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QUANTITATIVE ULTRASONOGRAPHIC ASSESSMENT OF LIVER SIZE IN THE DOG*

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Alteration in size of the liver may be associated with a number of liver diseases in the dogs. Although precise measurement of liver volume is rarely necessary, assessment of liver size can be a useful diagnostic aid. Subjective methods of liver assessment have been shown to be sensitive only to gross alterations in liver size (Kattan, 1980). Although, radiography and scintigraphy have proved to be useful techniques for evaluating liver size in dogs (Godshalk *et al.*, 1988), they expose the patient to the hazards of ionizing radiations. Ultrasound provides a non-invasive means of liver assessment in dogs (Barr, 1992). A study had been undertaken to establish a reference values for the ultrasonographic measurement of liver in dogs.

Materials and Methods

Thirty apparently healthy dogs brought for routine checkup and vaccination were selected to obtain reference values for ultrasonographic hepatometry in dogs. They were grouped into five according to the body weight as 0- 5 kg, 5-10 kg, 10-15 kg, 15-20 kg and 20-25 kg. Of these 15 animals were male and the rest were female. Ultrasonographic hepatometric assessment was done as per the protocol established by Barr (1992). During scanning in the transverse section of the liver, the head of the transducer was rotated through 90° to image a longitudinal section of the liver in the midline. The dorso ventral angulations of the beam were adjusted until the caudal liver surface was as near vertical as possible while retaining a clear image of the diaphragm line and the liver parenchyma. The image was frozen at maximal expiration and distance of vertical line taken from the skin surface to the diaphragm was measured. Measurements were repeated for four frozen images in each dog. The mean of the four measurements was substituted in the following formula for obtaining liver weight in grams as advocated by Barr *(loc. cit.)*.

Liver weight (gm) = [127 x Ultrasonographic measurement (cm)] - 348.68.

Sagittal longitudinal measurements were obtained by placing the transducer on or near the ventral sub-costal midline. Image was obtained at expiratory pause, to eliminate the apparent alteration in gall bladder shape and size during inspiration.

Measurements were made by electronic cursor placement at the luminal

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mucosal interface. Four repeated measurements of length, width and height were made and the mean value ($L_{average}$, $W_{average}$ and $H_{average}$) was calculated. Gall bladder volume was determined using the formula advocated by Finn-Bordner *et al.* (1993). Calculated Volume (ml) = 0.52 x [$W_{average}$ x $H_{average}$ x $L_{average}$). Corrected Volume (ml) = [Calculated Volume x a] + b; where a, regression co-efficient = 0.859; b, regression constant = 0.358. The data obtained were statistically analyzed as per Snedecor and Cochran (1994).

Results and Discussion

The mean liver size and weight as assessed by ultrasonography in different body weight and sex groups of apparently healthy animals are given in the Table. The mean liver weight of different body weight groups as calculated by ultrasonographic measurements ranged from 140.60 to 865.20 gm. The mean liver weight of male group presented insignificant variation over that of female group. In this study, the liver weight expressed in proportion of body weight ranged between 3.2 and 3.6 per cent and was similar to reports of Getty (1977) and Ewans (1993) who found that liver constituted 3 per cent and 3.0 to 3.8 per cent of the body weight respectively. Animals of different body weight groups showed significant variation in the mean liver weight with positive correlation between liver weight and body weight. This was also reflected by the non-significant variations observed among the means of liver weight expressed in percentage of body weight. Godshalk *et al.* (1988) found a statistically significant correlation between liver weight and body weight. England (1996) reported that there was a positive correlation between liver length and body weight from 8 weeks of age onwards. The present findings are in agreement with the above authors. Gall bladder volume in different body weight and sex groups is given in the Table. Gall bladder

Table - Hepatometry in Dogs

Body weight/ Sex	Ultrasonographic measurement cm	Liver weight gm	Body weight kg	Liver weight expressed in per cent of body weight	Gall bladder volume ml
0 to 5 kg	3.95^{d} ±0.40	153.60^{e} ±12.62	4.80^{d} ±0.47	3.20 ±0.10	5.41^{a} ±2.10
5 to 10 kg	5.01^{cd} ±0.65	286.90^{d} ±13.30	8.94^{cd} ±0.16	3.21 ±0.10	10.09^{a} ±2.20
10 to 15 kg	6.23^{c} ±0.42	442.80^{c} ±12.80	13.40^{bc} ±1.66	3.30 ±0.10	10.36^{a} ±4.22
15 to 20 kg	7.47^{d} ±0.20	600.60^{b} ±30.10	18.20^{ab} ±0.90	3.30 ±0.10	14.20^{a} ±3.20
20 to 25 kg	8.92^{a} ±0.26	784.74^{a} ±28.13	23.78^{a} ±1.22	3.30 ±0.10	12.59^{a} ±2.68
Female	7.73 ±0.50	633.75 ±26.50	18.11 ±3.00	3.50 ±0.13	10.30 ±2.68
Male	8.17 ±0.52	655.56 ±23.87	18.21 ±2.87	3.60 ±0.26	12.28 ±3.68

Mean values bearing the same superscript in the same column do not differ significantly.

volume varied from 3.3 to 21.0 ml. There were apparent differences in the means of gall bladder volume among body weight and sex groups. However, the variations were found to be statistically non-significant. Goddard (1996) and Selcer (1995) reported that gall bladder varied in shape and volume in normal animals depending on the feeding status; accounting for the variation in gall bladder volume. From the present study it is inferred that liver weight as assessed by ultrasonography when expressed in terms of percentage of body weight showed no significant difference irrespective of body weights or sex groups.

Summary

Ultrasonographic hepatometry of canine liver was done and it was found that there was insignificant variation in liver weight irrespective of body weights or sex groups when expressed in terms of percentage of body weight.

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REFERENCES

Barr, F. (1992)... *J. Small Anim. Pract.*, **33**:359.

England, C.G.W. (1996)... *Vet. Radiol. Ultrasound*, **37**:374.

Ewans, H.E. (1993)... Miller's Anatomy of the dog. 3rd edn., W.B.Saunders Co., Philadelphia.

Finn-Bodner, S.T., Park, R.D., Tyler, I.W., Twedt, D.C. and Cartee, C.R. (1993)... *Am. J. Vet. Res.*, **54**:832.

Getty, R. (1977)... Sisson and Grossman's The Anatomy of the Domestic Animals, 5th edn., Vol. 2. The Mac Millian Co., India Ltd., Delhi, p.1554.

Goddard, P.J. (1996)... Veterinary Ultrasonography. CAB International, Philadelphia.

Godshalk, P., Badertscher, R.R., Rippy, M.K. and Ghent, A.W. (1988)... *Vet. Radiol.*, **29**:162.

Kattan, R.R. (1980)... *Radiol. Clin. North Am.*, **18**:195.

Selcer, B.A. (1995)... In : Practical Veterinary Ultrasound (Eds.) RE. Cartee, B.A. Selcer and I.A. Hudson. Williams and Wilkins Co., Philadelphia. p. 88.

Snedecor, G.W. and Cochran, W.G. (1994)... Statistical Methods. 8th edn. Iowa State University Press, USA.