

# Lactoferrin-Protector against Oxidative Stress and Regulator of Glycolysis in Human Erythrocytes

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Binding of lactoferrin (Lf) to its membrane receptors requires an electron for the reduction of  $\text{Fe}^{3+}\text{LF}$  to  $\text{Fe}^{2+}\text{LF}$ . It is possible that glyceraldehyde –3-phosphate dehydrogenase, a glycolytic enzyme part of the erythrocyte membrane, delivers that electron. Then Lf, obtaining an electron from the coenzyme NADH, might stimulate glycolysis, which requires the oxidised state of the coenzyme  $\text{NAD}^+$ . Such possibility is supported by the finding that another extracellular  $\text{e}^-$  acceptor – potassium ferricyanide activates glycolysis by the similar mechanism. Present results show that ferricyanide inhibited the specific  $^{59}\text{Fe}$ -lactoferrin binding to its erythrocyte membrane receptors. It may be assumed that ferricyanide competes with lactoferrin for an electron which leads to decrease of the binding of  $^{59}\text{Fe}$ -lactoferrin to its receptors. Lactoferrin (50 and 100 nM), similar to ferricyanide, increased the accumulation of lactate (respectively by 25% and 30%). These results support the assumption that ferricyanide and lactoferrin are final acceptors of a common electron transport chain connected with the regulation of glycolysis.

We established an antioxidative effect of lactoferrin on erythrocytes, which was expressed as: a) an influence on content and on activity of intracellular antioxidants – namely an enhancement of the content of reduced glutathione; b) a decreased content both of products of lipid peroxidation (thiobarbituric acid reactive substances) and hemolysis under normal conditions and oxidative stress.

Lactoferrin is capable to bind metal ions and thus to block their catalytic participation in the oxidative disturbances of the membrane. In most of our experiments there were no metal ions in the incubation mixtures (except those stimulating oxidative stress). Our results showed that Lf limited both the generation of thiobarbituric acid reactive substances and hemolysis in the absence of metal ions in the media, as well as in their presence. These facts suggest that probably the antioxidative property of lactoferrin is glycolysis stimulation, leading to increased formation of ATP, which is necessary to maintain the ion gradient, membrane potential and morphology of the erythrocyte.

*Key words:* Lactoferrin, Antioxidant, Glycolysis