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Influence of Age and Sex on Muscle Fiber Type and Myoglobin Content in different Strains of Japanese Quail

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ABSTRACT

Three commercial meat type strains of Japanese quails (white, black and spotted brown) were slaughtered at 5, 6, 7 and 8 weeks of age and meat samples were collected from breast muscles. Male birds recorded significantly higher myoglobin (0.92 vs 0.79 mg/gm) and per cent red muscle fiber (84.79 vs 83.82) than females. The overall myoglobin content, in the meat of Japanese quails belonging to white, black and brown strains was 0.87, 0.86 and 0.84 mg/gm, respectively while the respective overall per cent red muscle fiber content was 83.41, 84.86 and 84.64. From the present study it is found that the quail meat is predominantly made of red muscle fibers and is hence suitable for processing and consumption similar to other red meats.

Key words: *Japanese quails, myoglobin, red muscle fibre*

Quails were reared as an alternate to broiler chicken for their fast growth, low feed and space requirement, less mortality, high feed conversion ratio etc. Proper understanding of biochemical architecture of meat is essential in choosing proper material for slaughter, processing and for predicting quality of the product as the physical and biochemical make up of meat will exert a profound influence on the shelf life and the response offered by the meat to processing (Singh and Panda, 1987). Muscle fiber characteristics are frequently used for evaluating growth impetus, muscular disease and even meat texture. Information on the muscle fiber type and myoglobin content in the meat of Japanese quail is scanty. Hence, the present study was taken up to assess the same in three strains of Japanese quail *viz.*, White, Black and Brown.

Day old chicks of three commercial meat type strains of Japanese quails (white, black and spotted brown) of different hatches, reared under deep litter system under identical management conditions were procured from Poultry Experimental Station, College of Veterinary Science, Rajendranagar, Hyderabad and slaughtered at 5, 6, 7 and 8 weeks of age. During each of the five trials conducted, four birds of each strain at each of the four ages with equal distribution of sexes were slaughtered as per the standard procedure and meat samples were collected from the breast muscles after 24 hours of storage at refrigerator temperature (4 ± 1^0C). Muscle fiber type was determined by estimating Succinate dehydrogenase activity from breast muscle (M. pectoralis superficialis) as outlined by Singh and Sulochana (1996). Myoglobin content was estimated as per the procedure of Araganosa and Hendrickson (1969).

Male birds recorded significantly more myoglobin (0.92 mg/gm) than females (0.79mg/gm) in the present study. This could be because male birds recorded slightly higher per cent of red muscle fiber (84.79) than females (83.82) which is in accordance with the findings of Genchev *et al.* (2010) who reported that the pectoral muscle of Japanese quails was composed mainly of dark muscle fibres (95.72-96.37%) and the percentage of light muscle fibres varied within 2.9 and 5.2%. Dawson *et al* (1964) indicated a close relationship between the red fibers content of a muscle, visual color, and Succinate dehydrogenase activity.

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The overall myoglobin content in the meat of Japanese quails belonging to white, black and brown strains was 0.87, 0.86 and 0.84 mg/gm, respectively while the respective overall per cent red muscle fiber content was 83.41, 84.86 and 84.64. The present study revealed the occurrence of more red fibers in quail meat. Hence, quail meat may be similar to red meat which is in agreement with findings of Denny Brown (1929) who established that muscle colour is dependent on the proportion of the red fibers. The breast muscles of pigeon, sparrow and humming bird also contain mainly red fibers. On the contrary, chicken breast muscle (*Pectoralis major*) was composed of almost entirely white fibers. Kiessling (1977) reported a ratio of 96 % white and 4% red fibers *pectoralis major* muscle of chicken, whereas Wiskus *et al.* (1976) reported a range of 90 to 100 % white and 0 to 10 % intermediate fibers in turkey breast muscle.

The overall mean red muscle fiber content in present study was 82.62, 84.51, 84.69 and 85.40 at 5, 6, 7 and 8 weeks of age, respectively and exhibited significant increase in red muscle fiber content as age advances. The mean percent red muscle fiber content ranged from 74.00 to 85.86. All red muscles had significantly high succinate dehydrogenase (SDH) activity than in the white muscles indicating high oxidative enzyme activity (SDH), whereas white muscles have high glycolytic activity which is in accordance with the observations of Lawrie (1953). Sreter and Woo (1963) reported wide ranges (0.0 - 65.5%) in the red fiber content in several muscles of rat while Beecher *et al*. (1965) reported that the red fiber content of porcine muscles ranged from 19.5 % (*Semitendinosus* light portion) to 47 % (*Trapezius*). This activity indicate structural, functional and biochemical adaptation of muscle which was also confirmed by George and Berger (1966) who described three types of fibers viz., red, white and intermediate in the muscles of birds and mammals which varied structurally, biochemically and functionally to adapt to their location in the body and for their performance.

The overall mean myoglobin content was 0.64, 0.74, 0.88 and 1.16 mg/gm at 5, 6, 7 and 8 weeks of age, respectively and exhibited significant increase in mean myoglobin content as age advances. These findings are in line with observations of Briskey *et al.* (1960) and Cassene *et al.* (1963) who has conducted experiments on porcine muscle. Riegel *et al.* (2004) observed that the breast muscle of Japanese quail contained 13 to 14% white muscle fibers and the myoglobin content of the muscles generally increased with the increase in the percentage of red muscle fibers indicating that red muscle fibers contain higher concentration of myoglobin than white muscle fibers.

The mean myoglobin content in the present study ranged from 0.63 to 1.28 mg/gm. These findings are in accordance with the findings of Karnen *et a*l. (1999) who reported that the myoglobin content of breast and leg muscles was 0.31 and 1.17 mg/g respectively in broiler chicken. Probable variations in the muscle myoglobin content found in the present study could be substantiated with the findings of several researchers like Hedrick *et al.* (1994) who stated that the amount of heme pigment is highly related to species, age, sex, muscle and

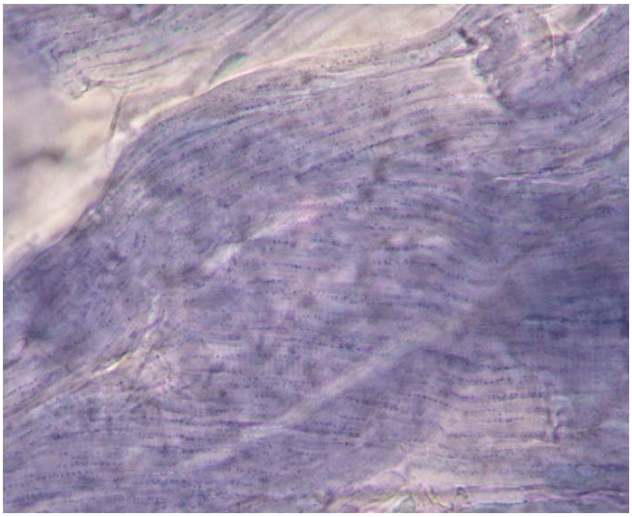

Fig.1 Photograph of stained section of pectoralis superficialis muscle exhibiting in muscle fiber, mitochondria appears as dark granules showing intensity of succinate dehydrogenase activity. Red muscle fibers are fast switch contain more mitochondria having oxidative enzymes (succinate dehydrogenase thus require more oxygen which supplies by myoglobin)

physiological activity. Han *et al.* (1994) reported that the myoglobin in red meat (beef) is high when compared to white meat (chicken) and further reported that the myoglobin content in beef and chicken ranged from 4.26 to 4.52 and 0.25 to 0.27 mg/g respectively. Fleming *et al.* (1991) observed that the myoglobin content of gizzard was high when compared to all other muscles and the myoglobin content in breast, thigh and gizzard was 0.15, 0.21 and 2.07 mg/g, respectively in broiler chicken.

The present study revealed an increase in the myoglobin content and percent red fibres in the meat of Japanese quails with increase in age. Based on histochemical observations in the present study, the majority of the breast muscle fibres (*M. pectoralis superficialis*) in quails are red muscle fibres. In general, there was a high predominance of red muscle fibres in the meat of Japanese quails indicating that its meat is similar to other red meat.

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