

# **Inheritance of the disposition for ARDS among Dalmatians**

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## **Introduction**

Adult Respiratory Distress Syndrome (ARDS) appeared as a symptom of a genetic defect (1) among Dalmatians in Finland (and once in Denmark) in the years 1987-1997. In Finland 6 litters were born, the last in 1997, with a total of 17 dogs thought to be suffering from the disease. All the 17 dogs died or were euthanized. Early indications for an inherited disease were found by dr. A.-K. Järvinen and coworkers in Finland and studies of the pedigrees of the affected litters soon pointed towards the bitch O'Soul Escada as the probable source of a genetic defect. Several of the descendants from Escada were extensively used in breeding and the results appeared to be in accordance with an autosomal recessive mechanism of inheritance. Although there has been no test matings to finally prove this mechanism, the majority of the Dalmatian owners in Finland as well as in the other Nordic countries, the breed clubs in Finland, Norway and Denmark and the health committee of the Danish Kennel Club have accepted the recessive inheritance hypothesis based on strong circumstantial evidence (1, 2). Nonetheless, some breeders have argued against the hypothesis of recessive inheritance, claiming that with the extensive crossbreeding after Escada more sick dogs would have been found. Such claims have, however, never been supported by factual arguments. In order to examine whether there is any substance to these claims, this study has utilized simple statistical methods for estimating the number of affected dogs that would be expected in Finland, starting with the first litter after Escada in 1977 (the O'Soul K-litter), ending with all the litters registered in 1997, including all the litters in between. Litters registered outside Finland have not been included.

Thus, the hypothesis is that ARDS symptoms were inherited by an autosomal recessive mechanism. Can this be supported by the cold facts?

## **Methods**

Two different analyses were performed:

The first (method 1) is a simple probability analysis of all the litters containing crossbreeding between descendants after Escada, assuming recessive inheritance, calculating the probability for both parents being carriers in each litter and multiplying this with 1/4 of the registered puppies of these litters. Only the distance in generations from Escada was utilized, without using any knowledge of which dogs are known as carriers today.

The second analysis (method 2) has taken into account the knowledge already existing about the known carriers. In addition, based on the assumption of recessive inheritance, all the dogs in the straight line between a known carrier and Escada have been included among the carriers. This method contains only the litters involving at least one carrier bred with another descendant of Escada, which naturally is a much smaller population than in method 1, but also a much more relevant population. The probabilities have been

calculated as with method 1, but the generations now are calculated in relation to the closest carrier, not to Escada.

Descendants after the popular stud dog O'Soul Kavaljero (son of Escada) are considered non-carriers, since he had 10 registered puppies without ARDS in 1987 with a known carrier, O'Soul Uubi Duubi Duu.

Selecting the carriers for method 2:

In 5 of the 6 litters there is no problem of seeing where the genetic defect has been carried along and pinpointing the carriers, assuming recessive inheritance. In one litter, the Coastal F-litter, a discussion is required (Figure 1). On the mother's side the answer is simple, but the father's side is more complicated. The father, Dagazza Jappeloup, has obviously inherited his trait from Dagazza Grand Prix, which could have received it from Dagazza Dolly Parton or from Chilfinas Benedict. Dolly Parton had to have her trait from Tachetee Amphitryon or from Dagazza Babydoll (after O'Soul Rumoroso, after O'Soul Karolina, after Escada), while Chilfinas Benedict must have received his from Charlotta, the daughter of Adalia (after O'Soul Klarissa, after Escada) and O'Soul Nobolino (known carrier). Being the brother of a carrier (Tachetee Alouette), Tachetee Amphitryon would seem to be a good candidate. However, this is not likely to be correct. Amphitryon was bred in 1989 with a known carrier, O'Soul Uubi Duubi Duu, and got no sick puppies in a registered litter of 8. Thus, there is only a probability of 0.4% that Amphitryon is a carrier, which almost completely rules him out.

An alternative is Dagazza Babydoll, but so far no descendants of O'Soul Rumoroso or Karolina have been found among the carriers. Clearly the probabilities point towards Charlotta which has a 50% probability for being a carrier after her father and a 25% probability from her mother. Thus, it is assumed that the carriers are Nobolino, Charlotta, Chilfinas Benedict, and Dagazza Grand Prix on the father's side of this litter.

### Results and discussion

The data according to the two methods contained fairly large populations of 665 and 131 registered dogs, respectively, from crossbred litters (Table 1).

	Litters	Dogs	Expected number of affected dogs
Method 1	90	665	7.3
Method 2	20	131	18.3

Table 1. Calculated expected number of affected dogs according to autosomal recessive inheritance by two methods

The first obvious result is that the actual number of affected dogs in Finland, 17, is not less than what would be expected from a genetic defect with recessive inheritance. Method 1 is, however, completely dependent on which of the children from the 4 litters of Escada which were used in breeding.

Deviations from average use in breeding of the first generation will rapidly result in deviations from the statistically expected numbers. Thus, in one of the litters the only dog used in breeding turned out to be a carrier. In another litter 3 out of the 4 dogs used in breeding turned out to be carriers. This more than compensates for the opposite effect of

the frequently used non-carrier O'Soul Kavaljero and explains why the expected number of affected dogs is lower than the actual number found.

With method 2, which is expected to be much more accurate, the closeness of the calculated number to the actual number of affected dogs, 18.3 compared to 17, confirms that the hypothesis of autosomal recessive inheritance cannot be rejected.

### **Conclusion**

Statistical treatment of the data from the Finnish population of Dalmatians support the theory of autosomal recessive inheritance of the genetic defect leading to ARDS.

### **References**

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