | DI | SI |
| A. Healthy Hip Joint | 8 | 45.26 ± 0.82 | 24.79 ± 0.85 | 66.58 ± 1.32 | 55.49 ± 1.81 | 98.19 ± 4.21 | 0.298 ± 0.03 | 0.268 ± 0.03 |
| Male | 4 | 46.57 ± 1.39 | 26.62 ± 0.84 | 64.07 ± 1.67 | 57.60 ± 3.26 | 88.90 ± 4.61 | 0.258 ± 0.04 | 0.230 ± 0.06 |
| Female | 4 | 43.95 ± 0.14 | 22.96 ± 0.64 | 69.10 ± 1.07 | 53.37 ± 1.30 | 107.49 ± 1.97 | 0.338 ± 0.03 | 0.305 ± 0.03 |
| Right limb | 4 | 45.38 ± 1.33 | 24.16 ± 1.20 | 66.93 ± 2.52 | 54.70 ± 2.33 | 94.70 ± 7.36 | 0.313 ± 0.02 | 0.290 ± 0.03 |
| Left limb | 4 | 45.14 ± 1.15 | 25.41 ± 1.28 | 66.24 ± 1.32 | 56.27 ± 3.07 | 101.68 ± 4.53 | 0.283 ± 0.05 | 0.245 ± 0.06 |

| | | | | | | | | |
|-------------------------------|----|--------------|--------------|--------------|--------------|---------------|--------------|--------------|
| Right limb-Male | 2 | 46.87 ± 2.50 | 25.84 ± 1.47 | 63.83 ± 4.07 | 57.20 ± 3.80 | 82.85 ± 6.50 | 0.310 ± 0.04 | 0.305 ± 0.07 |
| Right Limb-Female | 2 | 43.90 ± 0.11 | 22.48 ± 0.92 | 70.03 ± 1.50 | 52.20 ± 2.40 | 106.55 ± 1.25 | 0.315 ± 0.03 | 0.275 ± 0.01 |
| Left Limb- Male | 2 | 46.27 ± 2.29 | 27.39 ± 0.96 | 64.31 ± 0.42 | 58.00 ± 7.00 | 94.94 ± 3.46 | 0.205 ± 0.05 | 0.155 ± 0.06 |
| Left Limb-Female | 2 | 44.01 ± 0.31 | 23.44 ± 1.07 | 68.17 ± 1.70 | 54.55 ± 1.26 | 108.43 ± 0.36 | 0.360 ± 0.05 | 0.335 ± 0.05 |
| B. Dysplastic Hip Joint (CHD) | 16 | 56.61 ± 0.50 | 35.13 ± 0.51 | 51.70 ± 1.03 | 25.60 ± 3.26 | 78.31 ± 3.45 | 0.834 ± 0.03 | 0.812 ± 0.03 |
| Male | 8 | 56.77 ± 0.65 | 35.94 ± 0.70 | 53.17 ± 0.82 | 26.54 ± 5.57 | 73.79 ± 5.13 | 0.841 ± 0.05 | 0.838 ± 0.04 |
| Female | 8 | 56.46 ± 0.81 | 34.33 ± 0.68 | 50.23 ± 1.81 | 24.67 ± 3.76 | 82.84 ± 4.33 | 0.826 ± 0.04 | 0.786 ± 0.03 |
| Right Limb | 8 | 56.28 ± 0.75 | 34.74 ± 0.83 | 51.63 ± 0.97 | 20.91 ± 4.56 | 76.51 ± 5.13 | 0.833 ± 0.06 | 0.861 ± 0.04 |
| Left Limb | 8 | 56.95 ± 0.69 | 35.53 ± 0.63 | 51.77 ± 1.90 | 30.29 ± 4.28 | 80.11 ± 4.86 | 0.835 ± 0.03 | 0.763 ± 0.03 |
| Unilateral | 8 | 55.87 ± 0.73 | 35.16 ± 0.95 | 51.84 ± 0.62 | 27.11 ± 3.89 | 80.66 ± 4.07 | 0.796 ± 0.05 | 0.776 ± 0.04 |
| Unilateral Male | 4 | 55.90 ± 1.09 | 35.78 ± 1.48 | 52.02 ± 0.80 | 34.28 ± 5.89 | 81.48 ± 6.28 | 0.775 ± 0.08 | 0.808 ± 0.06 |
| Unilateral Female | 4 | 55.84 ± 1.14 | 34.55 ± 1.33 | 51.66 ± 1.07 | 19.95 ± 1.23 | 79.85 ± 6.11 | 0.818 ± 0.06 | 0.745 ± 0.04 |
| Bilateral | 8 | 57.36 ± 0.61 | 35.11 ± 0.48 | 51.57 ± 2.04 | 24.09 ± 5.45 | 75.96 ± 5.73 | 0.871 ± 0.04 | 0.848 ± 0.03 |
| Bilateral Male | 4 | 57.64 ± 0.49 | 36.10 ± 0.30 | 54.33 ± 1.26 | 18.80 ± 8.37 | 66.10 ± 6.63 | 0.908 ± 0.05 | 0.868 ± 0.06 |
| Bilateral Female | 4 | 57.08 ± 1.21 | 34.12 ± 0.58 | 48.80 ± 3.58 | 29.38 ± 7.05 | 85.83 ± 6.65 | 0.835 ± 0.05 | 0.828 ± 0.04 |

Table 6: Mean ± S.E values of acetabular measurements and other measurements in Doberman pinscher breed dogs between 6 to 12 months of age.

| Group I (Dogs below 6 months of age) | N | Proximal femoral measurements | | | | |
|--------------------------------------|----|-------------------------------|--------------|--------------|--------------|-------------|
| | | HAL | FNALa | FNALb | AW | FSC |
| A. Healthy Hip Joint | 8 | 50.96 ± 0.74 | 36.92 ± 1.58 | 39.04 ± 0.84 | 10.26 ± 0.53 | 1.90 ± 0.09 |
| Male | 4 | 50.84 ± 1.14 | 40.95 ± 0.68 | 38.90 ± 0.37 | 10.28 ± 0.32 | 2.07 ± 0.02 |
| Female | 4 | 51.08 ± 1.11 | 32.89 ± 0.58 | 39.19 ± 1.78 | 10.25 ± 1.10 | 1.72 ± 0.13 |
| Right limb | 4 | 51.14 ± 1.07 | 36.97 ± 2.28 | 39.51 ± 1.16 | 10.77 ± 0.61 | 1.89 ± 0.14 |
| Left limb | 4 | 50.79 ± 1.17 | 36.87 ± 2.54 | 38.58 ± 1.35 | 9.75 ± 0.88 | 1.90 ± 0.13 |
| Right limb-Male | 2 | 50.86 ± 1.63 | 40.73 ± 1.23 | 39.20 ± 0.67 | 9.95 ± 0.59 | 2.07 ± 0.03 |
| Right Limb-Female | 2 | 51.42 ± 2.01 | 33.22 ± 1.21 | 39.82 ± 2.72 | 11.60 ± 0.72 | 1.71 ± 0.23 |
| Left Limb- Male | 2 | 50.83 ± 2.26 | 41.18 ± 1.10 | 38.59 ± 0.42 | 10.60 ± 0.20 | 2.07 ± 0.03 |
| Left Limb-Female | 2 | 50.75 ± 1.80 | 32.56 ± 0.62 | 38.57 ± 3.29 | 8.90 ± 1.78 | 1.74 ± 0.22 |
| B. Dysplastic Hip Joint (CHD) | 16 | 57.09 ± 0.57 | 41.15 ± 0.62 | 34.22 ± 0.47 | 14.06 ± 0.46 | 2.03 ± 0.03 |
| Male | 8 | 57.72 ± 0.85 | 40.61 ± 0.84 | 34.40 ± 0.83 | 14.38 ± 0.78 | 1.96 ± 0.04 |
| Female | 8 | 56.46 ± 0.74 | 41.68 ± 0.94 | 34.04 ± 0.49 | 13.74 ± 0.51 | 2.10 ± 0.04 |
| Right Limb | 8 | 58.03 ± 0.85 | 40.70 ± 1.03 | 33.86 ± 0.59 | 14.00 ± 0.72 | 2.02 ± 0.06 |
| Left Limb | 8 | 56.15 ± 0.64 | 41.59 ± 0.74 | 34.57 ± 0.75 | 14.12 ± 0.62 | 2.04 ± 0.04 |
| Unilateral | 8 | 57.02 ± 0.82 | 41.01 ± 1.00 | 34.83 ± 0.72 | 13.12 ± 0.46 | 2.10 ± 0.05 |
| Unilateral Male | 4 | 56.32 ± 1.18 | 39.59 ± 1.33 | 36.02 ± 1.03 | 12.42 ± 0.52 | 2.02 ± 0.07 |
| Unilateral Female | 4 | 57.72 ± 1.19 | 42.44 ± 1.24 | 33.65 ± 0.67 | 13.81 ± 0.63 | 2.19 ± 0.04 |
| Bilateral | 8 | 57.16 ± 0.84 | 41.28 ± 0.82 | 33.60 ± 0.55 | 15.00 ± 0.66 | 1.96 ± 0.02 |
| Bilateral Male | 4 | 59.11 ± 0.83 | 41.64 ± 0.92 | 32.77 ± 0.64 | 16.34 ± 0.20 | 1.91 ± 0.01 |
| Bilateral Female | 4 | 55.21 ± 0.26 | 40.92 ± 1.47 | 34.43 ± 0.75 | 13.67 ± 0.90 | 2.01 ± 0.02 |

Table 7: Mean ± S.E values of proximal femoral measurements in Labrador retriever breed dogs below 6 months of age.

| Group I (Dogs below 6 months of age) | N | Proximal femoral measurements | | | | | |
|--------------------------------------|----|-------------------------------|--------------|--------------|--------------|---------------|---------------|
| | | HD | ND | TW | FSD | FIA° | H & N INDEX |
| A. Healthy Hip Joint | 8 | 17.85 ± 0.56 | 16.70 ± 0.54 | 31.03 ± 0.75 | 16.04 ± 0.26 | 136.25 ± 1.12 | 140.18 ± 3.31 |
| Male | 4 | 19.25 ± 0.15 | 18.08 ± 0.13 | 32.96 ± 0.21 | 15.73 ± 0.19 | 135.10 ± 1.21 | 146.04 ± 5.23 |
| Female | 4 | 16.44 ± 0.35 | 15.33 ± 0.28 | 29.10 ± 0.34 | 16.35 ± 0.47 | 137.40 ± 1.86 | 134.33 ± 1.00 |
| Right limb | 4 | 17.74 ± 0.89 | 16.49 ± 0.81 | 30.96 ± 1.23 | 15.70 ± 0.40 | 136.48 ± 1.32 | 137.62 ± 2.80 |
| Left limb | 4 | 17.95 ± 0.82 | 16.92 ± 0.82 | 31.11 ± 1.06 | 16.38 ± 0.28 | 136.03 ± 2.01 | 142.75 ± 6.24 |
| Right limb-Male | 2 | 19.15 ± 0.34 | 17.88 ± 0.13 | 32.99 ± 0.50 | 15.44 ± 0.06 | 135.00 ± 1.20 | 141.04 ± 4.34 |
| Right Limb-Female | 2 | 16.33 ± 0.78 | 15.10 ± 0.30 | 28.92 ± 0.72 | 15.97 ± 0.92 | 137.95 ± 2.15 | 134.20 ± 2.20 |
| Left Limb- Male | 2 | 19.35 ± 0.01 | 18.28 ± 0.07 | 32.93 ± 0.08 | 16.03 ± 0.18 | 135.20 ± 2.70 | 151.05 ± 9.76 |
| Left Limb-Female | 2 | 16.56 ± 0.33 | 15.56 ± 0.54 | 29.28 ± 0.32 | 16.73 ± 0.46 | 136.85 ± 3.95 | 134.45 ± 1.05 |
| B. Dysplastic Hip Joint (CHD) | 16 | 19.22 ± 0.18 | 15.99 ± 0.36 | 32.13 ± 0.35 | 19.43 ± 0.38 | 125.41 ± 1.08 | 128.27 ± 1.24 |
| Male | 8 | 19.07 ± 0.19 | 16.50 ± 0.62 | 31.40 ± 0.57 | 19.50 ± 0.46 | 128.34 ± 0.93 | 126.46 ± 1.83 |
| Female | 8 | 19.37 ± 0.31 | 15.47 ± 0.30 | 32.85 ± 0.22 | 19.37 ± 0.63 | 122.49 ± 1.28 | 130.08 ± 1.50 |
| Right Limb | 8 | 19.32 ± 0.28 | 16.10 ± 0.56 | 32.66 ± 0.24 | 19.31 ± 0.61 | 124.95 ± 1.90 | 127.39 ± 1.53 |
| Left Limb | 8 | 19.12 ± 0.24 | 15.87 ± 0.49 | 31.60 ± 0.62 | 19.55 ± 0.47 | 125.88 ± 1.13 | 129.14 ± 1.99 |
| Unilateral | 8 | 19.32 ± 0.28 | 15.21 ± 0.44 | 31.96 ± 0.66 | 19.64 ± 0.57 | 124.96 ± 1.92 | 128.75 ± 1.84 |
| Unilateral Male | 4 | 19.30 ± 0.30 | 15.19 ± 0.76 | 31.10 ± 1.15 | 18.53 ± 0.44 | 129.45 ± 1.57 | 128.06 ± 3.15 |
| Unilateral Female | 4 | 19.33 ± 0.53 | 15.23 ± 0.56 | 32.82 ± 0.47 | 20.75 ± 0.69 | 120.48 ± 1.10 | 129.44 ± 2.36 |
| Bilateral | 8 | 19.13 ± 0.24 | 16.77 ± 0.44 | 32.29 ± 0.27 | 19.22 ± 0.52 | 125.86 ± 1.11 | 127.78 ± 1.76 |
| Bilateral Male | 4 | 18.85 ± 0.22 | 17.81 ± 0.31 | 31.71 ± 0.35 | 20.47 ± 0.38 | 127.23 ± 0.88 | 124.85 ± 2.02 |
| Bilateral Female | 4 | 19.41 ± 0.41 | 15.72 ± 0.29 | 32.88 ± 0.08 | 17.98 ± 0.29 | 124.50 ± 1.94 | 130.71 ± 2.16 |

Table 8: Mean ± S.E values of proximal femoral measurements in Labrador retriever breed dogs below 6 months of age.

| Group I (Dogs below 6 months of age) | N | Acetabular measurements | | | Other measurements | | | |
|--------------------------------------|----|-------------------------|--------------|--------------|--------------------|---------------|--------------|--------------|
| | | AA° | EAA° | AHI | PC % | NA° | DI | SI |
| A. Healthy Hip Joint | 8 | 55.61 ± 0.67 | 23.90 ± 1.26 | 75.06 ± 4.08 | 56.11 ± 1.57 | 107.39 ± 0.92 | 0.329 ± 0.02 | 0.286 ± 0.02 |
| Male | 4 | 56.57 ± 1.09 | 22.10 ± 0.54 | 83.69 ± 3.78 | 59.23 ± 1.70 | 108.40 ± 1.75 | 0.333 ± 0.03 | 0.290 ± 0.03 |
| Female | 4 | 54.65 ± 0.56 | 25.70 ± 2.22 | 66.43 ± 3.71 | 53.00 ± 1.47 | 106.38 ± 0.48 | 0.325 ± 0.40 | 0.283 ± 0.01 |
| Right limb | 4 | 55.33 ± 0.74 | 23.70 ± 2.20 | 77.26 ± 7.00 | 55.83 ± 2.51 | 107.70 ± 1.72 | 0.320 ± 0.03 | 0.293 ± 0.03 |
| Left limb | 4 | 55.88 ± 1.23 | 24.10 ± 1.58 | 72.85 ± 5.05 | 56.40 ± 2.27 | 107.08 ± 0.98 | 0.338 ± 0.04 | 0.280 ± 0.02 |
| Right limb-Male | 2 | 56.39 ± 1.02 | 21.90 ± 0.70 | 88.73 ± 1.38 | 58.15 ± 3.85 | 108.80 ± 3.90 | 0.290 ± 0.05 | 0.285 ± 0.07 |
| Right Limb-Female | 2 | 54.28 ± 0.08 | 25.50 ± 4.70 | 65.80 ± 5.40 | 53.50 ± 3.50 | 106.60 ± 0.40 | 0.350 ± 0.01 | 0.300 ± 0.02 |
| Left Limb- Male | 2 | 56.75 ± 2.46 | 22.30 ± 1.10 | 78.65 ± 5.75 | 60.30 ± 0.50 | 108.00 ± 1.70 | 0.375 ± 0.01 | 0.295 ± 0.03 |
| Left Limb-Female | 2 | 55.02 ± 1.27 | 25.90 ± 2.70 | 67.05 ± 7.25 | 52.50 ± 0.50 | 106.15 ± 1.05 | 0.300 ± 0.09 | 0.265 ± 0.02 |
| B. Dysplastic Hip Joint (CHD) | 16 | 64.27 ± 0.52 | 31.95 ± 0.71 | 58.00 ± 4.05 | 33.13 ± 2.97 | 86.28 ± 2.52 | 0.884 ± 0.05 | 0.816 ± 0.06 |
| Male | 8 | 65.31 ± 0.79 | 31.85 ± 0.72 | 64.80 ± 3.84 | 32.36 ± 2.21 | 89.39 ± 2.43 | 0.819 ± 0.06 | 0.791 ± 0.10 |
| Female | 8 | 63.22 ± 0.49 | 32.05 ± 1.27 | 51.19 ± 6.50 | 33.90 ± 5.72 | 83.16 ± 4.31 | 0.950 ± 0.08 | 0.840 ± 0.07 |
| Right Limb | 8 | 63.84 ± 0.89 | 31.50 ± 1.04 | 57.55 ± 4.21 | 33.73 ± 2.34 | 82.89 ± 3.35 | 0.889 ± 0.05 | 0.771 ± 0.07 |
| Left Limb | 8 | 64.69 ± 0.59 | 32.40 ± 1.00 | 58.44 ± 1.25 | 32.54 ± 5.67 | 89.66 ± 3.58 | 0.880 ± 0.09 | 0.860 ± 0.09 |
| Unilateral | 8 | 63.56 ± 0.77 | 32.14 ± 0.78 | 63.04 ± 2.71 | 36.57 ± 3.36 | 86.58 ± 3.94 | 0.806 ± 0.04 | 0.766 ± 0.05 |

| | | | | | | | | |
|-------------------|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Unilateral Male | 4 | 64.20 ± 1.24 | 32.88 ± 1.08 | 63.00 ± 3.09 | 28.58 ± 1.67 | 87.85 ± 3.79 | 0.813 ± 0.06 | 0.813 ± 0.07 |
| Unilateral Female | 4 | 62.93 ± 0.98 | 31.40 ± 1.14 | 63.08 ± 4.96 | 44.56 ± 2.71 | 85.30 ± 7.55 | 0.800 ± 0.07 | 0.720 ± 0.07 |
| Bilateral | 8 | 64.97 ± 0.67 | 31.76 ± 1.23 | 52.95 ± 7.46 | 29.70 ± 4.81 | 85.98 ± 3.43 | 0.963 ± 0.09 | 0.865 ± 0.11 |
| Bilateral Male | 4 | 66.43 ± 0.75 | 30.83 ± 0.75 | 66.61 ± 7.55 | 36.15 ± 3.24 | 90.93 ± 3.41 | 0.825 ± 0.11 | 0.770 ± 0.21 |
| Bilateral Female | 4 | 63.52 ± 0.31 | 32.70 ± 2.44 | 39.29 ± 8.86 | 23.25 ± 8.34 | 81.03 ± 5.18 | 1.100 ± 0.11 | 0.960 ± 0.10 |

Table 9: Mean ± S.E values of acetabular and other measurements in Labrador retriever breed dogs below 6 months of age.

er in bilateral CHD within Rottweiler dogs and no such difference was observed within Doberman and Labrador breed dogs. Within the group of dogs with CHD, when the CHD was unilateral, HAL was significantly higher in female dogs in Doberman breed compared to male dogs in the same breed. In bilateral CHD, HAL was significantly higher in Labrador male dogs compared to the female dogs with bilateral CHD in the same breed.

In Labrador and Rottweiler breed dogs, FNALa was significantly higher in CHD. In CHA, FNALa was not significantly different between male and female dogs in within all the three breeds, where as in dogs with healthy hip joint, male dogs of Labrador and Rottweiler breed has higher FNALa compared to the female dogs in the same breed. FNALa was significantly higher in bilateral CHD in Doberman breed dogs and no such difference was observed in Labrador and Rottweiler breed dogs.

FNALb was significantly higher in CHD in Doberman breed dogs whereas FNALb was higher in healthy hip joint in Labrador breed dogs and FNALb was similar in healthy hip joint as well as CHD in Rottweiler breed dogs. Within the group of Rottweiler breed dogs, FNALb was significantly higher in male dogs when the hip joint is healthy and FNALb was significantly higher in female dogs in CHD. Within Rottweiler breed dogs, when the CHD was bilateral, FNALb was significantly higher in female dogs compared to male dogs in the same breed with bilateral CHD.

In Labrador and Rottweiler breed dogs, AW was significantly higher in CHD. Within the group of dogs with CHD, female dogs of Doberman and Rottweiler breed, male dogs of Doberman breed had higher AW value compared to the other gender in the group. AW was significantly higher in bilateral CHD in Labrador breed dogs. Within Rottweiler breed dogs, AW was significantly higher in female dogs compared to male dogs when the CHD was unilateral. In bilateral CHD, AW was significantly higher in male dogs of Doberman and Labrador compared to the female dogs with bilateral CHD within the same breed.

FSC was significantly higher in CHD in Doberman breed dogs. Within the group of dogs with CHD, FSC was significantly higher

in female dogs of Labrador and Rottweiler breed compared to the male dogs of the same breed. Within the group of dogs with healthy hip joints, FSC was significantly higher in Labrador male dogs compared to female dogs of same breed and no such difference was observed in the remaining breeds. FSC was thicker in male dogs with a healthy hip joint in Sivas Kangal breed [4]. FSC was significantly higher in unilateral CHD within Doberman and Labrador breed dogs and no such difference was observed in Rottweiler breed dogs. When the CHD was bilateral, FSC was significantly higher in female dogs within Labrador and Rottweiler breed dogs compared to the male dogs with bilateral CHD within the same breed.

Within the Labrador and Rottweiler breed dogs, HD was significantly higher in CHD and within the group of dogs with CHD, Labrador male dogs and Rottweiler female dogs had higher HD value compared to the other gender in the same breed. FNALa was similar in unilateral and bilateral CHD in all the breed dogs. Within the dogs with unilateral CHD in a breed, HD was significantly higher in Rottweiler breed female dogs compared to male dogs within the same breed, where as within the dogs with bilateral CHD in a breed, HD was significantly higher in male Doberman dogs compared to the female dogs in the same breed.

There was no significant difference in ND between healthy hip joint and CHD, between male and female dogs in Doberman breed dogs. ND was significantly higher in healthy hip joints in Labrador breed dogs and the contrary was true in Rottweiler breed dogs and within this group of dogs, male Labrador dogs and female Rottweiler dogs had significantly higher ND values compared to the opposite gender within the breed. In the group of dogs with CHD, ND was similar between male and female dogs within the three breeds. Within the dogs with unilateral CHD in Rottweiler breed, female dogs had significantly higher ND compared to male dogs. Within the dogs with bilateral CHD in Labrador breed, ND was significantly higher in male dogs compared to the female dogs in the same breed.

TW was similar in healthy hip as well as in CHD in all the three breeds of dogs. Within the group of dogs with healthy hip joint, fe-

male dogs in Doberman breed and male dogs in Labrador breed had higher TW values compared to the opposite gender within the group and breed. No such difference in TW values was observed in Rottweiler breed dogs with healthy hip or CHD. TW was similar in unilateral and bilateral CHD within the three breed dogs. Within the dogs with bilateral CHD in Doberman breed, TW was significantly higher in male compared to the female dogs in the same breed and in Labrador breed, TW was significantly higher in female dogs compared to the male dogs with bilateral CHD in the same breed.

In Doberman and Labrador breed dogs, FSD was significantly higher in CHD. Within this group of dogs, Rottweiler breed female dogs had higher FSD compared to the male dogs of the same breed. Within the group of dogs with healthy hip joint, female dogs of Doberman and Rottweiler breed had higher FSD value compared to the male dogs of the same breed. FSD was similar in unilateral and bilateral CHD within the group of dogs of three breeds. Within the group of Labrador and Rottweiler breed dogs with unilateral CHD, FSD was significantly higher in female dogs compared to the male dogs within the same breed. Within the group of dogs with bilateral CHD in a breed, FSD was significantly higher in male dogs compared to the female dogs in Doberman and Labrador breed dogs and on the contrary in Rottweiler breed dogs, FSD was significantly higher in female dogs compared to male dogs within the breed.

FIA is biomechanically important in the transfer of forces from the femur to the acetabulum and increased FIA was reported in CHD [5]. An association between hip status and inclination angle was recorded [6-8]. FIA was significantly higher in CHD in Doberman breed dogs whereas FIA values were higher in healthy hip joint in dogs of Labrador and Rottweiler breed. Within the group of dogs with healthy hip joint, significantly higher FIA was observed in female dogs of Doberman breed compared to the male dogs of the same breed. FIA was significantly higher in bilateral CHD in Rottweiler dogs and no such difference was observed in Doberman and Labrador breed dogs. Within the group of Labrador breed dogs with unilateral CHD, FIA was significantly higher in male dogs compared to the female dogs in the same breed, whereas in Rottweiler breed, FIA was significantly higher in female dogs with unilateral CHD compared to male dogs with unilateral CHD in the same breed. FIA was significantly higher in male Doberman dogs with bilateral CHD compared to the female dogs with bilateral CHD in the same breed.

Heyman and Herndon's HNI, is a measure of head and neck dimensions of femur that reflects the overall deformity of the proximal femur. HNI was significantly higher in dogs with healthy hip joint in Doberman, Labrador and Rottweiler breed. Within the

group of dogs with healthy hip joint, Rottweiler female dogs had higher HNI values compared to the male dogs in the same breed, whereas no such difference in HNI values between male and female dogs was observed in dogs of Labrador and Rottweiler breed. In dogs with CHD, there was no significant difference in HNI between male and female dogs within the Doberman, Labrador and Rottweiler breeds. HNI was similar in unilateral and bilateral CHD within all the three breeds. HNI was significantly higher in female Doberman dogs with bilateral CHD compared to the male dogs with bilateral CHD in the same breed.

Acetabular and other measurements

The acetabular angle (AA/ACM) derived by Idelberger and Frank is a measure of the acetabular depth. EAA is derived from the horizontal to its extern (HTE) angle, which is used to evaluate the acetabular roof's orientation at the coronal plane and lateral coverage level of the head. AA and EAA were significantly higher in CHD in all the three breeds. In CHD, AA and EAA were significantly higher [9,10]. Significantly higher EAA was observed in acetabular dysplasia [10]. Within the group of dogs with CHD, AA was significantly higher in male dogs within Labrador and Rottweiler dogs compared to female dogs of the same breeds and group, whereas Doberman female dogs with CHD had higher AA value compared to male Doberman dogs with CHD. Within the group of dogs with healthy hip joint, female dogs had higher AA and EAA values in Rottweiler breed dogs compared to the male dogs of the same breed and no such difference was observed in AA and EAA between male and female dogs within Doberman and Labrador breed. AA and EAA were similar in unilateral and bilateral CHD in all the three breeds. Within the group of dogs with unilateral CHD in a breed, AA was significantly higher in female dogs compared to male dogs in Doberman breed. Within the group of dogs with bilateral CHD in a breed, AA was significantly higher in male dogs in Labrador breed compared to the female dogs with bilateral CHD in the same breed.

AHI measures the percentage of covered surfaces of the femoral head by the acetabulum. Normal AHI values ranged between 70% and 90%, with an average of 90% [9]. Subluxation is reported to be minimal when 50 per cent of the diameter of the femoral head is within the acetabulum [11-13]. Norberg angle [13,14], different distraction indices [2,11,15,16] and the percentage coverage of the femoral head [13] have been used to assess the degree of lateral displacement of the femoral head from the acetabulum. NA is a quantitative method of assessing the hip joint for dysplasia and is commonly considered a measure of laxity.

AHI, PC [17] and NA were significantly higher in the group of dogs with healthy hip joint in all the three breeds. While AHI was

significantly higher in male dogs within the dogs with healthy hip joint in Labrador retriever breed compared to the female dogs of the same breed with healthy hip joint. NA was not significantly different between male and female dogs within the group of dogs with healthy hip or CHD in Doberman, Labrador and Rottweiler breed dogs. A correlation exists between NA and distraction index in dogs. NA has been related with the probability of CHD [7,18,19]. A normal hip was reportedly considered to have an NA greater than 105° and it is more likely that the dog will develop osteoarthritis as the subluxation progresses [20]. In the present study, within the group of dogs with healthy hip joint, PC was significantly higher in male dogs in Labrador and Rottweiler breeds compared to the female dogs of the same breed with healthy hip joint. No significant difference in AHI, PC and NA was observed in unilateral and bilateral CHD within all the breeds. Within the group of Labrador and Rottweiler breed dogs with unilateral CHD, PC was significantly higher in female dogs compared to the male dogs with unilateral CHD in the same breed. AHI was significantly higher in female Do-

berman dogs with bilateral CHD compared to the male dogs with bilateral CHD in the same breed.

Measurement of the DI involves measuring relative displacement of the femoral head from the acetabulum on a stress radiographic view of the pelvis [21]. A DI value of 0.3 was established as a susceptibility threshold value for degenerative joint disease [22]. DI and SI [2,15]. were significantly higher in the group of dogs with CHD in Doberman, Labrador and Rottweiler breed. There was no significant difference between male and female dogs within the group of dogs with healthy hip joint or CHD in Doberman, Labrador and Rottweiler breeds. DI and SI were similar in unilateral and bilateral CHD within the group of dogs with CHD in all the three breeds.

Large breed dogs between 6 to 12 months of age (Group-II)

Mean ± S.E values of hip joint metrics and p-values showing only significant difference (p < 0.05) are presented in Tables 10-19.

| Group II (Dogs between 6 to 12 months of age) | N | Proximal femoral measurements | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|-------------|
| | | HAL | FNALa | FNALb | AW | FSC |
| A. Healthy Hip Joint | 8 | 52.19 ± 0.76 | 38.57 ± 1.31 | 31.94 ± 0.44 | 19.09 ± 0.52 | 2.17 ± 0.01 |
| Male | 4 | 52.61 ± 1.49 | 41.83 ± 0.62 | 32.69 ± 0.54 | 19.20 ± 0.76 | 2.17 ± 0.01 |
| Female | 4 | 51.78 ± 0.59 | 35.30 ± 0.71 | 31.19 ± 0.48 | 18.99 ± 0.81 | 2.17 ± 0.02 |
| Right limb | 4 | 52.14 ± 1.02 | 38.51 ± 1.54 | 32.12 ± 0.75 | 19.18 ± 0.79 | 2.17 ± 0.02 |
| Left limb | 4 | 52.25 ± 1.29 | 38.63 ± 2.37 | 31.76 ± 0.56 | 19.00 ± 0.78 | 2.17 ± 0.02 |
| Right limb-Male | 2 | 52.58 ± 2.35 | 40.98 ± 0.90 | 33.07 ± 1.21 | 19.51 ± 1.14 | 2.18 ± 0.03 |
| Right Limb-Female | 2 | 51.70 ± 0.55 | 36.04 ± 1.15 | 31.16 ± 0.36 | 18.86 ± 1.50 | 2.16 ± 0.03 |
| Left Limb- Male | 2 | 52.65 ± 2.80 | 42.69 ± 0.27 | 32.31 ± 0.15 | 18.89 ± 1.40 | 2.16 ± 0.02 |
| Left Limb-Female | 2 | 51.85 ± 1.34 | 34.57 ± 0.80 | 31.21 ± 1.11 | 19.12 ± 1.30 | 2.19 ± 0.05 |
| B. Dysplastic Hip Joint (CHD) | 16 | 58.24 ± 1.41 | 42.20 ± 1.07 | 42.74 ± 1.44 | 19.04 ± 0.82 | 2.22 ± 0.03 |
| Male | 8 | 55.45 ± 1.61 | 41.81 ± 1.92 | 40.33 ± 2.00 | 17.78 ± 1.02 | 2.23 ± 0.04 |
| Female | 8 | 61.04 ± 1.91 | 42.59 ± 1.06 | 45.14 ± 1.71 | 20.30 ± 1.19 | 2.21 ± 0.04 |
| Right Limb | 8 | 57.30 ± 2.10 | 42.47 ± 1.58 | 42.12 ± 1.95 | 19.20 ± 1.20 | 2.19 ± 0.05 |
| Left Limb | 8 | 59.18 ± 1.95 | 41.94 ± 1.53 | 43.35 ± 2.23 | 18.89 ± 1.21 | 2.25 ± 0.03 |
| Unilateral | 8 | 57.61 ± 1.79 | 42.41 ± 1.35 | 40.88 ± 1.54 | 17.73 ± 0.67 | 2.20 ± 0.05 |
| Unilateral Male | 4 | 56.62 ± 1.88 | 42.55 ± 2.23 | 39.79 ± 1.93 | 17.77 ± 0.64 | 2.22 ± 0.07 |
| Unilateral Female | 4 | 58.60 ± 3.27 | 42.28 ± 1.87 | 41.98 ± 2.57 | 17.69 ± 1.31 | 2.19 ± 0.09 |
| Bilateral | 8 | 58.87 ± 2.27 | 41.99 ± 1.74 | 44.59 ± 2.35 | 20.36 ± 1.40 | 2.24 ± 0.02 |
| Bilateral Male | 4 | 54.27 ± 2.77 | 41.08 ± 3.46 | 40.87 ± 4.02 | 17.80 ± 2.11 | 2.24 ± 0.04 |
| Bilateral Female | 4 | 63.47 ± 1.53 | 42.91 ± 1.29 | 48.30 ± 0.56 | 22.92 ± 0.56 | 2.24 ± 0.01 |

Table 10: Mean ± S.E values of proximal femoral measurements in Labrador retriever breed dogs between 6 to 12 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Proximal femoral measurements | | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|---------------|---------------|
| | | HD | ND | TW | FSD | FIA° | H and N INDEX |
| A. Healthy Hip Joint | 8 | 20.64 ± 0.73 | 15.69 ± 0.28 | 31.31 ± 0.38 | 18.10 ± 0.69 | 134.59 ± 1.35 | 142.75 ± 3.74 |
| Male | 4 | 19.16 ± 0.27 | 15.72 ± 0.47 | 31.30 ± 0.29 | 19.03 ± 0.33 | 132.40 ± 2.05 | 134.48 ± 3.19 |
| Female | 4 | 22.12 ± 0.97 | 15.66 ± 0.39 | 31.33 ± 0.76 | 17.17 ± 1.23 | 136.78 ± 1.04 | 151.03 ± 3.04 |
| Right limb | 4 | 20.41 ± 1.14 | 15.90 ± 0.55 | 30.92 ± 0.39 | 18.10 ± 1.05 | 134.30 ± 1.77 | 143.05 ± 7.06 |
| Left limb | 4 | 20.88 ± 1.07 | 15.48 ± 0.19 | 31.71 ± 0.64 | 18.10 ± 1.04 | 134.88 ± 2.30 | 142.46 ± 3.89 |
| Right limb-Male | 2 | 18.79 ± 0.24 | 15.78 ± 1.12 | 31.48 ± 0.21 | 19.01 ± 0.68 | 132.55 ± 3.55 | 131.90 ± 6.90 |
| Right Limb-Female | 2 | 22.03 ± 1.56 | 16.01 ± 0.75 | 30.36 ± 0.50 | 17.19 ± 2.12 | 136.05 ± 0.38 | 154.20 ± 1.81 |
| Left Limb- Male | 2 | 19.54 ± 0.31 | 15.66 ± 0.27 | 31.12 ± 0.63 | 19.06 ± 0.43 | 132.25 ± 3.55 | 137.05 ± 0.55 |
| Left Limb-Female | 2 | 22.22 ± 1.80 | 15.31 ± 0.30 | 32.30 ± 1.18 | 17.14 ± 2.13 | 137.50 ± 2.30 | 147.87 ± 5.67 |
| B. Dysplastic Hip Joint (CHD) | 16 | 22.63 ± 0.37 | 17.05 ± 0.33 | 32.82 ± 0.45 | 18.40 ± 0.42 | 129.04 ± 1.12 | 126.03 ± 1.51 |
| Male | 8 | 22.82 ± 0.55 | 17.24 ± 0.60 | 32.50 ± 0.88 | 18.79 ± 0.74 | 130.06 ± 1.57 | 124.88 ± 1.20 |
| Female | 8 | 22.44 ± 0.53 | 16.85 ± 0.32 | 33.13 ± 0.28 | 18.01 ± 0.38 | 128.01 ± 1.61 | 127.18 ± 2.81 |
| Right Limb | 8 | 22.92 ± 0.46 | 17.43 ± 0.47 | 32.46 ± 0.69 | 18.26 ± 0.69 | 129.34 ± 1.17 | 127.79 ± 2.36 |
| Left Limb | 8 | 22.33 ± 0.59 | 16.66 ± 0.45 | 33.18 ± 0.61 | 18.55 ± 0.51 | 128.74 ± 1.99 | 124.27 ± 1.80 |
| Unilateral | 8 | 22.13 ± 0.46 | 16.73 ± 0.40 | 32.06 ± 0.83 | 18.06 ± 0.42 | 127.31 ± 1.56 | 128.04 ± 2.50 |
| Unilateral Male | 4 | 21.63 ± 0.67 | 15.90 ± 0.46 | 31.31 ± 1.61 | 17.75 ± 0.49 | 128.48 ± 1.91 | 125.94 ± 1.79 |
| Unilateral Female | 4 | 22.63 ± 0.62 | 17.56 ± 0.27 | 32.82 ± 0.47 | 18.37 ± 0.72 | 126.15 ± 2.62 | 130.14 ± 4.78 |
| Bilateral | 8 | 23.13 ± 0.55 | 17.37 ± 0.53 | 33.57 ± 0.18 | 18.75 ± 0.73 | 130.76 ± 1.44 | 124.02 ± 1.52 |
| Bilateral Male | 4 | 24.00 ± 0.10 | 18.59 ± 0.51 | 33.69 ± 0.23 | 19.84 ± 1.26 | 131.65 ± 2.49 | 123.82 ± 1.66 |
| Bilateral Female | 4 | 22.25 ± 0.94 | 16.15 ± 0.25 | 33.45 ± 0.29 | 17.66 ± 0.30 | 129.88 ± 1.72 | 124.22 ± 2.84 |

Table 11: Mean ± S.E values of proximal femoral measurements in Labrador retriever breed dogs between 6 to 12 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Acetabular measurements | | | Other measurements | | | |
|---|----|-------------------------|--------------|---------------|--------------------|---------------|--------------|--------------|
| | | AA° | EAA° | AHI | PC % | NA° | DI | SI |
| A. Healthy Hip Joint | 8 | 57.48 ± 1.27 | 24.63 ± 1.41 | 69.53 ± 3.79 | 58.41 ± 1.96 | 106.26 ± 0.37 | 0.318 ± 0.02 | 0.339 ± 0.02 |
| Male | 4 | 60.23 ± 1.47 | 27.18 ± 2.21 | 62.31 ± 2.74 | 62.70 ± 2.01 | 106.65 ± 0.53 | 0.298 ± 0.05 | 0.328 ± 0.23 |
| Female | 4 | 54.74 ± 0.59 | 22.08 ± 0.30 | 76.76 ± 4.96 | 54.13 ± 1.27 | 105.88 ± 0.52 | 0.338 ± 0.02 | 0.350 ± 0.02 |
| Right limb | 4 | 58.07 ± 1.82 | 26.25 ± 2.62 | 71.11 ± 5.23 | 58.60 ± 1.62 | 106.28 ± 0.34 | 0.275 ± 0.03 | 0.320 ± 0.02 |
| Left limb | 4 | 56.89 ± 2.00 | 23.00 ± 0.84 | 67.96 ± 6.15 | 58.22 ± 3.90 | 106.25 ± 0.73 | 0.360 ± 0.02 | 0.358 ± 0.02 |
| Right limb-Male | 2 | 60.55 ± 2.65 | 30.50 ± 2.20 | 63.21 ± 5.31 | 61.05 ± 1.75 | 105.80 ± 0.40 | 0.220 ± 0.01 | 0.295 ± 0.03 |
| Right Limb-Female | 2 | 55.60 ± 0.80 | 22.00 ± 0.30 | 79.00 ± 3.39 | 56.15 ± 0.85 | 106.75 ± 0.25 | 0.330 ± 0.02 | 0.345 ± 0.03 |
| Left Limb- Male | 2 | 59.90 ± 2.40 | 23.85 ± 1.55 | 61.40 ± 3.90 | 64.34 ± 3.96 | 107.50 ± 0.30 | 0.375 ± 0.03 | 0.360 ± 0.02 |
| Left Limb-Female | 2 | 53.88 ± 0.03 | 22.15 ± 0.65 | 74.52 ± 11.22 | 52.10 ± 0.90 | 105.00 ± 0.10 | 0.345 ± 0.04 | 0.355 ± 0.05 |
| B. Dysplastic Hip Joint (CHD) | 16 | 63.44 ± 0.84 | 33.22 ± 0.74 | 42.04 ± 4.03 | 28.61 ± 3.18 | 79.29 ± 4.39 | 0.927 ± 0.06 | 0.879 ± 0.04 |
| Male | 8 | 63.10 ± 1.40 | 33.50 ± 1.20 | 39.07 ± 6.48 | 28.45 ± 3.48 | 75.41 ± 5.88 | 1.000 ± 0.09 | 0.880 ± 0.06 |
| Female | 8 | 63.78 ± 1.03 | 32.94 ± 0.95 | 45.01 ± 5.00 | 28.78 ± 5.60 | 83.16 ± 6.60 | 0.850 ± 0.05 | 0.882 ± 0.04 |
| Right Limb | 8 | 63.07 ± 1.12 | 34.00 ± 1.00 | 41.37 ± 3.77 | 32.09 ± 4.21 | 84.73 ± 5.52 | 0.965 ± 0.08 | 0.890 ± 0.06 |
| Left Limb | 8 | 63.80 ± 1.33 | 32.44 ± 1.09 | 42.71 ± 7.42 | 25.14 ± 4.72 | 73.85 ± 6.59 | 0.889 ± 0.08 | 0.869 ± 0.05 |

| | | | | | | | | |
|-------------------|---|--------------|--------------|--------------|---------------|---------------|--------------|---------------|
| Unilateral | 8 | 61.35 ± 1.00 | 32.04 ± 0.79 | 49.18 ± 4.44 | 32.21 ± 3.44 | 86.15 ± 3.82 | 0.848 ± 0.05 | 0.860 ± 0.050 |
| Unilateral Male | 4 | 59.78 ± 1.08 | 31.77 ± 1.60 | 53.12 ± 6.16 | 28.86 ± 6.59 | 83.10 ± 5.96 | 0.925 ± 0.09 | 0.820 ± 0.07 |
| Unilateral Female | 4 | 62.93 ± 1.38 | 32.33 ± 0.56 | 45.24 ± 6.60 | 35.55 ± 2.06 | 89.20 ± 5.15 | 0.770 ± 0.05 | 0.900 ± 0.06 |
| Bilateral | 8 | 65.52 ± 0.09 | 34.39 ± 1.16 | 34.90 ± 5.94 | 25.02 ± 5.28 | 72.43 ± 7.37 | 1.007 ± 0.09 | 0.899 ± 0.06 |
| Bilateral Male | 4 | 66.42 ± 0.76 | 35.23 ± 1.48 | 25.02 ± 5.12 | 28.05 ± 3.58 | 67.73 ± 9.29 | 1.084 ± 0.16 | 0.933 ± 0.10 |
| Bilateral Female | 4 | 64.63 ± 1.61 | 33.55 ± 1.90 | 44.78 ± 8.56 | 22.00 ± 10.55 | 77.13 ± 12.35 | 0.930 ± 0.07 | 0.865 ± 0.09 |

Table 12: Mean ± S.E values of acetabular and other measurements in Labrador retriever breed dogs between 6 to 12 months of age.

| Group I (Dogs below 6 months of age) | N | Proximal femoral measurements | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|-------------|
| | | HAL | FNALa | FNALb | AW | FSC |
| A. Healthy Hip Joint | 8 | 55.48 ± 1.22 | 42.24 ± 1.02 | 34.31 ± 0.94 | 12.60 ± 0.67 | 2.03 ± 0.14 |
| Male | 4 | 57.38 ± 0.45 | 44.46 ± 0.57 | 36.59 ± 0.37 | 11.30 ± 0.13 | 2.25 ± 0.05 |
| Female | 4 | 53.59 ± 2.08 | 40.01 ± 1.10 | 32.03 ± 0.69 | 13.90 ± 0.96 | 1.80 ± 0.22 |
| Right limb | 4 | 54.90 ± 1.79 | 41.76 ± 1.68 | 34.54 ± 1.33 | 12.17 ± 0.85 | 2.01 ± 0.22 |
| Left limb | 4 | 56.06 ± 1.87 | 42.71 ± 1.36 | 34.08 ± 1.51 | 13.03 ± 1.11 | 2.04 ± 0.20 |
| Right limb-Male | 2 | 56.84 ± 0.54 | 44.11 ± 0.91 | 36.58 ± 0.76 | 11.15 ± 0.19 | 2.25 ± 0.11 |
| Right Limb-Female | 2 | 52.97 ± 3.39 | 39.42 ± 2.26 | 32.51 ± 1.31 | 13.21 ± 1.47 | 1.77 ± 0.41 |
| Left Limb- Male | 2 | 57.92 ± 0.57 | 44.82 ± 0.96 | 36.61 ± 0.51 | 11.46 ± 0.15 | 2.26 ± 0.08 |
| Left Limb-Female | 2 | 54.21 ± 3.72 | 40.61 ± 1.19 | 31.56 ± 0.84 | 14.60 ± 1.55 | 1.83 ± 0.37 |
| B. Dysplastic Hip Joint (CHD) | 16 | 58.23 ± 1.15 | 44.80 ± 0.46 | 34.87 ± 0.53 | 17.64 ± 1.05 | 2.04 ± 0.05 |
| Male | 8 | 57.45 ± 2.16 | 44.05 ± 0.68 | 33.68 ± 0.55 | 15.26 ± 1.12 | 1.88 ± 0.05 |
| Female | 8 | 59.01 ± 0.92 | 45.56 ± 0.54 | 36.06 ± 0.71 | 20.03 ± 1.37 | 2.20 ± 0.03 |
| Right Limb | 8 | 58.09 ± 1.41 | 44.23 ± 0.85 | 34.46 ± 0.90 | 17.44 ± 1.71 | 2.04 ± 0.07 |
| Left Limb | 8 | 58.37 ± 1.92 | 45.37 ± 0.32 | 35.28 ± 0.59 | 17.85 ± 1.35 | 2.04 ± 0.07 |
| Unilateral | 8 | 54.92 ± 1.29 | 44.36 ± 0.77 | 33.81 ± 0.82 | 16.84 ± 1.71 | 2.07 ± 0.07 |
| Unilateral Male | 4 | 52.53 ± 1.61 | 43.24 ± 0.15 | 32.37 ± 0.46 | 12.86 ± 0.89 | 1.95 ± 0.10 |
| Unilateral Female | 4 | 57.31 ± 1.18 | 45.48 ± 0.79 | 35.25 ± 1.26 | 20.82 ± 1.50 | 2.20 ± 0.06 |
| Bilateral | 8 | 61.54 ± 0.93 | 45.24 ± 0.52 | 35.94 ± 0.46 | 18.45 ± 1.29 | 2.01 ± 0.08 |
| Bilateral Male | 4 | 62.37 ± 1.72 | 44.85 ± 0.63 | 35.00 ± 0.23 | 17.66 ± 1.09 | 1.81 ± 0.02 |
| Bilateral Female | 4 | 60.71 ± 0.80 | 45.63 ± 0.86 | 36.88 ± 0.57 | 19.24 ± 2.48 | 2.21 ± 0.01 |

Table 13: Mean ± S.E values of proximal femoral measurements in Rottweiler Breed of dogs below 6 months of age.

| Group I (Dogs below 6 months of age) | N | Proximal femoral measurements | | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|---------------|---------------|
| | | HD | ND | TW | FSD | FIA° | H and N INDEX |
| A. Healthy Hip Joint | 8 | 18.02 ± 0.23 | 15.94 ± 0.39 | 28.97 ± 0.47 | 18.41 ± 0.97 | 142.22 ± 0.91 | 146.25 ± 2.01 |
| Male | 4 | 17.86 ± 0.38 | 15.09 ± 0.33 | 28.33 ± 0.77 | 15.99 ± 0.53 | 140.78 ± 1.13 | 141.07 ± 0.63 |
| Female | 4 | 18.17 ± 0.28 | 16.80 ± 0.33 | 29.60 ± 0.42 | 20.84 ± 0.43 | 143.65 ± 1.12 | 151.43 ± 0.76 |
| Right limb | 4 | 18.30 ± 0.24 | 16.04 ± 0.69 | 28.33 ± 0.64 | 18.77 ± 1.22 | 141.45 ± 1.35 | 146.73 ± 3.33 |
| Left limb | 4 | 17.73 ± 0.36 | 15.84 ± 0.47 | 29.61 ± 0.59 | 18.06 ± 1.68 | 142.98 ± 1.30 | 145.78 ± 2.77 |
| Right limb-Male | 2 | 18.31 ± 0.45 | 14.97 ± 0.32 | 27.68 ± 1.18 | 16.74 ± 0.24 | 139.70 ± 1.60 | 141.11 ± 1.40 |
| Right Limb-Female | 2 | 18.31 ± 0.38 | 17.13 ± 0.65 | 28.98 ± 0.52 | 20.81 ± 0.79 | 143.20 ± 1.50 | 152.35 ± 1.10 |
| Left Limb- Male | 2 | 17.42 ± 0.54 | 15.22 ± 0.72 | 28.98 ± 1.13 | 15.23 ± 0.71 | 141.85 ± 1.65 | 141.04 ± 0.68 |
| Left Limb-Female | 2 | 18.04 ± 0.56 | 16.46 ± 0.14 | 30.23 ± 0.02 | 20.88 ± 0.70 | 144.10 ± 2.20 | 150.52 ± 0.78 |
| B. Dysplastic Hip Joint (CHD) | 16 | 22.45 ± 0.50 | 19.81 ± 0.53 | 29.74 ± 0.32 | 19.67 ± 0.55 | 129.57 ± 0.67 | 129.78 ± 1.24 |
| Male | 8 | 21.15 ± 0.54 | 18.93 ± 0.75 | 29.45 ± 0.25 | 17.94 ± 0.59 | 128.65 ± 1.23 | 127.91 ± 1.65 |
| Female | 8 | 23.76 ± 0.52 | 20.69 ± 0.64 | 30.02 ± 0.59 | 21.39 ± 0.30 | 130.49 ± 0.42 | 131.65 ± 1.69 |
| Right Limb | 8 | 21.78 ± 0.73 | 19.32 ± 0.45 | 29.37 ± 0.26 | 19.92 ± 0.69 | 129.48 ± 1.09 | 129.50 ± 1.95 |
| Left Limb | 8 | 23.12 ± 0.62 | 20.30 ± 0.96 | 30.10 ± 0.57 | 19.41 ± 0.89 | 129.66 ± 0.86 | 130.07 ± 1.67 |
| Unilateral | 8 | 22.29 ± 0.94 | 19.44 ± 0.95 | 29.93 ± 0.59 | 20.20 ± 0.59 | 128.18 ± 0.95 | 131.58 ± 1.85 |
| Unilateral Male | 4 | 20.17 ± 0.60 | 17.44 ± 0.56 | 29.42 ± 0.30 | 19.05 ± 0.83 | 126.30 ± 1.34 | 128.73 ± 2.63 |
| Unilateral Female | 4 | 24.41 ± 0.85 | 21.44 ± 1.10 | 30.45 ± 1.16 | 21.35 ± 0.22 | 130.05 ± 0.27 | 134.43 ± 1.90 |
| Bilateral | 8 | 22.61 ± 0.41 | 20.19 ± 0.50 | 29.54 ± 0.29 | 19.13 ± 0.93 | 130.96 ± 0.69 | 127.98 ± 1.50 |
| Bilateral Male | 4 | 22.12 ± 0.60 | 20.43 ± 0.90 | 29.48 ± 0.45 | 16.83 ± 0.33 | 131.00 ± 1.26 | 127.08 ± 2.32 |
| Bilateral Female | 4 | 23.10 ± 0.51 | 19.94 ± 0.58 | 29.60 ± 0.42 | 21.44 ± 0.62 | 130.93 ± 0.80 | 128.88 ± 2.15 |

Table 14: Mean ± S.E values of proximal Femoral measurements in Rottweiler Breed of dogs below 6 months of age.

| Group I (Dogs below 6 months of age) | N | Acetabular measurements | | | Other measurements | | | |
|---|----|-------------------------|--------------|--------------|--------------------|---------------|--------------|--------------|
| | | AA° | EAA° | AHI | PC % | NA° | DI | SI |
| A. Healthy Hip Joint | 8 | 47.98 ± 1.27 | 18.64 ± 0.83 | 82.13 ± 3.03 | 58.21 ± 2.46 | 106.71 ± 0.51 | 0.253 ± 0.01 | 0.256 ± 0.01 |
| Male | 4 | 45.28 ± 1.13 | 16.68 ± 0.27 | 75.47 ± 2.09 | 63.63 ± 2.51 | 106.18 ± 0.61 | 0.235 ± 0.01 | 0.250 ± 0.01 |
| Female | 4 | 50.68 ± 1.17 | 20.60 ± 0.76 | 88.79 ± 2.97 | 52.79 ± 1.52 | 107.25 ± 0.81 | 0.270 ± 0.02 | 0.262 ± 0.03 |
| Right limb | 4 | 47.40 ± 1.86 | 18.48 ± 1.14 | 82.66 ± 3.48 | 60.50 ± 4.42 | 107.50 ± 0.40 | 0.255 ± 0.02 | 0.263 ± 0.02 |
| Left limb | 4 | 48.56 ± 1.96 | 18.80 ± 1.38 | 81.60 ± 5.52 | 55.92 ± 2.28 | 105.93 ± 0.80 | 0.250 ± 0.03 | 0.250 ± 0.01 |
| Right limb-Male | 2 | 45.05 ± 2.75 | 16.70 ± 0.60 | 77.95 ± 3.38 | 67.69 ± 2.21 | 107.10 ± 0.70 | 0.235 ± 0.01 | 0.260 ± 0.01 |
| Right Limb-Female | 2 | 49.75 ± 1.45 | 20.25 ± 1.05 | 87.37 ± 4.11 | 53.31 ± 3.01 | 107.90 ± 0.40 | 0.275 ± 0.03 | 0.265 ± 0.06 |
| Left Limb- Male | 2 | 45.51 ± 0.19 | 16.65 ± 0.25 | 72.99 ± 1.60 | 59.58 ± 0.18 | 105.25 ± 0.15 | 0.235 ± 0.03 | 0.240 ± 0.01 |
| Left Limb-Female | 2 | 51.60 ± 2.10 | 20.95 ± 1.45 | 90.21 ± 5.67 | 52.27 ± 2.09 | 106.60 ± 1.70 | 0.265 ± 0.06 | 0.260 ± 0.03 |
| B. Dysplastic Hip Joint (CHD) | 16 | 58.24 ± 0.73 | 29.48 ± 0.74 | 53.75 ± 0.95 | 27.86 ± 2.04 | 83.46 ± 4.20 | 0.823 ± 0.03 | 0.796 ± 0.04 |
| Male | 8 | 60.11 ± 0.80 | 28.09 ± 1.00 | 52.22 ± 1.44 | 29.97 ± 2.72 | 80.87 ± 6.69 | 0.875 ± 0.03 | 0.856 ± 0.04 |
| Female | 8 | 56.38 ± 0.80 | 30.86 ± 0.90 | 55.28 ± 1.05 | 25.75 ± 3.01 | 86.05 ± 5.37 | 0.770 ± 0.03 | 0.736 ± 0.05 |
| Right Limb | 8 | 58.60 ± 1.02 | 28.40 ± 1.11 | 53.24 ± 1.50 | 31.39 ± 2.85 | 80.45 ± 5.46 | 0.800 ± 0.04 | 0.768 ± 0.06 |
| Left Limb | 8 | 57.89 ± 1.09 | 30.55 ± 0.89 | 54.26 ± 1.24 | 24.34 ± 2.47 | 86.47 ± 6.57 | 0.845 ± 0.03 | 0.825 ± 0.03 |
| Unilateral | 8 | 59.51 ± 1.08 | 29.05 ± 1.17 | 53.78 ± 1.29 | 30.54 ± 2.37 | 91.85 ± 4.61 | 0.785 ± 0.04 | 0.737 ± 0.05 |
| Unilateral Male | 4 | 61.85 ± 0.60 | 27.95 ± 1.79 | 51.33 ± 1.35 | 34.08 ± 3.03 | 92.48 ± 6.41 | 0.855 ± 0.05 | 0.805 ± 0.06 |
| Unilateral Female | 4 | 57.18 ± 1.18 | 30.15 ± 1.55 | 56.22 ± 1.38 | 27.00 ± 2.93 | 91.23 ± 7.60 | 0.715 ± 0.04 | 0.670 ± 0.09 |
| Bilateral | 8 | 56.98 ± 0.81 | 29.90 ± 0.96 | 53.72 ± 1.48 | 25.18 ± 3.18 | 75.07 ± 5.85 | 0.860 ± 0.03 | 0.855 ± 0.03 |

| | | | | | | | | |
|------------------|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Bilateral Male | 4 | 58.38 ± 0.78 | 28.23 ± 1.21 | 53.11 ± 2.72 | 25.86 ± 3.76 | 69.26 ± 8.84 | 0.895 ± 0.04 | 0.908 ± 0.03 |
| Bilateral Female | 4 | 55.58 ± 1.06 | 31.58 ± 1.01 | 54.34 ± 1.62 | 24.50 ± 5.72 | 80.87 ± 7.69 | 0.825 ± 0.05 | 0.803 ± 0.05 |

Table 15: Mean ± S.E values of acetabular measurements and other measurements in Rottweiler Breed of dogs below 6 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Proximal femoral measurements | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|-------------|
| | | HAL | FNALa | FNALb | AW | FSC |
| A. Healthy Hip Joint | 8 | 57.86 ± 0.54 | 44.37 ± 0.83 | 35.15 ± 1.23 | 15.14 ± 0.27 | 2.15 ± 0.06 |
| Male | 4 | 57.84 ± 0.57 | 43.11 ± 0.75 | 32.61 ± 1.11 | 14.66 ± 0.24 | 2.13 ± 0.05 |
| Female | 4 | 57.88 ± 1.01 | 45.64 ± 1.24 | 37.69 ± 1.24 | 15.62 ± 0.37 | 2.17 ± 0.13 |
| Right limb | 4 | 58.26 ± 0.97 | 43.56 ± 1.03 | 34.72 ± 1.94 | 15.51 ± 0.29 | 2.15 ± 0.12 |
| Left limb | 4 | 57.46 ± 0.53 | 45.18 ± 1.29 | 35.57 ± 1.79 | 14.78 ± 0.41 | 2.16 ± 0.07 |
| Right limb-Male | 2 | 57.53 ± 1.00 | 42.34 ± 1.05 | 32.00 ± 1.46 | 15.04 ± 0.10 | 2.14 ± 0.10 |
| Right Limb-Female | 2 | 58.99 ± 1.91 | 44.78 ± 1.53 | 37.45 ± 2.35 | 15.97 ± 0.26 | 2.16 ± 0.27 |
| Left Limb- Male | 2 | 58.15 ± 0.86 | 43.88 ± 1.05 | 33.22 ± 2.14 | 14.28 ± 0.19 | 2.13 ± 0.08 |
| Left Limb-Female | 2 | 56.78 ± 0.12 | 46.49 ± 2.34 | 37.93 ± 1.91 | 15.28 ± 0.71 | 2.19 ± 0.15 |
| B. Dysplastic Hip Joint (CHD) | 16 | 64.25 ± 0.65 | 44.89 ± 0.56 | 35.68 ± 0.53 | 23.54 ± 1.62 | 2.20 ± 0.08 |
| Male | 8 | 62.69 ± 0.64 | 46.31 ± 0.66 | 35.58 ± 0.85 | 20.67 ± 2.86 | 2.32 ± 0.11 |
| Female | 8 | 65.81 ± 0.82 | 43.46 ± 0.56 | 35.78 ± 0.71 | 26.42 ± 0.84 | 2.08 ± 0.08 |
| Right Limb | 8 | 64.11 ± 0.77 | 44.54 ± 0.91 | 35.90 ± 0.93 | 23.31 ± 2.22 | 2.14 ± 0.09 |
| Left Limb | 8 | 64.38 ± 1.09 | 45.23 ± 0.69 | 35.46 ± 0.58 | 23.78 ± 2.50 | 2.25 ± 0.12 |
| Unilateral | 8 | 64.43 ± 0.82 | 44.37 ± 1.02 | 35.82 ± 0.93 | 20.48 ± 2.75 | 2.31 ± 0.11 |
| Unilateral Male | 4 | 62.76 ± 0.69 | 46.36 ± 1.35 | 36.63 ± 1.54 | 13.26 ± 0.56 | 2.47 ± 0.15 |
| Unilateral Female | 4 | 66.10 ± 0.92 | 42.39 ± 0.66 | 35.00 ± 1.12 | 27.70 ± 0.36 | 2.15 ± 0.14 |
| Bilateral | 8 | 64.06 ± 1.05 | 45.40 ± 0.45 | 35.55 ± 0.59 | 26.61 ± 1.00 | 2.08 ± 0.09 |
| Bilateral Male | 4 | 62.61 ± 1.21 | 46.26 ± 0.45 | 34.53 ± 0.49 | 28.08 ± 1.07 | 2.17 ± 0.15 |
| Bilateral Female | 4 | 65.52 ± 1.51 | 44.54 ± 0.51 | 36.56 ± 0.82 | 25.14 ± 1.43 | 2.00 ± 0.09 |

Table 16: Mean ± S.E values of proximal femoral measurements in Rottweiler Breed of dogs between 6 to 12 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Proximal femoral measurements | | | | | |
|---|----|-------------------------------|--------------|--------------|--------------|---------------|---------------|
| | | HD | ND | TW | FSD | FIA° | H & N INDEX |
| A. Healthy Hip Joint | 8 | 20.85 ± 0.78 | 18.81 ± 0.83 | 30.74 ± 0.55 | 20.26 ± 1.04 | 141.50 ± 1.27 | 147.28 ± 2.06 |
| Male | 4 | 18.96 ± 0.23 | 18.12 ± 0.31 | 29.43 ± 0.50 | 19.82 ± 2.11 | 144.28 ± 1.15 | 151.95 ± 1.95 |
| Female | 4 | 22.73 ± 0.65 | 19.51 ± 1.67 | 32.04 ± 0.11 | 20.71 ± 0.69 | 138.73 ± 1.05 | 142.62 ± 1.24 |
| Right limb | 4 | 20.70 ± 1.24 | 18.04 ± 0.35 | 30.71 ± 0.88 | 19.84 ± 1.33 | 140.60 ± 1.24 | 149.10 ± 3.15 |
| Left limb | 4 | 20.99 ± 1.14 | 19.59 ± 1.64 | 30.76 ± 0.79 | 20.68 ± 1.78 | 142.40 ± 2.34 | 145.47 ± 2.77 |
| Right limb-Male | 2 | 18.75 ± 0.46 | 17.94 ± 0.56 | 29.43 ± 1.14 | 19.67 ± 3.22 | 142.50 ± 1.20 | 154.06 ± 2.71 |
| Right Limb-Female | 2 | 22.66 ± 1.19 | 18.14 ± 0.64 | 32.00 ± 0.19 | 20.02 ± 0.48 | 138.70 ± 0.80 | 144.14 ± 1.76 |
| Left Limb- Male | 2 | 19.17 ± 0.16 | 18.30 ± 0.47 | 29.44 ± 0.43 | 19.96 ± 4.05 | 146.05 ± 0.45 | 149.84 ± 2.55 |
| Left Limb-Female | 2 | 22.81 ± 1.07 | 20.89 ± 3.55 | 32.09 ± 0.18 | 21.40 ± 1.30 | 138.75 ± 2.45 | 141.11 ± 1.26 |
| B. Dysplastic Hip Joint (CHD) | 16 | 21.66 ± 0.25 | 18.54 ± 0.39 | 31.23 ± 0.25 | 18.69 ± 0.59 | 127.72 ± 1.18 | 130.34 ± 1.08 |
| Male | 8 | 21.90 ± 0.35 | 18.64 ± 0.75 | 31.34 ± 0.28 | 18.39 ± 0.70 | 127.98 ± 1.36 | 130.34 ± 1.06 |
| Female | 8 | 21.41 ± 0.38 | 18.45 ± 0.30 | 31.11 ± 0.43 | 18.99 ± 0.99 | 127.45 ± 2.02 | 130.33 ± 1.96 |
| Right Limb | 8 | 21.66 ± 0.33 | 18.95 ± 0.64 | 31.20 ± 0.29 | 19.06 ± 0.92 | 126.06 ± 1.98 | 129.99 ± 1.52 |

| | | | | | | | |
|-------------------|---|--------------|--------------|--------------|--------------|---------------|---------------|
| Left Limb | 8 | 21.66 ± 0.42 | 18.13 ± 0.44 | 31.26 ± 0.43 | 18.32 ± 0.79 | 129.36 ± 1.13 | 130.68 ± 1.62 |
| Unilateral | 8 | 21.76 ± 0.31 | 18.62 ± 0.74 | 31.50 ± 0.31 | 18.43 ± 0.68 | 125.64 ± 1.80 | 128.41 ± 1.18 |
| Unilateral Male | 4 | 21.40 ± 0.25 | 19.29 ± 1.44 | 31.05 ± 0.21 | 19.95 ± 0.76 | 127.18 ± 2.05 | 128.59 ± 1.41 |
| Unilateral Female | 4 | 22.12 ± 0.55 | 17.95 ± 0.48 | 31.95 ± 0.51 | 16.92 ± 0.16 | 124.10 ± 3.07 | 128.23 ± 2.11 |
| Bilateral | 8 | 21.55 ± 0.43 | 18.46 ± 0.31 | 30.95 ± 0.39 | 18.95 ± 1.01 | 129.79 ± 1.22 | 132.26 ± 1.59 |
| Bilateral Male | 4 | 22.40 ± 0.58 | 17.99 ± 0.52 | 31.63 ± 0.52 | 16.84 ± 0.31 | 128.78 ± 2.00 | 132.10 ± 1.09 |
| Bilateral Female | 4 | 20.71 ± 0.21 | 18.94 ± 0.13 | 30.28 ± 0.37 | 21.06 ± 1.31 | 130.80 ± 1.49 | 132.43 ± 3.26 |

Table 17: Mean ± S.E values of proximal femoral measurements in Rottweiler Breed of dogs between 6 to 12 months of age.

| Group II (Dogs between 6 to 12 months of age) | N | Acetabular measurements | | Other measurements | | | | |
|---|----|-------------------------|--------------|--------------------|--------------|---------------|--------------|--------------|
| | | AA° | EAA° | AHI | PC % | NA° | DI | SI |
| A. Healthy Hip Joint | 8 | 47.45 ± 0.97 | 22.13 ± 0.49 | 86.59 ± 0.95 | 52.88 ± 1.23 | 107.06 ± 0.67 | 0.290 ± 0.02 | 0.289 ± 0.01 |
| Male | 4 | 47.28 ± 1.41 | 22.30 ± 0.58 | 86.77 ± 0.93 | 54.62 ± 2.02 | 107.95 ± 1.10 | 0.270 ± 0.02 | 0.285 ± 0.02 |
| Female | 4 | 47.63 ± 1.55 | 21.95 ± 0.87 | 86.41 ± 1.83 | 51.14 ± 0.98 | 106.18 ± 0.61 | 0.310 ± 0.01 | 0.292 ± 0.01 |
| Right limb | 4 | 47.10 ± 1.61 | 21.85 ± 0.83 | 87.42 ± 1.07 | 54.02 ± 2.16 | 106.93 ± 1.15 | 0.305 ± 0.02 | 0.303 ± 0.01 |
| Left limb | 4 | 47.80 ± 1.32 | 22.40 ± 0.61 | 85.77 ± 1.62 | 51.74 ± 1.24 | 107.20 ± 0.88 | 0.275 ± 0.03 | 0.275 ± 0.02 |
| Right limb-Male | 2 | 46.45 ± 3.25 | 22.20 ± 1.00 | 85.93 ± 0.56 | 56.18 ± 3.83 | 108.00 ± 2.30 | 0.295 ± 0.03 | 0.305 ± 0.01 |
| Right Limb-Female | 2 | 47.75 ± 2.05 | 21.50 ± 1.70 | 88.91 ± 1.46 | 51.87 ± 2.02 | 105.85 ± 0.55 | 0.315 ± 0.03 | 0.300 ± 0.02 |
| Left Limb- Male | 2 | 48.10 ± 0.20 | 22.40 ± 1.00 | 87.62 ± 1.86 | 53.06 ± 2.24 | 107.90 ± 1.40 | 0.245 ± 0.04 | 0.265 ± 0.05 |
| Left Limb-Female | 2 | 47.50 ± 3.20 | 22.40 ± 1.10 | 83.92 ± 2.35 | 50.41 ± 0.82 | 106.50 ± 1.30 | 0.305 ± 0.03 | 0.285 ± 0.03 |
| B. Dysplastic Hip Joint (CHD) | 16 | 61.29 ± 0.69 | 31.56 ± 0.46 | 54.71 ± 2.23 | 29.73 ± 3.36 | 75.73 ± 4.99 | 0.863 ± 0.04 | 0.783 ± 0.04 |
| Male | 8 | 61.09 ± 1.20 | 31.14 ± 0.65 | 57.35 ± 3.71 | 29.88 ± 6.08 | 65.09 ± 6.53 | 0.916 ± 0.03 | 0.826 ± 0.04 |
| Female | 8 | 61.50 ± 0.77 | 31.99 ± 0.64 | 52.08 ± 2.36 | 29.57 ± 3.36 | 86.36 ± 5.64 | 0.808 ± 0.06 | 0.738 ± 0.06 |
| Right Limb | 8 | 60.64 ± 0.95 | 31.36 ± 0.40 | 58.55 ± 2.73 | 24.93 ± 4.27 | 71.09 ± 5.86 | 0.881 ± 0.07 | 0.811 ± 0.05 |
| Left Limb | 8 | 61.95 ± 1.01 | 31.76 ± 0.84 | 50.88 ± 3.10 | 34.53 ± 4.85 | 80.36 ± 8.14 | 0.844 ± 0.03 | 0.754 ± 0.06 |
| Unilateral | 8 | 63.13 ± 0.47 | 32.13 ± 0.58 | 54.17 ± 3.86 | 37.05 ± 3.52 | 86.60 ± 5.20 | 0.855 ± 0.06 | 0.703 ± 0.06 |
| Unilateral Male | 4 | 63.68 ± 0.40 | 31.48 ± 0.95 | 55.06 ± 7.73 | 43.03 ± 1.09 | 78.90 ± 7.60 | 0.950 ± 0.04 | 0.773 ± 0.07 |
| Unilateral Female | 4 | 62.58 ± 0.82 | 32.78 ± 0.61 | 53.28 ± 3.04 | 31.07 ± 5.72 | 94.30 ± 5.39 | 0.760 ± 0.10 | 0.635 ± 0.08 |
| Bilateral | 8 | 59.46 ± 0.94 | 31.00 ± 0.68 | 55.26 ± 2.51 | 22.41 ± 4.54 | 64.85 ± 6.77 | 0.870 ± 0.04 | 0.861 ± 0.04 |
| Bilateral Male | 4 | 58.50 ± 1.46 | 30.80 ± 1.00 | 59.63 ± 0.89 | 16.74 ± 7.50 | 51.28 ± 3.73 | 0.883 ± 0.05 | 0.880 ± 0.05 |
| Bilateral Female | 4 | 60.43 ± 1.16 | 31.20 ± 1.06 | 50.89 ± 3.97 | 28.07 ± 4.31 | 78.43 ± 8.80 | 0.858 ± 0.06 | 0.843 ± 0.06 |

Table 18: Mean ± S.E values of acetabular measurements and other measurements in Rottweiler Breed of dogs between 6 to 12months of age.

| Interactions | Proximal femoral measurements | | | | | | | | | | | Acetabular measurements | | | Other measurements | | | |
|-------------------------------|-------------------------------|------------------|--------------|---------------|--------|---------------|------------|------------|---------------|-------------------|---------------------|-------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| | HAL | FNALa | FNALb | AW | FSC | HD | ND | TW | FSD | FIA° | HNI | AA | EAA | AHI | PC % | NA° | DI | SI |
| Healthy vs. CHD | D1, L1, 2, R2 | L1, R1 | D1, 2, L1, 2 | D2, L1, R1, 2 | D1 | D2, L1, 2, R1 | L1, 2, R1 | L2 | D1, 2, L1 | D1, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 | D1, 2, L1, 2, R1, 2 |
| Between Gender-Healthy | D2 | D1, 2, L1, 2, R1 | R1, 2 | D1, R1 | L1 | L1, 2, R2 | D2, L1, R1 | D1, L1, R2 | D1, L2, R1 | D1, R2, L2, R1, 2 | L2, R1 | D2, R1 | D2, L1, 2 | L1, 2, R1 | D2 | - | - | - |
| Between Gender-CHD | L2, R2 | R2 | R1 | D1, 2, R1 | L1, R1 | R1 | - | D1, L1 | R1 | D1, L1 | - | D1, L1, R1 | - | D1 | - | R2 | R1 | - |
| Unilateral vs. Bilateral CHD | D2, R1 | D1, 2 | R1 | L1 | D1, L1 | - | L1 | - | - | D2, R1 | - | D1, L2, R2 | - | - | R2 | R1, 2 | - | R2 |
| Male vs Female Unilateral CHD | D1, R2 | D2, R2 | - | R1, 2 | - | R1 | L2, R1 | - | L1, R1, 2 | L1, R1 | - | D1 | - | R1 | L1 | - | - | - |
| Male vs. Female Bilateral HD | D2, L1, 2 | D2, R2 | D2, R1 | D1, 2, L1 | L1, R1 | D1, R2 | L1, 2 | D1, L1 | D1, L1, R1, 2 | D1 | D1 | L1 | D2 | D1 | - | R2 | - | - |

Table 19: Significant difference (p < 0.05)-Hip measurements in Large breed dogs.

D1, L1, R1-Significant difference (p < 0.005) observed in Group-I dogs of Doberman, Labrador and Rottweiler breed dogs respectively.
 D2, L2, R2-Significant difference (p < 0.005) observed in Group-II dogs of Doberman, Labrador and Rottweiler breed dogs respectively.
 D1, 2-L1, 2-R1, 2-Significant difference (p < 0.005) observed both in Group I and II dogs of Doberman, Labrador and Rottweiler breed dogs respectively.

Proximal femoral measurements

HAL was significantly higher in CHD and within the group of Labrador and Rottweiler breed dogs with CHD, HAL was significantly in female dogs compared to male dogs of the same breed. Within the group of dogs with healthy hip joint, male dogs in Doberman breed had higher HAL compared to female dogs of the same breed. HAL was significantly higher in bilateral CHD in Doberman breed where as no such difference was observed in Labrador and Rottweiler breed dogs. Within the group of dogs with unilateral CHD in Rottweiler breed, HAL was significantly higher in female dogs compared to male dogs in the same breed. Within the group of dogs with bilateral CHD in Doberman breed, HAL was significantly higher in male dogs compared to the female dogs with bilateral CHD in the same breed and reverse was true in Labrador breed dogs.

FNALa was not significantly different between dogs with healthy hip joint or CHD within the three breeds. However, within the group of dogs with healthy hip joint, FNALa was significantly

higher in male dogs in Doberman and Labrador breed compared to female dogs of the same breed. In dogs with CHD, Rottweiler female dogs had higher FNALa values compared to the male dogs of the same breed. Similar observation was documented in Sivas Kangal dog breed [4]. FNALa was significantly higher in bilateral CHD in Doberman breed whereas no such difference was observed within the group of Labrador and Rottweiler breed dogs. Within the group of dogs with unilateral CHD in a breed, FNALa was significantly higher in male dogs compared to female dogs with unilateral CHD in Doberman breed where as FNALa was significantly higher in female dogs with unilateral CHD compared to male dogs with unilateral CHD in Rottweiler breed. FNALa was significantly higher in male Doberman dogs with bilateral CHD compared to the female dogs with bilateral CHD in the same breed.

FNALb was significantly higher in CHD in Doberman and Labrador breed dogs compared to dogs of same breed with healthy hip joint. Within the group of dogs with healthy hip joint or CHD, FNALb was not significantly different between male and female

dogs within Doberman, Labrador and Rottweiler breed dogs except the female dogs of Rottweiler breed with a healthy hip joint had higher FNALb value than the male dogs of the same breed with healthy hip joint. There was no significant difference in FNALb values between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs. Within the group of dogs with bilateral CHD in a breed, FNALb was significantly higher in male dogs compared to the female dogs in Doberman breed and the reverse was true in Rottweiler breed.

AW was significantly higher in CHD in Doberman and Rottweiler breed dogs compared to dogs of same breed with healthy hip joint. Within the group of dogs with healthy hip or CHD, AW was not significantly different between male and female dogs within Doberman, Labrador, and Rottweiler breed dogs except the female dogs of Doberman breed with CHD had higher AW value than the male dogs of the same breed with CHD. There was no significant difference in AW between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs. Within the group of dog with unilateral CHD in a breed, AW was significantly higher in female dogs compared to male dogs in Rottweiler breed. AW was significantly higher in female Doberman dogs with bilateral CHD compared to the male dogs with bilateral CHD in the same breed.

FSC was similar between dogs with a healthy hip joint or CHD within the group of dogs of Doberman, Labrador and Rottweiler breed. No significant difference was observed between male and female dogs, between unilateral and bilateral CHD within the groups of dogs of Doberman, Labrador and Rottweiler breed. There was no significant difference in FSC values between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs.

HD was significantly higher in dogs with healthy hip joint within Doberman breed dogs compared to the dogs with CHD within the same breed, where as within the groups of Labrador breed dogs, HD was significantly higher in dogs with CHD. Within the group of dogs with CHD in Doberman, Labrador and Rottweiler breed dogs, no significant difference in HD was observed between male and female dogs within the breed. Whereas within the group of dogs with healthy hip joint, HD was significantly higher in female dogs of Labrador and Rottweiler breed, compared to the male dogs of the same breed. There was no significant difference in HD values between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs. Within the group of dogs with bilateral CHD, HD was significantly higher in male dogs compared to female dogs within Rottweiler breed dogs.

ND and TW were not significantly different between dogs with healthy hip joint or with CHD in Doberman and Rottweiler breed dogs. Within the group of dogs with healthy hip or CHD, ND was not significantly different between male and female dogs within Doberman, Labrador and Rottweiler breed dogs except the male Doberman dogs and female dogs in Rottweiler with a healthy hip joint had higher ND and TW values respectively compared to the female dogs and male dogs respectively of the same breed with healthy hip joint. There was no significant difference in ND between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs. Within the group of Labrador breed dogs with unilateral CHD, ND was significantly higher in female dogs compared to the male dogs in the same breed. ND was significantly higher in male Labrador dogs with bilateral CHD compared to the female Labrador dogs with bilateral CHD.

FSD was significantly higher in dogs with a healthy hip joint in Doberman breed dogs compared to the dogs of the same breed with CHD, whereas no such difference in FSD value between dogs with healthy hip joint and dogs with CHD was observed within Labrador and Rottweiler breeds. Within the group of dogs with CHD, FSD was not significantly different between male and female dogs within Doberman, Labrador and Rottweiler breeds. Within the Labrador group of dogs with healthy hip joint, male dogs had higher FSD than the female dogs of the same breed. There was no significant difference in ND values between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs. Within the group of dogs with unilateral CHD in a breed, FSD was significantly higher in male dogs compared to the female dogs in Rottweiler breed. FSD was significantly higher in female dogs with bilateral CHD compared to male dogs with bilateral CHD in Rottweiler breed.

FIA was significantly higher in healthy hip joint within the group of dogs of Labrador and Rottweiler breed compared to the dogs of the same breed with CHD. No such difference in FIA between dogs with healthy hip joint and dogs with CHD was observed in Doberman breed dogs [6,7], whereas higher FIA values were recorded in CHD by some researchers [5]. Within the group of dogs with healthy hip joint, male dogs had higher FIA than female dogs in Rottweiler breed and no such difference was observed in Doberman and Labrador breed dogs. Within the group of dogs with CHD, FIA was not significantly different between male and female dogs within Doberman, Labrador and Rottweiler breed dogs. Age and sex did not affect the FIA values [6-8,23]. FIA was higher unilateral CHD compared to bilateral CHD in Doberman breed dogs.

HNI was significantly higher in healthy hip joint within the group of dogs of Doberman, Labrador and Rottweiler breed compared to the dogs with CHD in the same breed. Within the group of dogs with healthy hip joint, female dogs of Labrador breed and male dogs of Rottweiler breed had significantly higher HNI compared to opposite gender dogs of same breed. No significant difference in HNI between male and female dogs within Doberman breed was observed. There was no significant difference in HNI between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs.

AA and EAA were significantly higher in CHD in dogs of the three breeds compared to the group of dogs with healthy hip joint of the same breed. Higher EAA values were observed in acetabular dysplasia [10]. Within the group of dogs with CHD, AA and EAA were not significantly different between male and female dogs within the Doberman, Labrador and Rottweiler breed dogs. Within the group of dogs with healthy hip joint, AA was significantly higher in male dogs of Labrador breed compared to female dogs of the same breed [4] and EAA was significantly higher in male dogs of Doberman breed compared to the female dogs of the same breed. AA was significantly higher in unilateral CHD in Labrador and Rottweiler breed dogs compared to bilateral CHD in the same breed, whereas no such difference in EAA was observed between unilateral and bilateral CHD within Doberman, Labrador and Rottweiler breed dogs. EAA was significantly higher in male Doberman dogs with bilateral CHD compared to the female dogs with bilateral CHD in the same breed.

AHI was significantly higher in dogs with healthy hip joint compared to dogs with CHD within Doberman, Labrador and Rottweiler breed dogs. Within the group of dogs with healthy hip joint, male dogs had higher AHI compared to female dogs within Doberman and Labrador breed dogs and no such difference was observed in Rottweiler breed dogs. AHI was not significantly different between male and female dogs within the group of dogs with CHD in the three breeds. There was no significant difference in AHI between unilateral and bilateral CHD in Doberman, Labrador and Rottweiler breed dogs.

PC and NA were higher in dogs with healthy hip joint compared to dogs with CHD within Doberman, Labrador and Rottweiler breed dogs. Lower mean PC values have been reported in CHD [17]. Within the group of dogs with healthy hip joint, Labrador male dogs had higher PC compared to female dogs of the same breed, whereas NA was higher in female dogs of Doberman breed compared to the male dogs of the same breed. Within the group of dogs with

CHD, female dogs in Rottweiler breed had higher NA compared to male dogs with CHD in the same breed. PC and NA were higher in dogs with unilateral CHD compared to bilateral CHD in all the three breeds. In Rottweiler breed dogs, NA was significantly higher in female dogs with bilateral CHD compared to male dogs with bilateral CHD in the same breed.

DI and SI were higher in dogs with CHD compared to dogs with healthy hip joint in Doberman, Labrador and Rottweiler breed dogs. There was no significant difference between male and female dogs within the group of dogs with healthy hip joint or with CHD in all the three breeds. There was no significant difference in DI and SI values between dogs with unilateral or bilateral CHD in all the three breeds.

Conclusion

In Doberman breed dogs below 6 months age, HAL, FNALb, FSC, FSD, FIA, AA, EAA, DI and SI were significantly higher in CHD whereas HNI, AHI, PC and NA were significantly higher in dogs with healthy hip joints, while FNALa, AW, HD, ND and TW were similar between dogs with healthy hip joint or CHD. In Doberman dogs between 6 to 12 months of age, FNALb, AW, AA, EAA, DI and SI were significantly higher in CHD whereas HD, FSD, HNI, AHI, PC and NA were significantly higher in dogs with healthy hip joints. HAL, FNALa, FSC, ND, TW and FIA were similar between dogs with healthy hip joint or CHD.

In Labrador dogs below 6 months of age, HAL, FNALa, AW, HD, FSD, AA, EAA, DI and SI were significantly higher in CHD whereas FNALb, ND, FIA, HNI, AHI, PC and NA were higher in dogs with healthy hip joint. FSC and TW were similar between dogs with healthy hip joint or CHD. In Labrador dogs between 6 to 12 months of age, HAL, FNALb, HD, ND, TW, AA, EAA, DI and SI were significantly higher in CHD whereas FIA, HNI, AHI, PC and NA were significantly higher in dogs with healthy hip joint. FNALa, AW, FSC and FSD were similar between dogs with healthy hip joint or CHD.

In Rottweiler breed dogs below 6 months of age, FNALa, AW, HD, ND, AA, EAA, DI and SI were significantly higher in CHD whereas FIA, HNI, AHI, PC and NA were significantly higher in dogs with healthy hip joint. HAL, FNALb, FSC, TW and FSD were similar between dogs with healthy hip joint or CHD. In Rottweiler breed dogs between 6 to 12 months of age, HAL, AW, AA, EAA, DI and SI were significantly higher in CHD whereas FIA, HNI, AHI, PC and NA were significantly higher in dogs with healthy hip joint. FNALa, FNALb, FSC, HD, ND, TW and FSD were similar between dogs with healthy hip joint or CHD.

Conflict of Interest

The authors declare that there is no conflict of interest.

List of Author Contribution**Category - 1**

- Conception and Design: Veena Podarala
- Acquisition of Data: Jagan Mohan Reddy Kataru, Veda Samhitha Jampala
- Analysis and Interpretation of Data: Suresh Kumar Rayadurgam Venkata, Santhi Lakshmi Mukku

Category - 2

- Drafting the article: Jagan Mohan Reddy Kataru, Veda Samhitha Jampala
- Revising the article for intellectual content: Veena Podarala, Suresh Kumar Rayadurgam Venkata, Santhi Lakshmi Mukku

Category-3

- Final approval of the completed article: Jagan Mohan Reddy Kataru, Veena Podarala, Suresh Kumar Rayadurgam Venkata, Shanthi Lakshmi Mukku, Veda Samhitha Jampala

Category - 4

- Agreement to be accountable for all aspects of the work ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: Jagan Mohan Reddy Kataru, Veena Podarala, Suresh Kumar Rayadurgam Venkata, Shanthi Lakshmi Mukku, Veda Samhitha Jampala.

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