ABSTRACT

Oxidative Status, Myosatellite Proliferation and Growth Factor Expression in Different Muscle Fibre Types in the goldfish

(*Carassius auratus*, Family: Cyprinidae)

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Oxidative status, myosatellite proliferation, and growth factor levels in different muscle fibre types were investigated in the goldfish, *Carassius auratus*. Oxidative DNA damage was quantified using a comet assay in which the endonuclease formamidopyrimidine glycosylase (FPG) cut the DNA at sites that contained the oxidised base 8-hydroxyguanine. The fraction of DNA that was cut by FPG was about 20 % greater for oxidative muscle than for glycolytic muscle, suggesting that oxidative DNA damage was greater in oxidative fibres than in glycolytic ones. The ability of the antioxidant enzyme superoxide dismutase (SOD) to reduce the rates at which xanthine-xanthine oxidase-cytochrome *c* mixtures develop colour was exploited to determine SOD activities. The SOD activities in oxidative muscle were greater than those in glycolytic muscle, with unit mass of oxidative and glycolytic muscle protein reducing the rates of colour development by approximately 60 and 35 %, respectively. The proliferation rates of muscle stem cells (myosatellites) were determined by incorporating 5-bromo-2'-deoxyuridine (BrdU) into replicating DNA, and by detecting the incorporated BrdU with an ELISA kit. Immunoassay kits were also used to determine the concentrations of fibroblast growth factor 2 (FGF-2) and insulin-like growth factor 1 (IGF-1). The rates of BrdU incorporation into the DNA (and thus the myosatellite proliferation rates) of oxidative muscle were about 1.8 times the rates of glycolytic muscle, and the FGF-2 and IGF-1 concentrations of oxidative muscle were, respectively, 4 and 1.4 orders of magnitude greater than those of glycolytic muscle. Telomerase, an enzyme required for long-term cell proliferation, was assayed using a PCR-based telomeric repeat amplification protocol, and the telomerase activity of oxidative muscle was more than twice that of glycolytic muscle. These results show that different muscle fibre types have different susceptibilities to oxidative DNA damage, and that oxidative fibres overexpress SOD in order to minimise such damage. The data also show that the myosatellites of oxidative muscle proliferate at greater rates than those of glycolytic muscle, and that this higher proliferative capacity may be the result of higher growth factor levels in the vicinity of, and greater telomerase activities in, oxidative muscle myosatellites.

Keywords: Muscle Fibre Types; DNA damage; Superoxide dismutase; Myosatellite cells; Fibroblast growth factor 2; Insulin-like growth factor 1; Telomerase; Fish; *Carassius auratus*.