

MYOGLOBIN CONTENT IN SKELETAL AND HEART MUSCLES OF DOGS AT DIFFERENT AGE PERIODS

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In the early postnatal period before assumption of the standing posture, myoglobin (MHb) is found only in the myocardium, and is either absent from the skeletal muscles or present only as traces. MHb appears in considerable quantities in the skeletal muscles (tibialis anterior and gastrocnemius muscles) only after assumption of the standing posture, and its content subsequently increases with an increase in the static and dynamic components of the load on the skeletal muscles. A parallel increase takes place in the MHb content in the myocardium. It is postulated that the increase in MHb content in the myocardium during growth and development of the animal is directly dependent on the degree of vagal tone.

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Investigations in Arshavskii's laboratory have shown that the skeletal muscles perform different functions at different age periods: in antenatal life their role is circulatory, in the early postnatal period, before assumption of the standing posture they are thermoregulatory, and not until assumption of the standing posture do the skeletal muscles begin to perform their specific functions of counter-acting gravity and of performing acts of locomotion in the environment. Later the role of development of the skeletal muscles as a factor determining vagus regulation of cardiac activity and the intensity of vagal tone was established [1-6, 8-13].

The object of the present investigation was to study the content of myoglobin (MHb) in skeletal muscles (flexors and extensors) and in the myocardium of dogs at different age periods. Very few investigations have so far been made of the MHb content in the skeletal muscles of dogs at different ages [7, 15].

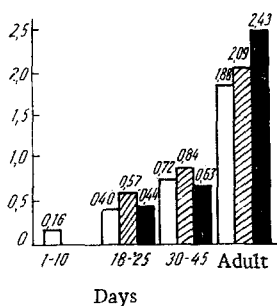


Fig. 1. Content of myoglobin in skeletal muscles: extensors (obliquely shaded columns), flexors (black columns), and myocardium (unshaded columns) of dogs in different age periods. Abscissa, age; ordinate, myoglobin content (in g/100 g dried tissue).

EXPERIMENTAL METHOD

MHb was determined quantitatively in an extensor muscle of the ankle (gastrocnemius) and in a flexor muscle (tibialis anterior) and in the myocardium by De Duve's method [14] using a type SF-4 spectrophotometer. The results were expressed in grams/100 g dried tissue.

EXPERIMENTAL RESULTS

Experiments were carried out on 25 dogs of 4 age groups: from 1-10 days (8), from 18-25 days (6), from 30-45 days (6), and on adult dogs (5).

In puppies of the first age group the skeletal muscles perform a thermoregulatory function and they contained no MHb or only traces of it. In this period the MHb content in the myocardium was 0.16 ± 0.1 g, i.e., on the average one-twelfth of that in adult dogs (Fig. 1).

In the puppies of the 2nd group, in an age period when the standing posture had been definitely assumed, the skeletal muscles were beginning to perform an antigravitational function; in every case MHb was found in them.

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Its content in the extensors (0.57 ± 0.07 g) was slightly greater than in the flexors (0.44 ± 0.01 g; $P = 0.05$). The first signs of an ill-defined vagal tone appear in this period. The MHb content in the myocardium was 0.40 ± 0.01 g.

In the puppies of the third age group the skeletal muscles had begun to perform acts of locomotion in the environment; their MHb content was increased, remaining higher (0.84 ± 0.02 g) in the extensors than in the flexors (0.63 ± 0.01 g; $P = 0.001$). In this period the vagal tone increases, and the MHb content in the myocardium rose to 0.72 ± 0.02 g.

The MHb content in the skeletal muscles of adult dogs showed a further increase. However, at this period its content in the flexors had become higher (2.43 ± 0.22 g) than in the extensors (2.09 ± 0.14 g; $P < 0.05$).

In dogs aged 2.5-3 months the vagal tone is established in its final form, and the MHb content in the myocardium rose to 1.88 ± 0.007 g.

Hence, MHb was discovered for the first time in the skeletal muscles in significant amounts only after assumption of the standing posture (after 18-25 days). Until 2.5-3 months of age mainly the static component of the load on the skeletal muscles increases, as a result of the need to counteract the increasing body weight due to the action of gravitational forces. Naturally during this period (30-45 days) the MHb content in the antigravitational extensor muscles remains higher than in the flexors. From the age of 2.5-3 months, when the dynamic component of the load on skeletal muscles increases at the same time because of the need for movement of a body whose weight has increased in the gravitational field, the MHb content becomes greater in the flexors. In contrast to the skeletal muscles, the MHb content in the myocardium is significant in the early postnatal period (1-10 days). Later the MHb content in the myocardium increases parallel with the degree of vagal tone and the increase in MHb content in the skeletal muscles.

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