－原著－

Expression of Immunoreactivities for Manganese and Copper/Zinc Superoxide Dismutases (Mn- and Cu/Zn-SODs) During Development of the Rat Submandibular Gland

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Abstract: Manganase- and copper-zinc superoxide dismutases (Mn- and Cu/Zn-SODs) are representative enzymes for scavenging superoxide radicals, which are considered to cause aging and cell damage. Our recent study has demonstrated the localization of Mn- and Cu/Zn-SOD proteins as well as the expression of Mn- and Cu/Zn-SOD mRNAs in all types of duct cells -- and not in acinar cells -- in the submandibular gland of adult rats. However, the expression of these two enzymes remains unclear in rat developing submandibular gland. Thus, the present study examined the expression of Mn- and Cu/Zn-SODs in the submandibular gland of rats aged from embryonic 18 days to postnatal 8 weeks by an immunohistochemical technique using specific antisera. The deparaffinized sections were processed for the avidin-biotin complex method. On the prenatal 18th day, a small number of epithelial duct cells and cells in acini exhibited Cu/Zn-SOD-immunoreactivity, but they did not show any immunoreactions for Mn-SODs. From postnatal 1 day to 1 week, Mn- and Cu/Zn-SOD-immunoreactivities were found in both the duct cells and the cells in acini. This drastic change in the expression of Mn- and Cu/Zn-SOD-immunoreactivities between prenatal and postnatal periods was believed to relate to the commencement of pulmonary respiration due to oxygen exposure. After 2 weeks, however, the cells in the acini lost Mn- and Cu/Zn-SOD-immunoreactions, though the duct cells retained them, suggesting that the duct cells in the mature submandibular gland exhibit greater resistance against oxidative stress than do the acinar cells.

INTRODUCTION

Active oxygen species and free radicals play crucial roles in protection against bacterial infection and scavenging by antioxidant enzymes. Active oxygen species and antioxidant enzymes are considered to be implicated in a variety of pathologic processes including aging[1, 2] and cell damage[3-6] in spite of their favorable balance in a healthy organism. Superoxide disumtase (SOD), also known as superoxide oxidoreductase, is a key enzyme that protects cells against oxidative injury: it resolves superoxide into H_2O_2 and O_2, and H_2O_2 is subsequently broken down by catalase and glutathione peroxidase into H_2O and O_2. Biochemical analyses have revealed at least three different SOD enzymes in mammalian tissues. They are classified into two forms of intracellular SOD[7] and one extracellular SOD[8]. The intracellular SODs include manganese SOD (Mn-SOD) and copper-zinc SOD (Cu/Zn-SOD). The Mn-SOD is found predominantly in the mitochondrial matrix while Cu/Zn-SOD is uniform throughout the cytoplasm[9].

The formation of salivary gland is initiated by the proliferation of oral epithelial cells and their down-growth into the underlying mesenchyme[10-12]. During