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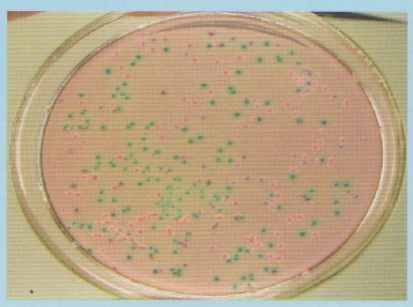


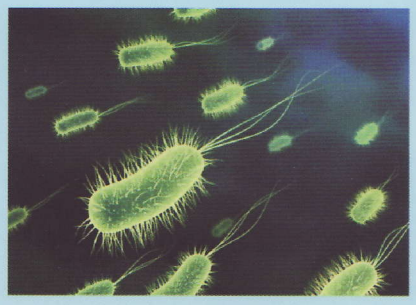
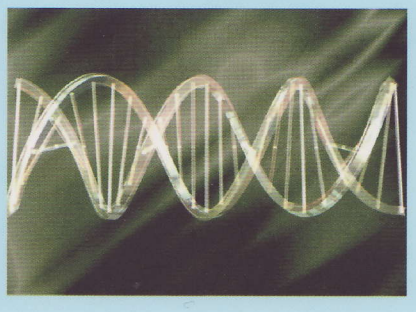

From Knowledge to Wisdom

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# A Survey on Morphological Traits of Basset Hound Dogs Raised in Italy

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**Abstract:** Several biometric measures were taken from 48 adult (mean age 2.78 ± 1.71 years) Basset Hound dogs (24 males and 24 females) belonging to four different farms. For each animal, the following biometrical measurements were considered: withers height, chest height, chest depth, trunk length, rump length, ischium width of the rump, ear and nose length, chest and cannon circumference. Results showed that sexual dimorphism was not present; however two morphological groups of Basset Hound with some differences were found. The first group consisted of animals with high and broad chest, while the second one was more compact, with more pronounced nose and ears. Considering breed health, it would be interesting to select the subjects of the first group since showing an anatomical less susceptible to some conformational disorders typical of the breed. On the contrary, focusing our interest on the breed hunting attitude, the second group would have some characteristics more suitable for this purpose.

**Key words:** Morphological characterization, Basset Hound dog breed, clusters, conformational defects.

## 1. Introduction

The Basset Hound is an old breed which is a direct descended of the Bloodhound and has a nose that is almost as outstanding. Some sources suggest the Basset Hound may have originated from genetic dwarf dogs which were born in litters of different types of hunting hounds [1, 2]. The name "Basset Hound" comes from the French word "bas" meaning low, with the attenuating suffix -et, together meaning "rather low". The Basset Hounds long ears have been poetically described by Shakespeare as: "Ears which sweep away the morning dew". The breed was first presented at a Paris dog show in 1863 which began the dog's popularity. Their popularity spread to England and feuds soon arose between those who wanted the dog to be more of a show dog, keeping them more as a companion dog and those who wanted to keep it as a hunting dog. The breed spread to America where breeders started developing a dog which they felt covered both hunting and companion/show traits. The breed was recognized by the American Kennel Club in 1885. Able to hunt in both packs or alone, the dog is good at hunting in the den and in the open. They are used to hunt fox, hare, opossum, and pheasant. While the dogs reflexes are slow, it has an excellent sense of smell for tracking, second only to that of the Bloodhound. The fact that they are relatively slow on their feet means they can be more convenient for hunters who are on foot. They are also less likely to scare game out of reach. It is said that George Washington owned Basset Hounds which were given to him by Lafayette after the American Revolution.

Basset Hound appears like a short-legged breed of dog of the hound family. They are scent hounds, bred to hunt rabbits. These dogs are around 1 foot in height at the withers and usually weigh between 35-70 ibs.

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They have smooth, short-haired coats but a rough haired hound is possible. They have long, downward ears and powerful necks, with much loose skin around their heads that forms wrinkles. Basset hounds are generally tricolor (black, tan, and white), and most often spotted, but also exist in a variety of colors considered acceptable by breed standards. This breed is sweet, gentle and naturally well-behaved, very affectionate and friendly with its master, never vicious nor harsh: for this reason it is an excellent pet for children.

Although being generally healthy, the Basset Hound is susceptible to several genetic diseases [3-6] and to glaucoma, obesity, gastric torsion, panosteitis, and allergies. His long back predisposes him to disc problems and can cause problems if he is overweight, out of condition, or jumps on and off furniture. He is also subject to von Willebrand's disease, a genetic blood disease similar to haemophilia and to elbow dysplasia. Studies were conducted on epilepsy [7, 8], syndactylism [9], and hermaphroditism [10] of Basset Hound.

In the Basset Hound there is also high incidence of disorders associated with conformation. These disorders are directly related to the conformation or standards for the breed. Although these conditions have in many cases become so common that they are accepted as normal for the breed, they can still cause serious physical problems and discomfort for the dog. One component of responsible breeding is to breed away from the extremes of conformation that cause these physical problems. Asher et al. [11] had conducted a study that considered the conformational breed-associated defects and they have shown that the Basset Hound was predisposed to about 41 disorders including 16 conformational related disorders.

Basset Hound is a chondrodysplastic breed [12] and it was hypothesized that this breed-defining trait would be under strong selective pressure.

Few are the scientific studies carried out on the genetic variability and on the morphological traits in the breed. In a previous work Lubas et al. [13] have studied the genetic variability of Basset Hound raised in Italy by genealogical data. The study has pointed out the good genetic variability of the dogs reared in the principal herds of the breed.

Jordana et al. [14] had analyzed several morphological and behavioral characters of a series of breeds, including Basset Hound, in order to improve the knowledge of relationships among current breeds. However scores were assigned to each state of different characteristics in an arbitrary manner and no analytical measurements were done.

The aim of the present work was to report the first results of a survey on morphological traits of Basset Hound dogs reared in Italy, to assess whether there are particular conformations less susceptible to conformational disorders and/or most suitable to hunting tests. Furthermore, this work is a part of a more comprehensive study whose objective is to identify morpho-functional attributes having the greatest potential of being genetically improved.

## 2. Material and Method

Body measures were taken from 48 adult (mean age 2.78 ± 1.71 years) Basset Hound dogs (24 males and 24 females). The animals belonged to four different farms. For each animal, the following biometrical measurements were considered: withers height, chest height, chest depth, trunk length, rump length, ischium width of the rump, ear and nose length, chest and cannon circumference.

Data analysis: A cluster analysis with the link "Sum of Square" method has been applied on all parameters with the aim to stratify the population in different morphological groups.

Subsequently, the associations between clusters with the classes of sex (male and female) and with the classes of herd (four herds or farms) were made in order to detect the distribution of subjects belonging to different morphological groups within the sexes and within the herds.

All the differences between sexes, among farms and between clusters were tested using the following model:

$Yijkl = \mu + \alpha i + \beta j + \chi k + b1X1 + \varepsilon ijkl$

where Yijkl = considered parameters;

$\mu$ = overall mean;

$\alpha i$ = fixed effect of the ith sex (i=1, 2);

$\beta j$ = fixed effect of the jth farm (i=1,.., 4);

$\chi k$ = fixed effect of the kth cluster (i=1, 2);

b1X1 = regression coefficient on the age at measurements;

$\varepsilon ijkl$ = residual error.

Simple correlations were used to calculate the relationships between different parameters.

All experimental data obtained were analyzed by JMP software version 5.0 [15].

## 3. Results

Fig. 1 shows the measurements on the two sexes.

The comparison between males and females evidences that the dogs examined in this study, for all parameters considered, show limited differences in their average values but never statistically significant, even if males have a greater standard deviation for most of the considered parameters. The average withers height was 35.95 ± 1.359 cm in females and 36.01 ± 1.801 cm in males. The age at measurement has never shown significant effects. No significant differences in morphological measurements were also observed among farms (Table 1). All parameters were similar, even if the animals of farm 3 have the greatest average withers height (36.93 vs 36.22 in farm 1, 35.31 in farm 2 and 35.46 in farm 4) while the animals of farm 4 have the largest average chest circumference (72.85 in farm 4 vs 71.23 in farm 1, 72.22 in farm 2 and 71.67 in farm 3).

The Cluster Analysis applied to the morphological data recorded on 48 subjects revealed the existence of

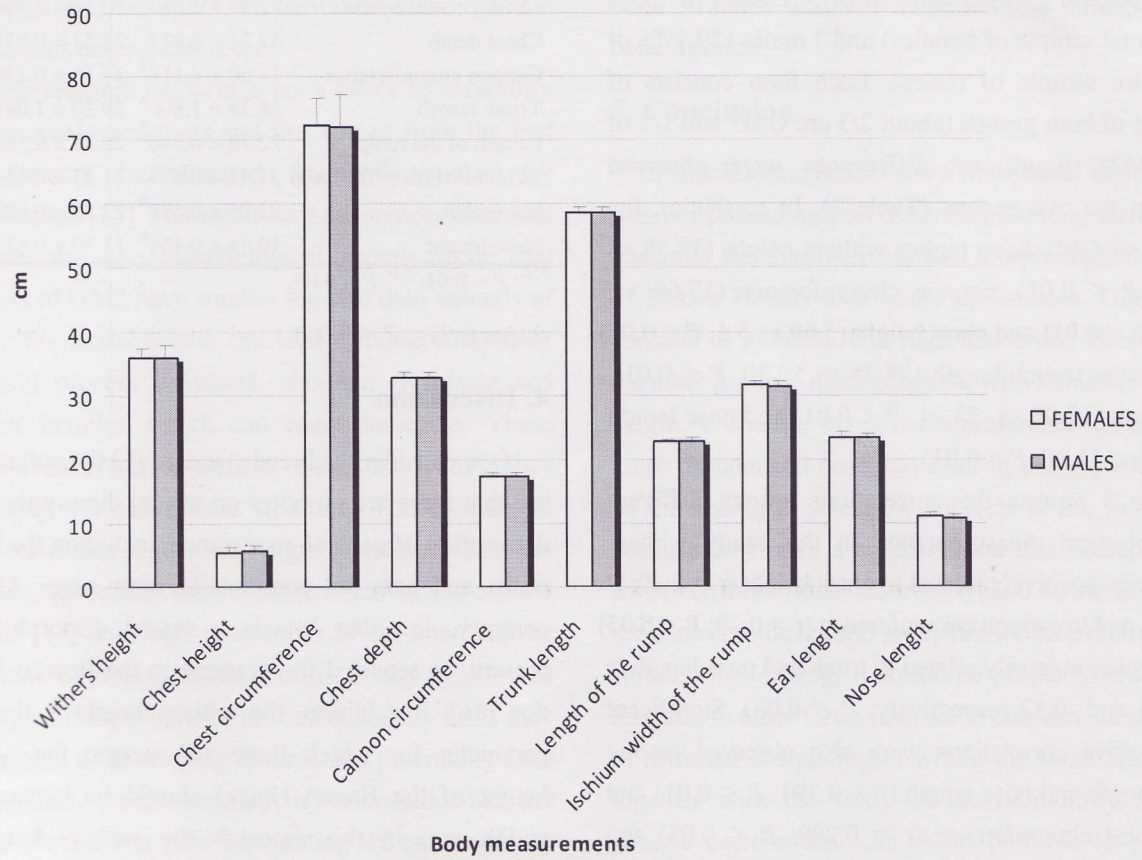


**Fig. 1 Differences between females and males for morphological measurements (means and SD).**

**Table 1 Differences in morphological measurements among dogs of different farms.**

| Body measures | FARM 1 with 15 animals Mean ± SD (cm) | FARM 2 with 12 animals Mean ± SD (cm) | FARM 3 with 8 animals Mean ± SD (cm) | FARM 4 with 13 animals Mean ± SD (cm) | SEM |
|---|---|---|---|---|---|
| Withers height | 36.22 ± 1.252 | 35.31 ± 1.294 | 36.93 ± 2.064 | 35.46 ± 1.682 | 1.56 |
| Chest circumference | 71.23 ± 3.755 | 72.22 ± 4.809 | 71.67 ± 6.614 | 72.85 ± 5.028 | 4.96 |
| Chest height | 5.69 ± 1.135 | 5.52 ± 0.746 | 5.20 ± 1.332 | 5.36 ± 0.906 | 0.11 |
| Chest depth | 32.61 ± 0.925 | 32.88 ± 0.787 | 32.36 ± 0.994 | 32.66 ± 0.972 | 0.97 |
| Cannon circumference | 17.47 ± 0.461 | 17.34 ± 0.434 | 17.31 ± 0.415 | 17.26 ± 0.311 | 0.42 |
| Trunk length | 59.00 ± 1.035 | 58.51 ± 0.946 | 58.36 ± 0.927 | 58.56 ± 0.932 | 0.98 |
| Length of the rump | 22.81 ± 0.354 | 22.71 ± 0.444 | 22.68 ± 0.589 | 22.81 ± 0.578 | 0.49 |
| Ischium width of the rump | 31.45 ± 0.783 | 31.47 ± 0.851 | 31.59 ± 0.946 | 31.37 ± 0.779 | 0.84 |
| Ear lenght | 23.25 ± 0.712 | 23.39 ± 0.844 | 23.58 ± 0.644 | 23.31 ± 0.628 | 0.71 |
| Nose lenght | 10.97 ± 0.647 | 10.92 ± 0.533 | 10.76 ± 0.478 | 11.02 ± 0.669 | 0.60 |

two distinct morphological groups, GM1 and GM2, of 32 and 16 subjects respectively. The subsequent association sex/morphological group has revealed that the morphological group 1 (GM1) consists of 15 females (62.50% of the total sample of females) and 17 males (70.83% of the entire sample of males), while the morphological group 2 consists of 9 females (37.50% of the total sample of females) and 7 males (29.17% of the entire sample of males). Each farm consists of subjects of both groups (about 2/3 are GM1 and 1/3 of the GM2). Significant differences were observed between the two groups (Table 2). In particular, the subject of GM1 have higher withers height (36.58 vs 34.42, $P < 0.01$), cannon circumference (17.60 vs. 17.16, $P < 0.01$) and chest height (5.69 vs 5.5, $P < 0.05$) but a lower trunck length (58.38 vs 59.20, $P < 0.01$), ear length (23.08 vs. 23.74, $P < 0.01$) and nose length (10.74 vs. 11.30, $P < 0.01$).

Table 3 reports the correlations among different morphological measurements. In this study withers height was positively related to chest height (r = 0.40; $P < 0.01$) and to cannon circumference (r = 0.29; $P < 0.05$) while it was inversely related to trunk and nose length (r = -0.33 and -0.32 respectively, $P < 0.05$). Significant and positive correlations were also observed among trunk length and nose length (r = 0.384; $P < 0.01$) and with chest circumference (r = 0.299; $P < 0.05$) and among chest depth with chest circumference (r = 0.354 respectively; $P < 0.05$).

**Table 2 Differences in morphological measurements among clusters.**

| | Cluster1 (GM1)/(cm) | Cluster2 (GM2)/(cm) |
|---|---|---|
| Number of animals | 32 | 16 |
| Body measures | Mean ± SD | Mean ± SD |
| Withers height | $36.58 \pm 1.162^{A}$ | $34.42 \pm 1.369^{B}$ |
| Chest height | $5.69 \pm 1.009^{a}$ | $5.05 \pm 0.887^{b}$ |
| Chest circumference | 72.97 ± 4.660 | 70.51 ± 4.766 |
| Chest depth | 32.71 ± 0.877 | 32.53 ± 0.971 |
| Cannon circumference | $17.60 \pm 4.111^{A}$ | $17.16 \pm 0.236^{B}$ |
| Trunk length | $58.38 \pm 1.806^{B}$ | $59.20 \pm 1.041^{A}$ |
| Length of the rump | 22.76 ± 0.340 | 22.81 ± 0.560 |
| Ischium width of the rump | 31.41 ± 0.876 | 31.53 ± 0.654 |
| Ear lenght | $23.08 \pm 0.584^{B}$ | $23.72 \pm 0.693^{A}$ |
| Nose lenght | $10.74 \pm 0.469^{B}$ | $11.30 \pm 0.629^{A}$ |

$^{A, B}$: $P < 0.01$; $^{a, b}$: $P < 0.05$.

## 4. Discussion

If we consider the breed standard [1] the authors can see that there are no notes on sexual dimorphism: the description of general appearance, including the trunk, noses and ears are common in both sexes. On the contrary, in other breeds a sexual dimorphism is present, as reported for example in the Bracco Italian dog [16]. In addition, the withers height is the only parameter for which there are ranges: the withers height of the Basset Hound should be between 33 and38 cm; in this research the withers height is approximately 36 cm in both sexes, a value that falls

**Table 3 Correlations among morphological measurements.**

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Withers height | 1.000 | | | | | | | | | |
| 2 | Chest circumference | 0.107 | 1.000 | | | | | | | | |
| 3 | Chest height | 0.404** | 0.263 | 1.000 | | | | | | | |
| 4 | Chest depth | 0.126 | 0.354* | 0.157 | 1.000 | | | | | | |
| 5 | Trunk lenght | -0.334* | 0.299* | -0.166 | 0.071 | 1.000 | | | | | |
| 6 | Rump lenght | 0.153 | 0.118 | 0.152 | 0.003 | 0.117 | 1.000 | | | | |
| 7 | Ischium width of the rump | -0.138 | -0.238 | -0.122 | -0.263 | -0.113 | 0.034 | 1.000 | | | |
| 8 | Ear lenght | -0.106 | -0.209 | -0.189 | -0.016 | 0.050 | -0.246 | -0.178 | 1.000 | | |
| 9 | Nose lenght | -0.325* | 0.121 | 0.039 | 0.018 | 0.384** | 0.037 | -0.107 | 0.012 | 1.000 | |
| 10 | Cannon circumference | 0.292* | 0.201 | 0.251 | 0.062 | -0.048 | 0.064 | -0.090 | -0.212 | -0.032 | 1.000 |

**: $P < 0.01$; *: $P < 0.05$.

exactly in the expected values.

The greatest standard deviation observed for males in relation to withers height, chest circumference, and to ischium width of the rump might suggest the possibility of making selective interventions especially on the males, although these considerations should be supported by the study of heritability and genetic correlations among characters.

In our research the farm is not a factor of variability for the considered traits and this comes from the fact that farmers interchanged frequently males for reproduction [13]. The significant differences observed between the two morphological groups show that subjects of GM2 have smaller leg size than animals of GM1; this characteristic can lead to more commonly odontoid process dysplasia, shoulder dysplasia and patellar luxation which can cause lameness. These animals have also a smaller cannon circumference indicating a weaker bone structure. The animals of GM2 have also higher ear length: pendulous ears but too long, associated with excessive hair in and around the ear [17] and high production of cerumen can be indicative of predisposition to otitis. If ears are allowed to dangle on the ground or in food on a daily basis they are capable of developing chronic and potentially fatal ear diseases. On the contrary, if we consider that the Basset Hound was bred for hunting we can point out that GM2 is the most suitable to this aim. In fact, the Basset Hound is first and foremost a hunting dog, with a large capacity of the nose and long ears, which serve to sweep the smell in the nose, as he moves. Its keen nose and short stature are suited to small-game hunting on foot.

It is confirmed that higher animals have a stronger bone structure and are therefore less susceptible to bone injuries.

## 5. Conclusion

In conclusions, results show that sexual dimorphism was not present and no differences among farms were observed but that there are two morphological groups of Basset Hound with some differences. One group consists of animals with high and broad chest, while the other group is more compact, with a smaller withers height, a smaller cannon circumference and with a more pronounced nose and ears. In our view it would be interesting to select the subjects of the first group because they have a conformation less susceptible to some conformational disorder typical of the breed. On the contrary, the second group has a conformation most suitable for hunting. It would be proper to extend the research to other farms in order to confirm the presence of different morphologies within the same breed that, together with the study of the heritability and the genetic correlations, can make possible to program genetic improvement plans depending on the primary

requirements of the breeders and on the health of the breed.

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