



Standards, Health and Genetics in Dogs

CHAPTER I - Standards, health and hypertypes in Dogs

José Luis Payró Dueñas

Dr. Vétérinaire / DVM

Professeur à la Faculté de médecine vétérinaire et zootechnie de la UNAM

UNAM Veterinary medicine and animal breeding faculty Professor

Président de la Section des Amériques et des Caraïbes de la Fédération Cynologique Internationale

President of the Americas and Caribbean Section of Fédération Cynologique Internationale

Zapotecas No. 29 Col. Tlalcoligia CP 14430, Tlalpan, Ciudad de México, MEXIQUE / MEXICO

payro2002jlpd@yahoo.com.mx

Collaborateurs / Collaborators:

MVZ Jesús Andrés Villalobos Díaz

MVZ Francisco Guadarrama Capitaine

Standards, health and hypertypes in Dogs

Abstract - It is of great importance for dog breeders to properly interpret the breed standard, since it is the base upon which dogs are selected for reproduction and these animals will pass their characteristics on to their offspring, be they desirable or not. When dogs are poorly selected for breeding, some pathological cases may occur including hereditary diseases and hypertypes. Selecting the right dogs to be used for breeding is done by means of correctly interpreting the breed standard, paying attention to the pedigree (parents, grandparents, great-grandparents), the phenotype of the animals, ensuring that the standard is respected, and guaranteeing not only the beauty of the dogs, but also their health, their zootechnical function and their welfare. All of this is essential in reproducing various breeds of dogs and it also explains why breeders, veterinarians and cynological institutions worldwide such as the Federation Cynologique Internationale (FCI) work together as a team.

Keywords: Health, Genetics, Hypertypes, Standards, Breeding, Breeds, Welfare.

In countries affiliated to the Federation Cynologique International (FCI) where their fondness for the breeding of purebred dogs deserves the greatest attention, the selection process has given outstanding results, perpetuating pure breeds, which over the years have been evolving and their qualities and skills have been improved. It should be remembered that the purity of the breed is the real zootechnical ideal of a breeder and these pure breeds are preserved according to the selection and breeding techniques in relation to the phenotype of every recognized breed specified in standards, or ideal descriptions of each one, which are drawn up by the breed's country of origin as a member of the FCI.

Selection is the process of choosing the most suitable dogs which correspond most closely to the breed standard, enabling them to be used in various zootechnical functions, as parents of the following generation and beyond and allowing them to breed. The selective improvement of the qualitative characteristics of every breed depends on the inheritability of those characteristics and on the extent to which the selection is carried out. Differential selection is the individual merit of every specimen and the most important base in the selection process, since the genetic information about the ancestors, the collateral relatives and the produced offspring represents very valuable and useful data in the individual selection of every specimen with the characteristics linked to the breed standard. The information about the pedigree (parents, grandparents and great-grandparents), as well as the offspring produced, is essential for the selection of specimens which are to be introduced into the blood line.

The simultaneous selection of several characteristics to look for the ideal phenotype including structure, coat, color, temperament, etc. reduces the intensity of the selection of any individual characteristic. Nevertheless, it is possible to achieve the zootechnical improvement of every breed rapidly by means of an index that allows every characteristic applying to every specimen to be evaluated in an ideal way. Even if the current evidence indicates that the interactions of genotypes are of great practical importance, the most common recommendation is that the selection should be done between the related specimens in the same blood lines of a given kennel.

The changes in the characteristics originate in the selection, in direct form from the changes in the gene frequencies that affect these characteristics. In practice, selection can rarely be carried out for a simple locus; actually, it cannot just be based on the effects of the genes that can influence the simple expression of a characteristic. The majority of the characteristics in dog breeds are important for their qualitative nature. The transmission between the qualitative features is often a source of frustration for the breeder concerning the apparent inability to identify the genetic variation, that is to say, it is difficult to locate the undesirable genes that transmit the *hereditary diseases, hypertypes, and the exaggerations* that are present in the offspring.

Selection is of great value for the production of excellent dogs and has great alternatives, that is to say, through selection, there is an increase in the correlation that exists between the reproductive value of every specimen and the information of the pedigree used by the breeder, producing excellent specimens which contribute to the improvement of every breed specifically.

In this text, we will examine each of the methods through which the breeder can change the genetic composition of a breed, to see what he will be able to do, where he will fail by obtaining exaggerations in the progeny, and in which circumstances the selection will be of great use for the breeders. Before taking a look at the general procedures that a breeder must apply in order to implement his selective reproduction plans, it seems relevant to mention the tools which are available according to each case in order to carry out the selection adequately. That is to say, the difference in the number of descendants that can be produced by each of the different specimens of a breed, in a kennel specialized in a bloodline of any given breed. This is the most effective method to change the frequency of the genes and the genetic averages of several characteristics. It is, naturally, the first method that the breeder must consider since the benefits will depend more than anything on the quality of the different specimens that are used and that are produced in his kennel.

All the breeders need a schedule to achieve effective selective breeding, taking into account the following points:

1. Selecting the breed and the bloodlines that determine the ideal, adhering to the breed standards.
2. Locating the dogs that have the genetic composition which is most similar to the zootechnical ideal determined in the breed standard, to embody the ideal specimen of the breed
 - a. Evaluating every specimen in comparison to its breed standard.
 - b. Checking the merit of its close ancestors and collateral relatives.
 - c. Studying the pedigree and checking the consanguinity and the qualities of the ancestors.
 - d. Knowing the faults that have taken place in the bloodlines, hereditary diseases and physical exaggerations.
 - e. Studying the offspring produced to evaluate both the desirable and undesirable characteristics.
3. Remember that in maintaining the selective related breeding, both excellent and poor quality specimens can reproduce.

Morphological selection is of great importance, since it is essential to maintain the specific characteristics of each breed. A breed is composed of a group of animals with the same phenotype and genotype characteristics and of which, after mating a sire with a dam, the resulting offspring is entirely equal to its progenitors. The selection based on phenotype is carried out using the breed standards or norms for every breed.

From a zootechnical point of view, the norms for a perfect breed specimen (breed standard) mean that the animal conforms to the morphological, biometrical and functional description of its breed. The diverse varieties of dog breeds today recognized by the FCI as pure breeds have been formed throughout history under the influence of a wide range of factors: geography, climate and social aspects, which

arose from crossing dogs in order to obtain suitable specimens for the accomplishment of a number of practical zootechnical roles which were of great use to humans, such as trackers, hunters, shepherds, and as guards, to name but a few. These utilizations make up the official classification of the ten groups set out by the FCI. Nowadays, we can add to that list, citing the examples of assisting people in different capacities and as companions, police dogs, military dogs, and search and rescue, amongst others.

Related breeding, that is to say, crossing consanguineous individuals (inbreeding, linebreeding) increases the degree of homozygosity and the genetic consequence of this is a result of the own homozygousness. Breeds comprise identical genes and this predisposes them to the appearance of abnormalities, hereditary diseases and exaggerations (hypertypes, see Triquet, 2013). According to each of the official FCI breed standards, any dog showing clear signs of physical or behavioral abnormalities must be disqualified. The appearance of recessive deleterious genes and the reduction of the proportion of heterozygous genes are the main causes of the appearance of abnormalities, hereditary diseases or physical exaggerations. This is why breeders must take care when resorting to the consanguineous selective breeding of the progenitors in the bloodlines.

Knowledge of the Mendelian principle of genetic inheritance is of great use for the breeders when establishing programs of genetic improvement, tending to eliminate or to fix a gene or group of genes responsible for the manifestation of an exaggerated feature such as excess skin in the Shar Pei breed, or entropion and ectropion in the Bulldog.

The control of hereditary diseases is a fundamental aspect in the selective breeding and the breeder must be capable of determining the reasons that predispose these faults in order to foresee them, control them and avoid them.

By properly analyzing the pedigree, the breeder can obtain a series of indicators that suggest the etiology of the abnormalities that were present in the bloodlines, but there are situations in which an ailment has a similar expression, whether it be determined genetically or congenitally.

If the characteristic in question appears recurrently in the related specimens produced by the kennel through different generations, it is a clear indication of the characteristic being of a hereditary nature. But if, on the other hand, the characteristic appears in unrelated individuals and at determined places and times, then it is a sign of their congenital nature.

The first step to identify the nature of the congenital disease is to identify that it can be caused by factors such as:

- stressful issues
- physical agents (x-ray, ultraviolet, amongst others.)
- biological agents (immune reactions, amongst others.)

On the contrary, the genetic origin of an abnormality, hereditary disease, or physical exaggeration (hypertypes) should be suspected when:

- the alteration is of sudden appearance, or accompanied by the introduction of a new breeding bloodline (outcross).
- there is a greater incidence in one particular bloodline than in another.
- there is a greater incidence in certain breeds than in others.
- its frequency is greater in pure specimens than in hybrids.
- it is known that a fault or similar exaggeration is hereditary in other breeds.

The breeder must consult a specialist veterinarian who is capable of identifying the type of inheritance that produces such an abnormality, exaggeration or disease, to establish a breeding system that allows the breeder to decrease the frequency of the undesirable genes in the breed with a view to eradicating them.

Nowadays it is not difficult to determine the presence of a gene responsible for an alteration, fault or pathological exaggeration given that by means of biochemical tests and via DNA analysis (it is possible to identify the sequence of a gene or of a genetic marker associated with the gene) it is possible to precisely diagnose the most probable genotype of an individual, even in the case of incomplete penetration, variable expressiveness or when the undesirable characteristic in question has not expressed itself at the moment of the study, or when it never manages to express itself. Nevertheless, with a few exceptions, there are no tests that specify the type of inheritance of a hereditary disease or of an alteration; this must be done in a specialized laboratory that fulfills all the requirements.

On having analyzed the pedigree or the family history of an affected individual, it can be decided if the alteration or the disease was inherited or not, and the way of inheritance, in this case. As for this information, it can be used for predicting the risk of a recurrence of the disease, deformations or alterations in future generations, as well as for planning the systems of genetic matchings (inbreeding, linebreeding, outcrossing) tending to eliminate the undesirable genes from the blood line.

To analyze the pedigree of a particular specimen, it is suitable to check each of the members of the genealogical blood line, and that in it there are several generations (parents, grandparents, great-grandparents, great-great-grandparents) which lead to an ancestor who had the feature or the alteration in question, or which lead to a common ancestor of several affected individuals to detect a possible causal effect. Logically, the more information you have in the pedigree, the more obvious the feature will be.

When sufficient information is obtained, the breeder has the possibility of determining the genetic effect involved in the manifestation of the undesirable features, alterations, hereditary diseases or physical exaggerations (hypertypes).

In autosomal dominant genes, every characteristic is expressed in both sexes, sire and dam, and none of them is more inclined than another to show each characteristic.

When the breeder considers a feature of interest which he wants to eliminate in the offspring, it is because the said characteristic can appear in each of the offspring if they have at least one progenitor who presents that affected condition.

The specimen that does not demonstrate the hypertype of interest in the phenotype will not be able to pass on this condition to their offspring.

When only one of the progenitors has the hypertype of interest in the phenotype and has it in a heterozygous condition, each of the puppies has a 50% probability of inheriting the said condition.

When one of the progenitors has the phenotype of interest and has it in a homozygous condition, all the puppies will inherit this feature.

In autosomal recessive genes, each characteristic is expressed in both parents and none of them is more inclined than another to show the said condition. The progenitors who do not show the characteristic in their phenotype can pass it on to their offspring.

The characteristic is only expressed when the specimen is recessively homozygous.

When both progenitors are affected by the desirable or undesirable characteristics, all the progeny will also be affected.

Phenotypic selection applied by breeders in the selection of different dog breeds for their physical improvement or behavior, uses the breed standards or breeding procedures as guides. These guides describe certain physical characteristics as conforming to the breed's typical beauty. However, **sometimes a misinterpretation of the standard on the part of the breeders provokes the appearance of different hereditary diseases, genetic malformations or hypertypes**, which are the consequence of indirect selection. These problems are then incorporated into the bloodline through different crosses and by breeding affected specimens. Undesirable characteristics can be passed on, which can be dominant or recessive, they can be detrimental to the breed and its health, such as the brachycephalic syndrome which can be considered as a group of symptoms which characterize a disease or an abnormal condition. Examples of these abnormalities which can occur in certain individuals are broad and square skull shape, a short muzzle, flat face, rounded and wrinkled cheeks, short nose, medium, round, sunken or protruding eyes, etc. Some examples of breeds that present these conditions are the Bulldog, the French Bulldog, Pekingese, Pug, Shih Tzu, Lhasa Apso, Shar Pei, Boston Terrier, Neapolitan Mastiff and Bull Mastiff, to name but a few.

This skull shape causes a series of detrimental effects on the dog's health, causing respiratory problems such as obstructive congenital disease of the upper respiratory tract, stenosis of the nares with severe tightening of the nostrils, cleft or elongated soft palate which extends towards the back part of the larynx and can partially block the respiratory tract, or the eversion of the laryngeal sacculles that increase the effort the dog needs to make when breathing in, due to the stenotic nares and to the elongated soft palate; the sacculles that normally hang forwards are stuck against the respiratory tract which restricts the air flow further, provoking laryngeal collapse in the dog.

The reduction of the diameter of the trachea can vary according to each of the previously mentioned breeds or can be due to one or more of these abnormalities that increase difficulty in breathing, due to the enlargement of the respiratory tract and that more effort is needed when the dog inhales.

Other abnormalities of the respiratory tract can exist in all these breeds, such as inflammation or edema of the larynx and pharyngitis. Also, an eversion of the tonsils can occur, causing a collapse of the epiglottis.

As a consequence of all these abnormalities, dogs of these breeds suffer from a wide variety of additional signs, such as difficult and extremely noisy breathing with an intolerance to walking or exercise, with reflux, coughing, sneezing, cyanosis, tracheal collapse and a greater susceptibility to heat stroke. In addition they frequently have difficulty swallowing.

All these respiratory abnormalities are associated with anatomical problems (hypertypes). In addition to these respiratory problems they can also suffer from gastro-intestinal problems, which can cause vomiting, regurgitation, esophageal diversion, pyloric stenosis, functional anomalies of the cardiac atony, duodenal-gastric reflux, extremely pronounced gastritis, and even death. But besides all these respiratory problems caused by the cranial anatomy that the breeders look for as the ideal prototype of each one of these breeds because they have wrongly interpreted the breed standard, dogs can additionally present many other undesirable deformations such as sunken eyes, entropion or ectropion and wrinkles on the

face and on the body, with multiple pyodermas that provoke parasitic diseases of the skin. Another of the most frequent affections in the said breeds with prognathous jaws is that they can present malformations in the alignment of the incisors of the upper jaw or of the longest jaw, causing the dog to be unable to close its mouth and thus sticking its tongue out. Other effects are tooth loss, gingival hyperplasia, bad occlusion causing deficiencies in cutting and crushing food, overbite, and underbite which causes injuries to the hard palate.

Dogs with bodies which are too short or too long, high croup, over angulated front or hind legs or rounded thorax commonly present secondary pathologies associated with their anatomical shape, such as hemivertebrae, cleft spine/Spina Bifida, lumbosacral instability, supernumerary vertebrae, kneecap dislocation, Wobbler's Syndrome, coxo-femoral joint dysplasia, elbow dysplasia, ulna and radius dysplasia, hemiplegia and quadriplegia. All of this affects how each individual walks.

The problems that are often observed in many breeds are due to the whims of the breeders to obtain uncommon and showy colors that lead to the presentation of pathologies such as deafness, blindness, albinism, atopies, alopecia or excess of coat, epidermal dysplasia, as well as serious reproductive problems and bad temperament to mention but a few.

The main aim of dog shows is for breeders to be able to compare their dogs with other dogs of the same breed, in order to improve them, controlling the quality of every breed, preserving the purity and at the same time guaranteeing the well-being and the health of every dog.

For the breeder, the results of judging in an exhibition mark the evaluation of his effort and at the same time the value of his production, using the breed standards as model. As we previously mentioned, the poor interpretation of the standards can cause a breeder to produce specimens with hypertypes or with deformations that will remain concentrated in the breed, producing hereditary diseases. When evaluating a dog, the judge values the effort and the production of every exhibitor whose aim must not just be the pride of winning, but the goal of fixing the type by not selecting those specimens with the hypertypes that are not desired in the breed. Because of this, the judge has the responsibility in dog shows of rewarding exclusively those dogs that stick to the breed standard, always trying to guarantee the health and the well-being of each one of the dogs as is considered in all the official breed standards of the Fédération Cynologique Internationale (FCI).

REFERENCES

Garciadueñas R., 2015, *Mejoramiento animal I: Caracteres cualitativos*, Universidad Michoacana, 2° reimpresión, México, 168 p.

Gough A., Thomas A., 2010, *Breed predispositions to Disease in Dogs and Cats*, Wiley-Blackwell, Second Edition, USA, 352 p.

Oddone A.J., Rodriguez Jurado P.M., 2010, *Enfermedades congénitas y hereditarias de las razas caninas y felinas*, Editorial Inter-médica, Argentina, 147 p.

Payró J.L., 2001, *El perro y su mundo*, 5 tomos, Federación Canófila Mexicana, A. C. México.

Triquet R., 2013, *La lutte contre les hypertypes, le point de vue d'un vieux cynophile*, conférence au Sénat le 14 octobre 2013, *Ethnozootechnie*, n° 95, 89-92.

