

A Study on Morphology and Behavior of the Sapsaree : A Korean native dog (*Canis familiaris*)

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ABSTRACT

This study was conducted to characterize the morphological and behavior patterns of Sapsaree dogs. The population (n=8,256) has been constructed since 1990 over 12 generations and managed at the Sapsaree Breeding Research Institute, Gyeongsan, Gyeongbuk province. Eighteen morphological and seven behavioral traits were investigated for 882 individuals. Linear models were applied for each trait by fitting sex, season of birth, hair color or test age. The averages of body weight, body length, body height, and depth of chest were 20.5±2.4 kg, 57.3±4.2 cm, 52.1±3.6 cm, and 21.1±2.4 cm, respectively. Males had greater estimated values than females for these body conformation traits. The chocolate Sapsarees had greater averages for body weight, body height and chest depth. The older animals (>2 years) had heavier body weight than younger animals. About 54, 69, 97, 39 and 83.3% of the Sapsarees had hairs with yellow color, straight, medium to long, untangled, and longer around eyes, respectively. Also, about 40% brown eye, 43% curly tail, 78% normal jaw, 86% no missing teeth, 90% no dewclaw, and >90% with black nose, pendent ear, tongue without spots were observed. About 95% males were normal in testicles state. The males performed significantly better than the females for majority of the behavioral traits. For nerve stability, affability, wariness, adaptability, sharpness, activity, and reaction during blood drawn about 79%, 73%, 76%, 61%, 70%, 48% and 81% of the Sapsarees performed at desired level. In general, the Sapsarees showed good characteristics for both morphological and behavioral traits, which can be exploited to use the Sapsaree breed as a companion or guide dog.

(**Key words** : Morphology, Behavior, Sapsaree, Guide dog, Companion dog)

INTRODUCTION

Among the domestic animals, the dog takes a significant position in the human society due to its very intimate behavioral exhibition with human. Moreover, dog's position in the animal kingdom is a quite interesting one in scientific field, due to huge variations in colors, appearance and behavior.

The dog (*Canis familiaris*), is the oldest domestic animal, originally domesticated in the pre-agricultural age between 14,000 and 12,000 years ago (Turnbell and Reed, 1974; Tanabe et al., 1991). The dogs are one of the most diverse domestic species. Their range in size and conformation is exemplified by the petite Chihuahua (0.5 kg) and the massive Great Dane (80 kg) (Wayne and Ostrander, 1999). Although individual breeds show general uniformity for behavior and

morphology, most breeds show evidence of a genetically diverse heritage because of different haplotypes related to the traits (Vila et al., 1997). These results can be supported by analysis of protein alleles (Ferrell et al., 1978; Simonsen, 1976), as well as hypervariable microsatellite loci (Fredholm and Wintero, 1995, Zajc et al., 1997). Currently, there are more than 400 registered dog breeds around the world that were bred for various purposes, e.g. hunting, guarding, guides for blind, pets, etc.

The Sapsaree is known as a very friendly dog in Korea. The dog has medium body size with body height ranging 49~55cm (Kim et al., 2001). Adult coat is long and abundant with two typical variations in color, like blue and yellow. With regard to temperament, they are very gentle, protective and loyal to their owner. Generally, the breed is not aggressive, but express aggression if other dog enters into

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their territory.

The Sapsaree was habituated in regions along the Sobaik and Taibaik mountains until Japanese colonization, on which the breed was close to extinction. Afterwards, in 1986, eight individuals with the same characteristics as Sapsaree in color and body conformation were collected by local Sapsaree lovers in Daegu. Successively, systematic mating and reproductions enabled the current population of about 3,000 individuals including about six hundreds at the Sapsaree Breeding Research Institute in Gyeongsan, Gyeongbuk province.

It seems that Sapsaree possesses some favorable genetic characteristics suitable for companion, guide or cure purposes. However, a lot of variations have been observed in coat color, body conformation, and behaviors between individuals. In this study, we investigated the existing variations in the physical appearances as well as behavior patterns in the Sapsaree population, so as to evaluate the possibility of using the breed as a guide or companion dog.

MATERIALS AND METHODS

1. Animals and traits

Pedigrees of 12 generations were recorded for 8,256 Sapsaree individuals that were born between 1990 and 2007. Eighteen morphological and seven behavioral traits like ① body weight, ② body length, ③ body height, ④ depth of chest, ⑤ hair color, ⑥ hair pattern, ⑦ hair length, ⑧ hair length surrounding eyes, ⑨ hair quality, ⑩ eye color, ⑪ nose color, ⑫ ear erection pattern, ⑬ jaw pattern, ⑭ dewclaw, ⑮ tongue spot, ⑯ tail-set, ⑰ missing teeth, ⑱ testicles, ⑲ nerve stability, ⑳ affability, ㉑ wariness, ㉒ adaptability, ㉓ activity or energy levels, ㉔ sharpness, and ㉕ reaction during blood drawn were measured. Information of sex, date of birth, mother's parity, litter size, season of birth, time of data collection, and all other useful information were recorded in the Sapsaree registration book and database, which has been managed by a few breeders. Two breeding seasons were defined each year, i.e., Spring: *January-June* and Fall: *July-December*. Each individual was tested after reaching maturity stage, i.e. after 1 year old. The behavior data were collected from 1999 to 2007 once a year.

Morphological traits and behavior characteristics analyzed in this study were described below.

(1) Morphological traits

Body weight: measured in kilogram (kg) by weighing balance.

Body length: from point of shoulder to rear point of croup (cm).

Body height: from the ground to top of withers (cm).

Depth of chest: the distance from elbow to top of withers (cm).

Hair color: four major external coat colors were recorded-blue, yellow, white, or chocolate.

Hair pattern: the state of curliness of hairs-straight, wavy, or curly.

Hair length: four levels of hair length-long, medium, short, or very short.

Hair length surrounding eyes: measured in three categories-long, medium, or short.

Hair quality: three levels of hair twisting-untangled or no twisting, medium tangled, or tangled.

Eye color: four different colors-dark brown, brown, light brown or, blue gray.

Nose color: two types-black or chestnut.

Ear erection pattern: four conditions-pendent, half-pricked, erect, or front pendent.

Jaw pattern: three types of lower and upper jaw conformation-normal, cutting, or under shot.

Dewclaw: presence or absence of dew claw-absent, one, two or more dewclaw present.

Tongue spot: presence or absence of tongue spots.

Tail-set: three categories-curl, upright, or sickle.

Missing teeth: four categories-no tooth missing, one, two, or more than two teeth missing.

Testicles: presence or absence (hernia) of testicles in male dogs.

(2) Behavioral traits

The behavioral patterns were categorized on hedonic scale according to intensities of behavior. Highest grade of 4 was for nerve stability, affability, wariness, adaptability and activity, and 3 for sharpness and reaction during blood drawn each. The lowest grade reflected the most desired pattern of behavior, while higher scores indicated increasingly undesirable behavior. Trait definitions of nerve stability, affability, wariness, activity or energy level, and sharpness were adapted from Wilson and Sundgren (1997).

Nerve stability: appropriateness of reaction to a certain situation or ability to adapt to various types of situations (stable, medium, unstable, or very unstable).

Affability: willingness to make contact with people (friendly, medium friendly, less friendly, or avoiding tendency).

Wariness: level of fearfulness (none, exists, exists seriously, or very seriously).

Adaptability: adjustment to changing environments (good, normal, weak, or very weak).

Activity or energy level: degree of liveliness (very active, active, medium, or static).

Sharpness: tendency of reaction with aggression in order to reach a certain goal (offensive, normal, or absence of sharpness).

Reaction during blood drawn: expression during blood collection (obedient, shrunken, or over agitated).

2. Analysis of data

After screening the original database comprising 1,014 individuals for the traits in this study, data of 882 individuals were chosen (Table 1) for statistical analyses. The traits with descriptive measures were analyzed by using SAS[®] GLM procedure (Release 9.1, SAS Institute Inc., Cary, NC, USA, 2003). For morphological traits, linear models were applied by fitting sex, season of birth, and hair color to test the mean differences and significance of each factor. Effects of sex and testing age were also considered for behavioral traits.

RESULTS AND DISCUSSION

1. Morphological traits

(1) Body weight

The mean body weight (\pm standard deviation, SD) of Sapsaree

Table 1. Number of individuals for data analysis

Birth year	Number of males	Number of females	Number of individuals
1990~1997	27	78	105
1998	12	19	31
1999	92	82	174
2000	47	51	98
2001	60	66	126
2002	37	45	82
2003	48	48	96
2004	15	13	28
2005	22	40	62
2006	3	18	21
2007	24	35	59
Total	387	495	882

was 20.5 ± 2.4 kg and the weights were significantly different between males and females ($p < 0.0001$, Table 2). There was a significant difference in body weight according to hair color ($p < 0.05$, Table 3). Those individuals with chocolate had heavier weight than white ones ($p < 0.05$). The effect of season of birth also resulted in significant weight differences in Sapsaree, with heavier weights for those that were born in spring ($p < 0.01$, Table 4). In addition, the effect of testing age were highly significant at $p < 0.0001$; indicating that those of more than 2 year old of age were heavier than those with the younger age (Table 5). The average values of body weight for male and female were 21.3 and 19.9 kg, respectively. Helmink et al. (2000) showed that German shepherd and Labrador males were heavier than females for body weight. Similar differences for sex in Labrador retrievers were also observed by Allard et al. (1988).

Table 2. Least squares means of morphological traits of Sapsaree for sex

Trait	Sex	Min	Max	Average \pm SD	Overall \pm SD	F-statistics
Body weight (kg)	Male	15.0	32.5	21.3 ± 2.7	20.5 ± 2.4	***
	Female	14.0	25.5	19.9 ± 1.9		
Body length (cm)	Male	45.0	70.0	58.5 ± 4.0	57.3 ± 4.2	***
	Female	45.1	70.0	56.3 ± 4.1		
Body height (cm)	Male	44.2	63.0	53.4 ± 3.6	52.1 ± 3.6	***
	Female	42.2	62.0	51.1 ± 3.3		
Depth of chest (cm)	Male	16.7	31.0	21.7 ± 2.3	21.1 ± 2.4	***
	Female	15.6	29.0	20.7 ± 2.3		

*** Significance of gender difference at $p < 0.0001$.

Table 3. Least squares means of morphological traits of Sapsaree for hair color

Trait	Hair color (average [†] ± SD)				F-statistics
	Black	Yellow	White	Chocolate	
Body weight (kg)	20.7 ^{ab} ±2.6	20.3 ^{ab} ±2.2	19.6 ^b ±1.8	21.0 ^a ±2.7	*
Body length (cm)	56.4 ^b ±3.9	57.6 ^b ±4.2	60.9 ^a ±3.7	60.7 ^a ±4.4	***
Body height (cm)	51.7 ^c ±3.5	52.2 ^{bc} ±3.6	53.6 ^{ab} ±2.8	54.6 ^a ±4.2	**
Depth of chest (cm)	21.0 ^b ±2.3	21.1 ^b ±2.3	23.0 ^a ±2.4	23.0 ^a ±2.5	***

[†] No. of observation for black: 360 (M-149, F-211), yellow: 485 (M-224, F-261), white: 24 (M-9, F-15), and chocolate: 13 (M-5, F- 8)

^{abc} Means with different superscripts in the same row differ significantly.

* Significance at p<0.05.

** Significance at p<0.01.

*** Significance at p<0.001.

Table 4. Least squares means of morphological traits of Sapsaree for season of birth

Trait	Season of birth	Mean [†] ± SD	Overall mean ± SD	F-statistics
Body weight (kg)	Spring	21.1 ± 2.8	20.5 ± 2.4	**
	Fall	20.3 ± 2.2		
Body length (cm)	Spring	56.6 ± 4.3	57.3 ± 4.2	*
	Fall	57.5 ± 4.1		
Body height (cm)	Spring	51.6 ± 3.6	52.1 ± 3.6	NS
	Fall	52.2 ± 3.6		
Depth of chest (cm)	Spring	20.9 ± 2.3	21.1 ± 2.4	*
	Fall	21.2 ± 2.4		

[†] No. of observation for spring and fall were 199 (M-77, F-122) and 683 (M-310, F-373)

* Significance at p<0.05

** Significance at p<0.01

^{NS} Non-significant.

However, there was a trend for decreasing Sapsaree's body weight (Fig. 1) during the experimental period.

(2) Body length

The average body lengths (±SD) of Sapsaree male and females were 58.5±4.0 and 56.3±4.1 cm, respectively (Table 2), and were significantly different for various hair colors (Table 3). Similarly, breeding season was also significant at p<0.05 (Table 4), whereas, test age was found to be non-significant for the same dog (Table 5). The overall trend for body length throughout the whole period showed to be slightly increasing (Fig. 1). Lack of reviews was evident for this trait as well.

(3) Body height

The average body height (±SD) was 52.1±3.6, and males were taller than females by 2.3 cm (Table 2). Hair color was

also a significant factor for the trait (p<0.01, Table 3). However, season of birth and test age did not influence the Sapsaree height (p>0.05, Table 4 and 5). In addition, a slightly increasing trend was observed for body height from 1990 to 2007 (Fig. 1). Our results supported the previous report of Kim et al. (2001), in which a range of 49~55 cm was observed for the Sapsaree population. Helmink et al. (2003) also found body heights of male and female as 62.1 and 59.2 cm for German shepherd, and 57.4 and 55.0 cm for Labrador retrievers, respectively. Comparing the previous reviews it was found that the Sapsaree was a little shorter in height than other guide dogs.

(4) Depth of chest

The average (±SD) of chest depth was 21.1±2.4 cm, and males had a greater average than females (p<0.0001, Table 2). There were also significant differences in the trait for

Table 5. Least squares means of morphological traits of Sapsaree for age of testing

Trait	Test age (average \pm SD)			Overall \pm SD	F-statistics
	1 to 1.5 yr. (n=528)	1.5 yr. to 2.0 yr. (n=166)	More than 2 yr. (n=170)		
Body weight (kg)	20.2 ^c \pm 2.1	20.7 ^b \pm 2.5	21.1 ^a \pm 2.8	20.5 \pm 2.4	***
Body length (cm)	57.4 ^a \pm 4.3	57.0 ^{ab} \pm 4.4	56.6 ^b \pm 3.5	57.1 \pm 4.3	NS
Body height (cm)	52.3 \pm 3.7	51.7 \pm 3.6	51.8 \pm 3.3	52.1 \pm 3.6	NS
Depth of chest (cm)	21.1 \pm 2.4	21.2 \pm 2.5	20.8 \pm 1.7	21.1 \pm 2.6	NS

^{abc} Means with different superscripts in the same row differ significantly.

*** Significance at $P < 0.0001$.

NS Non-significant.

hair color and season of birth ($p < 0.001$ and $p < 0.05$; Table 3 and 4), while age of testing was not a significant factor for the trait (Table 5). The overall trend for depth of chest did not change dramatically, except in the last two years showing a slightly increasing tendency (Fig. 1).

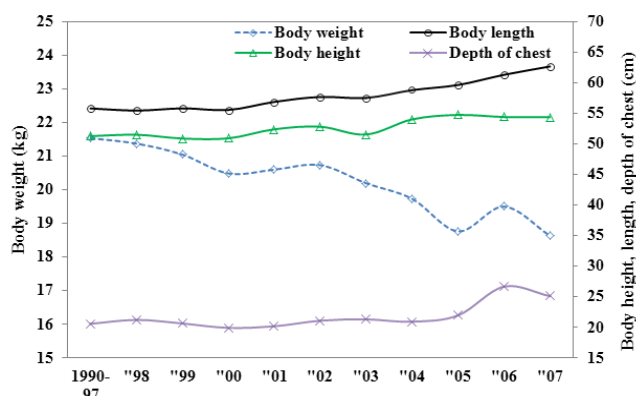


Fig. 1. Morphological performances of Sapsarees over the birth years.

We observed from the Fig. 1 that body weight decreased although other traits increased a little which is seemingly unconventional in practice and it might be entirely due to the smaller and frequently fluctuating number of individuals obtained from 2004. The SD values of yearly performance for the traits after 2004 (data not shown) also showed more fluctuations indicating more inconsistencies for chest depth, body length and body weight. More data might have avoided this problem.

However, it can be said from the above findings of body conformation in this study that the Sapsaree is close to the standard specifications as a guide dog. According to Helmkink et al. (2003), guide dogs like Labrador retrievers or German shepherds should have an optimum range of body weight from 18 to 32 kg along with a height measurement of 53 to

64 cm at the withers at maturity. The Sapsaree is found very close to these values and falls near the lower range for weight and height. Thus, the Sapsaree should be selected for heavier weight and greater height in the next generations to become closer to the standard guide dogs.

(5) Hair color, pattern, length, length surrounding eyes and quality

About 54%, 42%, 3%, and 1% Sapsarees were colored as yellow, blue, white, and chocolate, respectively, and these trends were consistent over the testing years (1990~2007), except for the last three years, in which the proportion of individuals with white color increased up to 10% (results not shown). The dogs with straight hair had a greater proportion (69%) than those with wavy (16%) or curly (15%) pattern. For the latter two hair patterns, there were more individuals with the wavy hair pattern since 2001 (results not shown). Among the Sapsarees considered under this experiment, about 97% of them had medium to long hairs. Proportion of individuals having long hairs surrounding eye region was 83.8%, whereas 16% and 0.2% of them had medium and short hairs, respectively, and most individuals that were born in the last two testing years had long hairs around the eye region (results not shown). Proportion of animals with untangled hairs was 39%, while 34% and 27% of the individuals were medium tangled and fully tangled, respectively, and the proportion of untangled individuals became smaller since 2001 (results not shown).

(6) Other morphological traits

The detail counts for other morphological traits are presented in Table 6. The major eye color of Sapsarees was brown (40%) followed by dark brown (38%), light brown (21%), and blue gray (1%), and this tendency was generally

Table 6. Number of individuals[†] for several morphological traits

Trait	Criterion			
Eye color	Light brown (182)	Brown (356)	Dark brown (333)	Blue gray (9)
Nose color	Black (836)	Chestnut (46)		
Ear erection pattern	Pendent (878)	Half-pricked (4)	Erect (0)	Front pendent (0)
Jaw pattern	Normal (683)	Cutting (133)	Undershot (66)	
Dewclaw	Absent (793)	One present (88)	Two or more (1)	
Tongue spot	Absent (818)	Present (64)		
Tail-set	Curl (375)	Upright (258)	Sickle (249)	
Missing teeth	None (755)	One missing (84)	Two missing (41)	More than 2 (2)
Testicles	Present (368)	Absent (19)		

[†] Total number of animals: 882.

consistent since 2000 except for the last testing year, in which proportion of individuals with dark brown eyes was greater than those with brown color (results not shown). Most Sapsarees (>90%) had black noses, pendant ears and spotless tongues. For tail-set trait, however, the number of individuals with curly tail was marginally greater (43%) than those with sickle (29%) or upright pattern (28%). Most male Sapsarees (>95%) had typical two testicles and there was no tendency of increasing number of males with abnormal testicle patterns over the testing years (results not shown). A major proportion (86%) of Sapsarees had no missing teeth, while 9% and 5% of them had one and more than one missing teeth, respectively.

Jaw pattern analyses showed that proportions with normal, under-short, and cutting jaw patterns were 78%, 15% and 7%, respectively, and most Sapsarees (90%) had no dewclaw, while only 9% and 1% of them had one and two dewclaws, respectively. There was a tendency of increasing number of individuals with normal jaw pattern and no dewclaws over the testing years (results not shown), due to the implementation of phenotypic selections against abnormal jaws and dewclaws.

2. Behavioral traits

(1) Nerve stability

The average score (\pm SD) for nerve stability in Sapsaree was 1.29 ± 0.61 , for which there was a significant difference in sex at $p < 0.05$, i.e. males had larger degree of nerve stability (lower value) than females (Table 7). The effect of

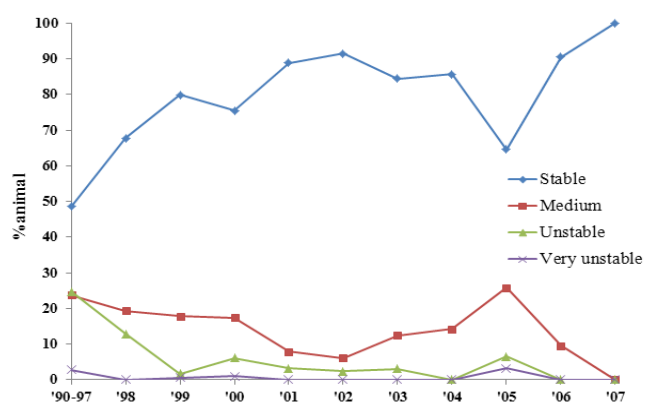


Fig. 2. The trend of nerve stability in Sapsarees over the birth years.

testing age was also highly significant ($p < 0.001$), showing that animals of 2 years or less had greater nerve stability than over 2 years old (Table 8). About 79% of the individuals showed a greater degree of nerve stability, compared to medium stable (14%), unstable (6%) and very unstable (1%) animals, and there was an overall increasing tendency of proportion of nerve stable individuals over the testing years (Fig. 2). The great decrease in 2005 may be due to sampling effect, i.e. small number of animals that year (Table 1).

(2) Affability

The average affability score as found in this study was 1.35 ± 0.62 . Like the results for nerve stability, both sex and testing age were significant for the trait ($p < 0.01$). Males were more ($p < 0.01$) friendly than females (Table 7), and animals under 2 years age were more friendly than older animals

Table 7. Least squares means of behavioral traits of Sapsaree for sex

Trait	Gender	Mean \pm SD	Overall \pm SD	F-Statistics for sex difference
Nerve stability	Male	1.22 \pm 0.55	1.29 \pm 0.61	*
	Female	1.34 \pm 0.65		
Affability	Male	1.26 \pm 0.54	1.35 \pm 0.62	**
	Female	1.40 \pm 0.66		
Wariness	Male	2.02 \pm 0.55	2.02 \pm 0.55	NS
	Female	2.01 \pm 0.56		
Adaptability	Male	1.39 \pm 0.56	1.45 \pm 0.62	NS
	Female	1.49 \pm 0.66		
Sharpness	Male	1.73 \pm 0.53	1.82 \pm 0.52	***
	Female	1.88 \pm 0.51		
Activity or energy level	Male	1.75 \pm 0.90	1.77 \pm 0.83	NS
	Female	1.79 \pm 0.77		
Reaction during blood drawn	Male	1.92 \pm 0.42	1.99 \pm 0.43	***
	Female	2.04 \pm 0.43		

* Significance at $p < 0.05$.

** Significance at $p < 0.01$.

*** Significance at $p < 0.001$.

^{NS} Non-significant.

(Table 8). Major proportion of Sapsarees are friendly (73%), followed by medium friendly (21%), less friendly (5%) and avoidance (1%), respectively. There was an increasing tendency of proportion of friendly individuals over the testing years, whose pattern was similar to that of nerve stability (results not shown).

(3) Wariness

The overall score (\pm SD) was 2.02 ± 0.56 , and there was no significant difference between sexes for the behavior trait (Table 7). However, testing age was a significant factor ($p < 0.001$, Table 8), e.g. individuals under 1.5 year were the least wary (1.96 ± 0.48). About 76% of Sapsarees fell into the category of normal wariness. Among the rest, about 12% not warred, 10% seriously warred, and 2% were very seriously warred. There was a consistent tendency of increasing normal wariness over the testing years (results not shown).

(4) Adaptability

The average value (\pm SD) for adaptability was 1.45 ± 0.62 , and sex was statistically non-significant for the same trait, although the male performance was higher than female (Table 7). The effect of test age was also highly significant

($p < 0.001$, Table 8) while the younger ones showed better adaptability, especially under 2 years of age. A major proportion (61%) of animals had well adaptability, followed by 33% medium, 5% weak and 1% very weak adaptability to the environment. Proportion of good adaptability consistently increased over the testing years (results not shown).

(5) Sharpness

Generally, absence of sharpness is undesirable in dogs. The average (\pm SD) values for sharpness was 1.82 ± 0.52 that was based on a scale of 1 to 3. Males had more tendency to be sharper than females by 0.15 points ($p < 0.001$, Table 7). However, there was no effect of test age on the trait (Table 8). A major proportion of the Sapsarees (70%) showed normal sharpness, and 24% and 6% had aggressiveness and absence of sharpness, respectively. The relative proportions of individuals due to sharpness were generally similar up to 2003 (Fig. 3). After 2004, the proportion of individuals due to sharpness decreased.

(6) Activity or energy level

An average (\pm SD) of 1.77 ± 0.83 was observed for the activity (Table 7) in Sapsaree and there was no effect of sex

Table 8. Least squares means of behavioral traits of Sapsaree for age of testing

Trait	Testing age (average \pm SD)			Overall \pm SD	F-statistics
	1 to 1.5 yr. (n=528)	1.5 to 2.0 yr. (n=166)	More than 2 yr. (n=170)		
Nerve stability	1.21 ^b \pm 0.51	1.22 ^b \pm 0.49	1.62 ^a \pm 0.84	1.29 \pm 0.61	**
Affability	1.26 ^b \pm 0.53	1.27 ^b \pm 0.52	1.72 ^a \pm 0.81	1.35 \pm 0.62	**
Wariness	1.96 ^b \pm 0.49	2.02 ^b \pm 0.53	2.19 ^a \pm 0.73	2.02 \pm 0.56	**
Adaptability	1.39 ^b \pm 0.57	1.45 ^b \pm 0.59	1.64 ^a \pm 0.77	1.45 \pm 0.62	**
Sharpness	1.81 \pm 0.51	1.80 \pm 0.52	1.89 \pm 0.56	1.82 \pm 0.52	NS
Activity	1.73 ^b \pm 0.83	1.75 ^b \pm 0.82	1.96 ^a \pm 0.83	1.77 \pm 0.83	*
Reaction during blood drawn	1.95 ^b \pm 0.41	1.97 ^b \pm 0.39	2.11 ^a \pm 0.50	1.99 \pm 0.43	*

^{a,b} Means with different superscripts in the same row differ significantly.

* Significance at $p < 0.01$.

** Significance at $p < 0.001$.

^{NS} Non-significant.

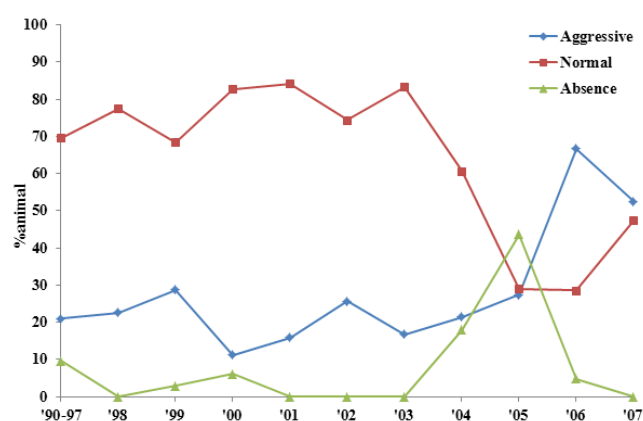


Fig. 3. The trend of sharpness in Sapsarees over the birth years.

on the trait ($p > 0.05$). Age of testing was significant for the trait ($p < 0.01$), in which less than 2 years old dogs were more active than dogs over 2 years age (Table 8). Most individuals were active (41%) or medium (46%), while few of them were very active (7%) or static (6%). This trend was consistent over the testing years (results not shown).

(7) Reaction during blood drawn

The mean (\pm SD) for bleeding reaction was 1.99 ± 0.43 , and males had better response for bleeding than females ($p < 0.001$, Table 7). The effect of testing age was also significant at $p < 0.001$ level, where older animals (> 2 years) responded worse than the rest (Table 8). A major proportion of Sapsarees (81%) were obedient during blood collection, whereas 10% and 9% were over agitated and shrunken,

respectively. This tendency was consistent across testing years (results not shown).

According to the breed standards, a good family pet should have some ideal characters such as good-nature, friendly and confident (Liinamo et al. 2007). However, some of the Sapsarees did not have good characteristics in wariness and reaction during blood drawn. Therefore, the Sapsarees should be selected consistently for the most desired patterns of behaviors, in particular for wariness, bleeding reactions, sharpness and activity level, because all these traits are most essential for a guide or companion dogs.

3. Effect of gender on behavior traits

This study indicated that the four behavioral traits (except wariness, adaptability and activity) were significantly influenced by gender effects, with males having more desirable behavioral performance than females (Table 7). Similar results were reported by Wright and Nesselrote (1987), Svartberg (2002), and Courreau and Langlois (2005), in which males had desirable behavior performance than females. Van der Waaij et al. (2008) also showed that gender was a significant factor on most of the behavioral traits in their study. Goddard and Beilharz (1985) reported that the effect of gender was significant only on fear behavior. According to Courreau and Langlois (2005), male Belgian shepherds performed better than females for behavioral trait, i.e., jumping, attacking or guarding. Rooney and Bradshaw (2004)

showed that males were more aggressive towards other dogs.

However, caution was taken to compare results between studies on behavior, because of different definitions of behavioral traits as well as the differences in measurement scales. Wilsson and Sundgren (1997) reported significant difference between males and females for nerve stability in German shepherd and for sharpness in Labrador retrievers. However, they also found that gender was not a significant factor for nerve stability in Labradors. Hoffmann et al. (2003) reported no significant difference between genders regarding behavior performance in sheep dogs. These results suggest that the difference of behavior performance between genders is due to breed effect, definition, or measurement of behavioral traits.

4. Effect of testing age on behavior traits

Our results showed that the individuals below 2 years of age had more desirable behavior performance than those over 2 years for all behavioral traits, while no significant differences were observed for the traits between individuals of <1 and 2 years of age. These results were similar to Wilson and Sundgren (1997), in which there was no age effect on behavior traits in German shepherd and Labrador retrievers between 15 and 20 months of age. According to Ruefenacht et al. (2002), all behavior scores were higher (or animals performed badly) for older dogs. Van der Waaij et al. (2008) also showed that age influenced most of the behavioral traits, while the dogs below 1 year of age performed badly than the older ones in German shepherd and Labrador retrievers, whose results was different from those in this study. However, Wright and Nesselrote (1987) did not find any significant effect of age on the animals ranging from 0.25 to 11.5 years. Pfeleiderer-Högner (1979) did not find any significant effects of age on behavior scores for dogs ranging from 11 months to 4-years of age. The conflicting results between this study and other reports might be partly due to the fact that behavioral traits were defined in a more distinctive pattern, causing large variation between aging groups, which can be supported by the large standard deviations for the estimated means for older animals (Table 8).

CONCLUSIONS

This study shows that variations in morphological and

behavioral patterns exist in Sapsarees. For body weight, height, length and chest depth, the population included desirable values for the purpose of companion or guide dogs. Behavioral characteristics of the Sapsarees were generally favorable, i.e. majority of the individuals were active, friendly, nerve stable, and well adaptable and conscious about their surroundings. In addition, their physical deformities remained minimal over the last several years. Therefore, these results indicate that Sapsaree can be one of good aboriginal candidate breeds as a companion or guide dog, if variations for morphological or behavioral traits could be reduced as minimum as possible. To achieve this goal, appropriate selection and mating programs have to be implemented.

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