

## Original Research Article

### Epidemiological Assessment of Systemic Hypertension in Dogs

#### ABSTRACT

Systemic hypertension in dogs is a clinically significant condition often associated with underlying diseases. The objective of this study was to assess the prevalence and distribution of hypertension in dogs. A total of 214 dogs (149 males and 65 females, irrespective of age and breed) were surveyed randomly at the Veterinary Clinical Complex, College of Veterinary Science & Animal Husbandry, Nanaji Deshmukh Veterinary Science University, Jabalpur, Madhya Pradesh, India, between May and October 2024. This study comprised of 81 clinically healthy dogs and 133 dogs diagnosed with various systemic co-morbidities. Blood pressure measurements were performed using a Doppler Vet BP machine following ACVIM guidelines (Acierno et al., 2018). Clinical Hypertension (SAP  $\geq$  160 mmHg) using Doppler NIBP was recorded in 39 dogs, resulting in an overall prevalence of 18.22%. Secondary hypertension was more common (27.81%) compared to primary hypertension (2.46%), reinforcing the strong association between hypertension and concurrent diseases. Age-wise analysis revealed a higher prevalence in dogs over 8 years (30%), suggesting an age-related predisposition. Male dogs (76.92%) were more frequently affected than females (23.07%). Breed predisposition was observed, with Labrador Retrievers (33.3%) and German Shepherds (23.07%) showing the highest occurrence.

**KEY WORDS:** Blood pressure measurement, hypertension, prevalence, dog

#### 1. INTRODUCTION

Systemic hypertension is a term attributed to clinically sustained increase in systolic arterial pressure. Hypertension is categorized into three distinct types. It can be aggravated by external or environmental stressors, arise as a consequence of underlying pathological conditions that elevate blood pressure (secondary hypertension), or manifest without an identifiable causative disease process (idiopathic or primary hypertension) [1]. In both human and veterinary medicine, systolic blood pressure is the most significant of the three components of arterial blood pressure as it is an important cause of vascular and hypertensive damage.

The prevalence of hypertension in dogs and cats is not known [1]. However, surveys conducted on apparently healthy dogs have reported varying prevalence rates. The prevalence of hypertension has been reported in various canine populations, with incidences of 0.5% among 400 dogs [2], 0.9% in a cohort of 1,000 young dogs [3], 2% among 215 dogs [4], 10% in a sample of 102 dogs [5], and 13% in clinically healthy Shetland Sheepdogs [6]. Primary hypertension is uncommon in dogs, as it is most commonly observed in veterinary practice as a secondary condition associated with an underlying disease or disorder [7].

Secondary hypertension is the most common form of hypertension in canines and associated with various disease processes, including endocrine disorders, ocular pathology, chronic renal failure, neurologic complications and cardiovascular changes [7]. Although primary hypertension accounts for more than 90% of all cases of elevated blood pressure in human patients, secondary hypertension accounts for almost all identified cases of elevated blood pressure in small animal patients [8].

Systemic hypertension poses a significant concern primarily due to the chronic elevation of blood pressure, which leads to tissue injury. The resulting damage from persistently high blood pressure is commonly termed end-organ or target-organ damage (TOD) [1]. The risk of target organ damage has to be considered when the systolic arterial blood pressure (SABP) and diastolic ABP exceed 150 and 95mmHg, respectively [9]. The clinical signs associated with hypertension in these organs include retinopathy, hyphema, neurologic signs of intracranial hemorrhage (seizures, altered mental status, focal neurologic deficits, etc.), renal (proteinuria, micro-albuminuria, azotemia) and cardiovascular effects (left ventricular hypertrophy, gallop rhythm, arrhythmia, systolic murmur and epistaxis) [10][11]. With the rising focus on hypertension in veterinary medicine, blood pressure monitoring has become crucial in small animals to assess its systemic effects and associated health risks.

## **2. MATERIALS AND METHODS**

The present study was executed in the Department of Veterinary Medicine, Veterinary Clinical Complex (VCC), College of Veterinary Science and Animal Husbandry, Jabalpur, Nanaji Deshmukh Veterinary Science University, Jabalpur (M.P.) during the period of from May 2024 – October 2024. The study was conducted to record the blood pressure in dogs presented at VCC, Jabalpur.

### **2.1 Screening**

A total of 214 dogs (149 males and 65 females) of varying ages and breeds were included in the study and blood pressure was recorded in all the dogs by using Doppler Vet BP machine (fig. 01) following the standardized protocol proposed by the ACVIM guidelines (Acierno et al., 2018). A total of 214 dogs were included in the study to assess the prevalence of hypertension, comprising 81 apparently healthy dogs and 133 dogs presenting with various clinical conditions. A detailed history regarding age, sex, breed etc. was recorded and thorough clinical examination like recording temperature, pulse rate and respiration rate was done. Hematobiochemical parameters and different diagnostic modalities like ultrasonography and electrocardiography were performed to confirm the diagnosis of concerned clinical conditions.



**Fig. 1. Doppler Vet BP Machine**

## **2.2 Blood pressure measurement**

The patient should be allowed to acclimatise to the measurement room for 5-10 minutes to minimize the anxiety or excitement-induced situational hypertension. The cuff width should be approximately 30%-40% of circumference of the cuff site. Hair was trimmed just above the palmar metacarpal pad, aligned with the superficial palmar arterial arch, for forelimb measurements. An occluding cuff was positioned on forelimb (taking into account animal conformation and tolerance) above the flow detection site (mid-radius in the forelimb) and measurements were taken with the cuff positioned at the heart level. Ultrasonic coupling gel

was applied to the concave side of the doppler transducer, which was either held in place during measurements. An audible pulse signal was detected, and the cuff was inflated using a bulb connected to a pressure gauge. It was inflated to at least 40 mm Hg above the point where the signal became inaudible. The cuff was then gradually deflated and the pressure at which the doppler signal became audible again was recorded as the systolic pressure. The first measurement was discarded and an average of 5-7 consecutive consistent indirect measurements were obtained [12]. Measurement of blood pressure is illustrated in fig.02.



**Fig. 2. Blood pressure measurement in a dog**

### **2.3 Categorization of systolic arterial pressure**

The hypertension categorization was based on the guidelines proposed by the ACVIM Consensus Statement (Acierno et al., 2018) [1] which categorizes systolic arterial pressure in dogs based on the risk of future target-organ damage (TOD) (Table.1). Hypertension is classified when systolic arterial pressure ranges from 160 to 179 mm Hg, posing a moderate risk, while severe hypertension, defined as 180 mm Hg or higher, poses a high risk of TOD. These classifications help assess and manage the potential impact of elevated blood pressure on vital organs such as the kidneys, heart, eyes, and central nervous system. Hypertension in dogs is further categorized into primary (idiopathic) hypertension and secondary hypertension, based on the presence or absence of an underlying disease.

**Table. 1: Classification of systolic arterial pressure in dogs based on risk for future target-organ damage (TOD)**

<b>Risk category</b>	<b>Systolic blood pressure (mmHg)</b>	<b>Risk of future TOD</b>
Normotensive	<140 mm Hg	Minimal

Prehypertensive	140-159 mm Hg	Low
Hypertensive	160-179 mm Hg	Moderate
Severely hypertensive	$\geq 180$ mm Hg	High

### 3. RESULTS AND DISCUSSION

#### 3.1 Overall occurrence of hypertension in dogs

During the study period from May 2024 – October 2024, a total of 214 dogs presented at the Veterinary Clinical Complex (VCC), College of Veterinary Science and Animal Husbandry, Jabalpur, underwent blood pressure measurement. Among them, 39 dogs of various breeds and genders were diagnosed with hypertension (SBP  $>160$  mm Hg). The overall occurrence of hypertension (SAP  $\geq 160$  mm Hg) in dogs was recorded as 18.22% (39 out of 214), with secondary hypertension accounting for 27.81% and idiopathic (primary) hypertension comprising 2.46%. The findings are presented in Table.2.

**Table.2: Overall occurrence of hypertension in dogs**

Condition	Screened	Affected	Occurrence rate (%)
Healthy (primary)	81	02	02.46
Disease (secondary)	133	37	27.81
Total	214	39	18.22

Our findings partially align with those of [13], who conducted a study involving 6856 adult dogs, identifying 87 cases of hypertension ( $>150$  mm Hg). The incidence of hypertension in their study was 1.27%, with secondary hypertension accounting for 90.8% of cases and idiopathic hypertension for 9.2%. Acierno *et al.* (2018) stated that the prevalence of hypertension was unknown in dogs and cats and this was assumed due to lack of uniform measurement techniques, variable inclusion criteria and inconsistent thresholds for establishing a diagnosis of hypertension in veterinary medicine make prevalence data difficult to interpret.

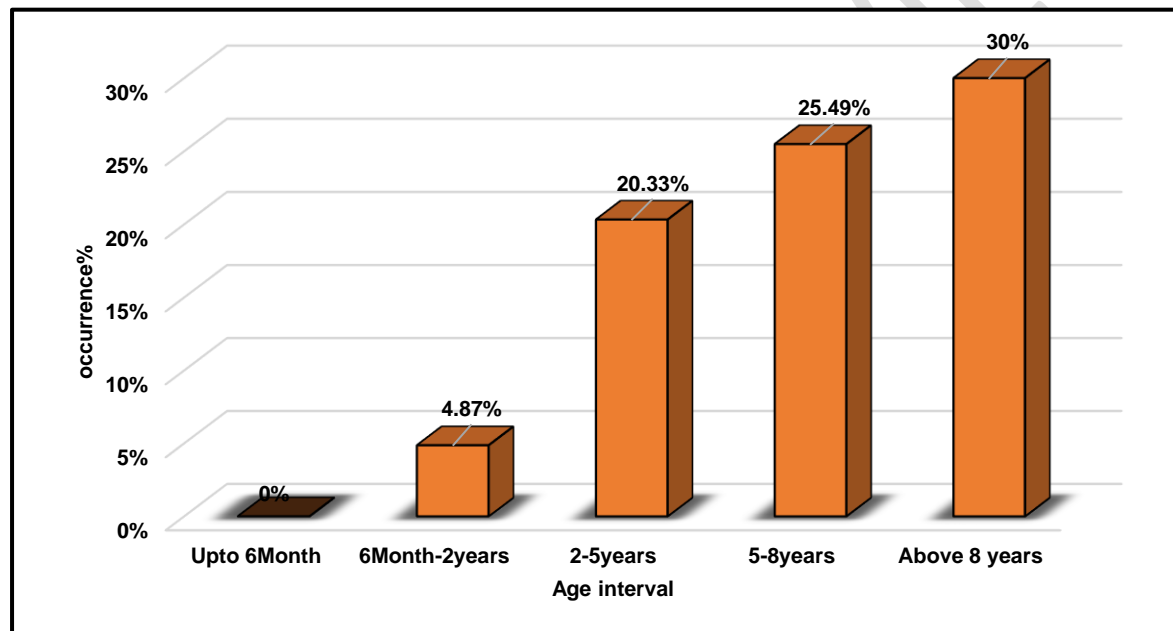
#### 3.2 Age wise occurrence of hypertension in dogs

The age wise occurrence of hypertension in dogs among different age groups i.e., 6months to 2years, 2 to 5years, 5 to 8years and above 8years revealed occurrence of 4.87%, 20.33%,

25.49% and 30% respectively. The study highlighted that the higher occurrence was reported in above 8 years age. The results are depicted in Table. 3 and Fig. 3.

**Table. 3: Age wise occurrence of hypertension in dogs**

Age	Dogs screened	Hypertensive dogs ( $\geq 160\text{mmHg}$ )	Occurrence rate (%)
Up to 6 months	23	00	00
6months to 2 years	41	02	4.87
2 to 5 years	59	12	20.33
5 to 8 years	51	13	25.49
Above 8 years	40	12	30.00



**Fig. 3: Age wise occurrence of hypertension in dogs**

The observed trends in blood pressure are congruent with earlier studies who have also recorded BP in dogs. Bodey and Michell (1996) [14] observed a significant increase in blood pressure with age, followed by a decline in advanced age, although data on very elderly dogs were limited. Singla (2015) [15] noted a significant increase in blood pressure up to 7 years of age. The findings partially align with those of [13], who reported a higher incidence of hypertension in dogs aged 6 to 8 years, followed by those aged 12 years. This trend may be attributed to age-related loss of arterial compliance, secondary to progressive decrease in the distensibility and elasticity of the large capacitance arteries which impairs the mechanisms for adequate vasodilation [16]. Another possibility of hypertension in geriatric dogs in the study

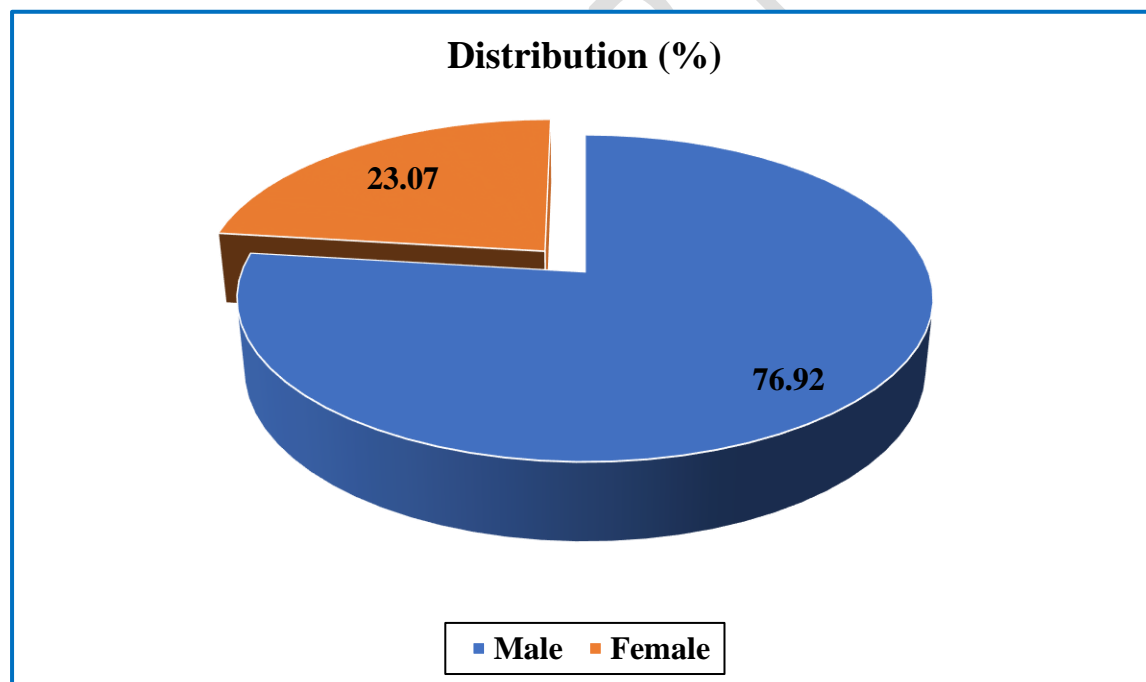
might have had due to undiagnosed, underlying disease process or due to the higher representation of this age group within the study population.

### 3.3 Gender wise distribution of hypertension in dogs

Among 39 dogs have hypertension (SAP  $\geq$ 160 mm Hg), with a higher distribution observed in males (76.92%) compared to females (23.07%). These results are presented in Table. 4 and Fig. 4.

**Table. 4: Gender wise distribution of hypertension in dogs**

Gender	Hypertensive dogs (n=39)	Distribution (%)
Male	30	76.92
Female	09	23.07



**Fig. 4: Gender wise distribution of hypertension in dogs**

Priyanka (2010) [17] also reported the predominance of hypertension in male dogs with an incidence of 64% and 36% in female dogs. Thiruselvame (2011) [18] also observed that male dogs had higher blood pressure than females, which could be attributed to factors such as larger body mass, greater heart size and higher cardiac output in males, or the predominance of male dogs presented at veterinary hospitals. Charitha *et al.* (2023) [13] also reported that males (56.32 %) were affected more than females (43.68%). Bodey and Michell (1996) [14] studies

which indicates that blood pressure is slightly higher in male dogs compared to females, but the difference is not substantial enough to be clinically relevant. Similarly, Bala et al. (2021) [19] concluded that blood pressure was not influenced by sex.

### 3.4 Breed wise distribution of hypertension in dogs

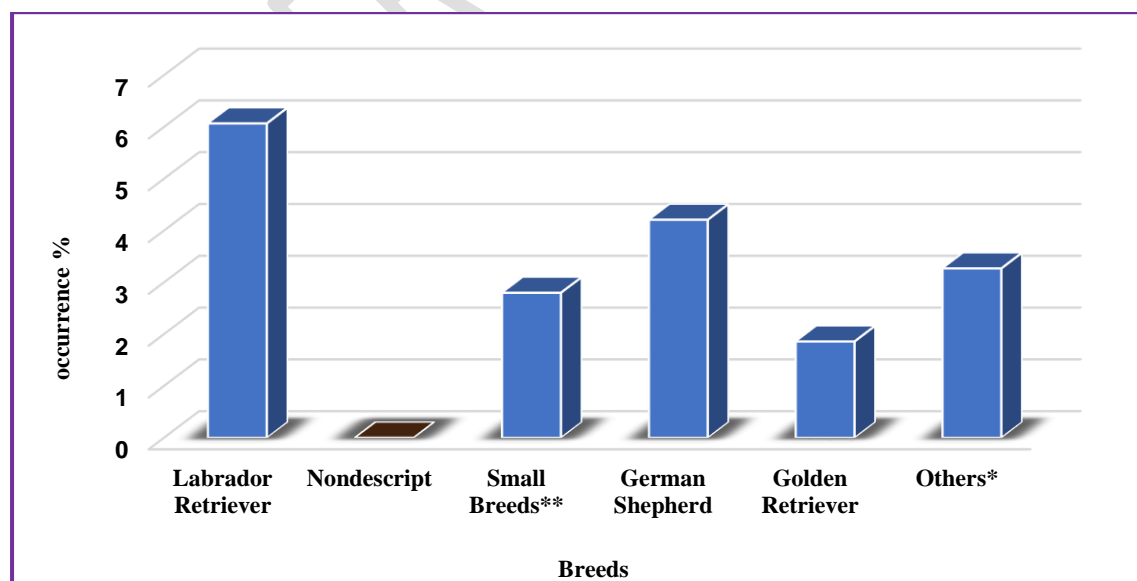
The breed wise distribution of hypertension (SAP  $\geq$  160 mm Hg) in dogs was found to be higher in Labrador Retriever (33.3%), followed by German Shepherd (23.07%), small breeds (15.38%) and Golden Retriever (10.25%). The details are shown in Table. 5 and Fig. 5.

**Table 05: Breed wise distribution of hypertension in dogs**

Breeds	Hypertensive dogs (n=39)	Distribution (%)
Labrador Retriever	13	33.33
German Shepherd	09	23.07
Small Breeds**	06	15.38
Golden Retriever	04	10.25
Others*	07	17.90

\*\* Pomeranian, Shihtzu, Pug, Beagle, Dachshund, Lhasa apso, Cocker spaniel

\* Saint Bernard, Doberman, Siberian Husky, Bull Mastiff, French Mastiff, Great Dane, Argentino, Dalmatian



**Fig. 5: Breed wise distribution of hypertension in dogs**



Our findings somewhat align with Charitha *et al.* (2023) [13] who found higher incidence of hypertension among Spitz (33.33%), followed by Labrador Retriever (17.24%) and German Shepherd (10.34%). Perez-Sanchez *et al.* (2015) [20] reported that Labradors exhibit a higher predisposition to overweight and obesity, which may contribute to an increased prevalence of hypertension. However, there is limited research on blood pressure (BP) variations across different canine breeds. Conversely, Bodey and Michell (1996) [14] observed that sight hounds tend to have a higher systolic blood pressure (SBP) (133 mmHg), whereas Labradors demonstrated a comparatively lower SBP (122 mmHg). Their study did not establish a direct correlation between breed and hypertension (HTN).

#### **4. CONCLUSION**

The present study provides valuable insights into the prevalence and distribution of hypertension in dogs presented at the Veterinary Clinical Complex, Jabalpur. The overall prevalence of hypertension was recorded as 18.22%, with secondary hypertension (27.81%) being more common than idiopathic hypertension (2.46%), highlighting the strong association between hypertension and underlying disease conditions like renal affections, cardiac disorders, epilepsy, ascites (hepatic origin), ocular affections, obesity, hameoprotzoan, gastroenteritis and diabetes mellites. The study also evidenced that older dogs (above 8 years) had the highest occurrence (30%), which may be attributed to age-related vascular changes or a greater prevalence of concurrent diseases in this age group. Additionally, male dogs (76.92%) were more frequently affected than females, and breed predisposition was observed, with Labrador Retrievers (33.3%) and German Shepherds (23.07%) being the most commonly affected. These findings emphasize the importance of regular blood pressure monitoring, particularly in older dogs and breeds predisposed to hypertension, to facilitate early detection and management.

#### **5. FUTURE SCOPE**

This cohort study provides data on the prevalence of hypertension in the canine population in and around Jabalpur. The predominance of secondary hypertension highlights the importance of screening for underlying diseases in hypertensive patients. A longitudinal cohort study involving a larger canine population over an extended period is required to investigate blood pressure variations, the incidence and progression of hypertension and its long-term health

outcomes. Additionally, the efficacy of various antihypertensive drugs in the therapeutic management of hypertension should be systematically evaluated.

## **DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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