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Comparison of skeletal muscle protein in three different mammalian species

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Abstract

The characteristics, nature, and distinctiveness of the proteins give a unique individuality to each organism. For the present investigation three different mammalian species of Amravati region were selected and their muscle protein were analyzed by SDS-PAGE, and total protein were estimated by Folin phenol method. The muscle proteins were estimated from leg muscles and it was found a significant variation in total muscle protein content. Electrophoretic separation of muscle proteins of the selected mammals showed inter specific variations. All these observations indicate that, the muscle protein electrophorograms can be used for species specificity.

Keywords: skeletal muscle protein, SDS-PAGE, leg muscles, protein bands, species-specificity

1. Introduction

Proteins are the macromolecules and serve as diverse functions. characteristics, nature, and distinctiveness of the proteins give unique individuality to organism. The genes for actin and myosin are members of gene families that encode proteins that enable movement while actin and myosin are highly conserved across all animal species, other muscle proteins show more variability. The variations in an organism's proteins are the results of random DNA mutations within the encoding genes, which have occurred over thousands to millions of years. Each mutation may result in some kind of change in a protein.

Thangaraj and Lipton [1] identified the species of sea horses *Hippocampus kuda* and *H. trimaculatus* with protein markers in Indo-Pacific region. The sarcoplasmic proteins which account for 20 to 30% of the total protein in fishes have an unique property that the separation profile obtained on electrophoresis can be used for unequivocal identification of fish species with reference of authentic sample profile [2].

Usually fish muscle contains three main groups of proteins [3] which the sarcoplasmic protein component forms an ideal moiety for electrophoresis method of species identification. Bulbul and Kutrup [4] demonstrated inter specific differences in the molecular weights of the skeletal muscle myosin, actin, troponin and tropomyosin in amphibian species. In this investigation use of high resolution Polyacrylamide Gel Electrophoresis is used to know the proteins in the muscle tissues of different mammals and to examine them for similarities and differences among the different species.

2. Methodology

For the present study, three mammalian species *Rattus norvegicus*, *Oryctolagus cuniculus* and *Mus musculus* were procured from the Amravati region and were stunned by cerebral blow, muscles of anterior most portion of the abdominal region - leg region were dissected out. Total protein was estimated by Folin- phenol method *Lowry et al* [5] and analysis of muscle protein were carried out by SDS-PAGE, *Lamelli* [6].

3. Results and Discussion

In the muscle homogenates of *Rattus norvegicus*, the protein contents in fore and hind limb are found as 36.45, 49.53 (mg/g) 57.69, 59.24 (mg/g) in *Oryctolagus cuniculus* and 35.25, 48.26 (mg/g) in *Mus musculus* respectively. In mammalia, the fore limb muscle homogenates of *Rattus norvegicus* showed four bands having molecular weights 96, 64, 36, 29 kilodaltons. While hind limbs muscle homogenate separated into four bands having 90, 64, 43 and 31 kilodalton molecular weights. In *Oryctolagus cuniculus,* muscle homogenates of hind limb resulted into similar banding pattern but variations are found in molecular weights (Fig.1.1). The fore limb muscle homogenates gave 10 prominent bands having molecular weights 120, 97, 85, 60, 57, 49, 39, 29, 23 and 21 kilodaltons, while hind limb muscle homogenates exhibited 10 distinct bands with molecular weights 125 ,97, 85, 60, 49, 39, 32, 22, 20 and 14 kilodaltons (Fig.1.2). In *Mus musculus*, muscle homogenates of fore limb and hind limb got separated into five distinct bands each having molecular weights 140, 105, 95, 32, 30 kilodaltons in the respective samples (Fig. 1.3).

Table 1. Showing total protein in different region of the body of experimental animals.

Experimental animal	Fore limb (mg/g)	Hind limb (mg/g)
Rattus norvegicus	36.45	49.53
Oryctolagus cuniculus	57.69	59.24
Mus musculus	35.25	48.26

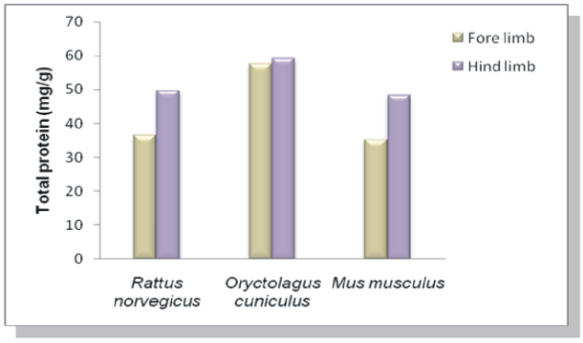

Fig.1: Showing total protein in different region of the body of experimental animals

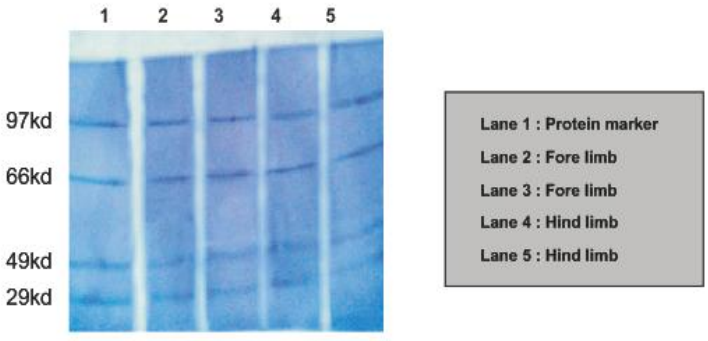

Fig.1.1 Electrophorogram of striated muscle proteins of fore and hind limb of *Rattus norvegicus*

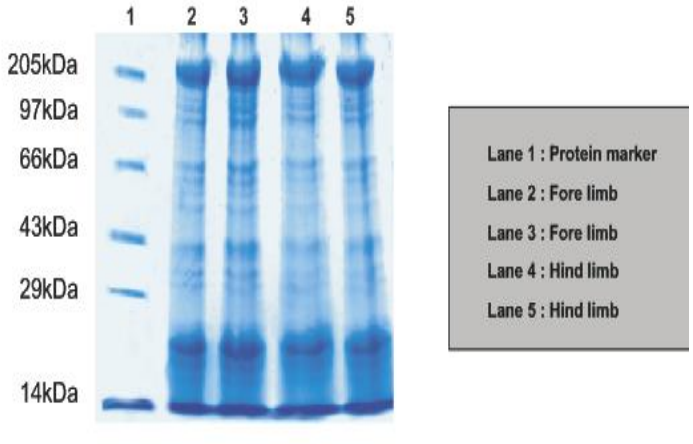

Fig.1.2: Electrophorogram of striated muscle proteins of fore and hind limb of *Oryctolagus cuniculus*

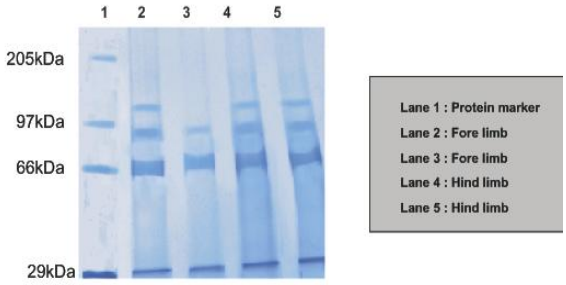

Fig. 1.3: Electrophorogram of striated muscle proteins of fore and hind limb of *Mus musculus*

Discussion and Conclusion

In mammals, total muscle protein content were estimated from the fore limbs and hind limbs and it was found that in *Oryctolagus cuniculus* the protein contents were maximum in the two regions when compared with those in *R.norvegicus* and *M.musculus*. Thus, the present study showed significant variations in total muscle protein content from selected locomotary organs, which proves that, the organs which are used more, store proteins. the protein content is found to be positively exponential with the availability of myoglobin.

The protein content in muscles of these mammalian species showed inter specific variations [7]. Distinct

differences were observed in the intensity of the stained bands. These differences were also observed between the protein separations of muscles from different functional regions of the body of the same species [8].

In the present study muscle homogenate separations were carried from mammals. The biological specificity of protein is related to the number of amino acid residues and their sequence along with molecular weight of proteins. Using skeletal muscle protein differentiation in the present study showed that different species had different numbers of bands and it indicates interspecific variations in respect to proteins of different body parts. Similarity and differences in the molecular weights showed species characteristics that could be used for species identification. The species specificity of the band patterns revealed prominent variations in banding patterns would be helpful in solving the ambiguous problem related with taxonomy. The fore limb and hind limb muscle homogenates from *R.norvegicus*, *O.cuniculus* and *M.musculus,* 10 prominent protein bands with maximum molecular weights were estimated from *O.cuniculus* when compared with banding patterns and molecular weight of others studied animals. *O.cuniculus* is a fast runner and its legs are stronger and function more and hence contain proteins with more molecular weights.

A considerable variability in the intensity of the protein bands derived from different muscles of the same species confirm their wide functional diversification with regard to their protein content. All these observations indicate that, the muscle protein electrophorograms can be used for species identification [9]. This is particularly of greatest importance to the forest department where the wild life are poached and their meat illegally sold in the market. This hightech method is a alternative techniques for species specific identification such as PCR- RFLP [10], the present electrophoretic technique of protein analysis is quite cheaper, time saving and more reliable in modern era.

Conflicts of interest: The authors stated that no conflicts of interest.

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