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RESEARCH ARTICLE

THE PARTICIPATION OF THE FULL 9 STEPPED CYCLE OF PROTON CONDUCTANCEIN THE TRANSLOCATION OF ELECTRONS AND PROTONS PRODUCED DURING GLYCOLYSIS TO MITOCHONDRIAL MATRIX

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ABSTRACT

The creation of normal condition of translocation of electrons and protons produced during glycolysis to mitochondrial matrix, owing to the full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016) have been played a more important role in the general bioenergetic processes of organism by participating to formation of proton gradients and thereby increasing the ATP generation and heat energy. In such way, any forms of deficiency of generation of the high-energy molecules as NADH, in which have been contained electrons and protons produced during glycoly_sis would be lead to decrease of proton gradients, thereby limitation of cellular energy sources as ATP and heat energy. The normal condition of translocation of electrons and protons produced during glycolysisis connected with malate-aspartate shuttle is a biochemical system for translocating of protons with electrons across the semipermeable inner membrane of the mitochondrion for oxidative phosphorylation in eukaryotes. We came to conclusion that one of very useful condition of prevention of shortage of cellular energy sources, in which have been participated NADH molecules produced during glycolysisis the stimulation of the full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii 2016), thereby making the possibility to the intensification of anaerobic respiration and paralleled intensifying of aerobic respiration with oxygen, which would be appeared as increasing of the translocation of a electrons and protons from cytosol (contained in the NADH molecules) to mitochondrial matrix through inner mitochondrial membrane with involvement of intensified malate-aspartate shuttle.

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INTRODUCTION

But untill now the recent findings of literature could not give the appropriate answer to the questions, relating to the participation of the full 9 stepped cycle of proton conductancein the translocation of electrons and protons produced during glycolysis from cytosol to mitochondrial matrix. Within frame of recent scientific work we are aiming to discuss the participation of the full 9 stepped cycle of proton conductancein the the translocation of electrons and protons produced during glycolysis in the forms of NADH molecules from cytosol to mitochondrial matrix through inner mitochondrial membrane and their role in the paralleled stimulation of anaerobic respiration without oxygen and aerobic respiration with oxygen and also, involvement of intensification of malate-aspartate shuttle in this regulation.

RESULTS AND DISCUSSION

Glycolysis have originated with the first prokaryotes at least 3.5 billion years ago before forming of the full 9 stepped cycle of proton conductance. Glycolysis serves principal functions as generation of the high-energy molecules as ATP and NADH, which are used as cellular energy sources in the aerobic respiration with oxygen within the full 9 stepped cycle of proton conductanceand anaerobic respiration without oxygen. It would be interesting to study the effect of the full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016) and the participation of malate-aspartate shuttle to prevention of shortage of cellular energy sources in which have been participated electrons and protons produced during glycolysis in the form of NADH molecules. For aerobic organisms such as humans, glycolysis is only the initial stage of carbohydratecatabolism, the end-products of glycolysis enter into the Krebs cycle and the electron transport chain for further oxidation with direct participation of the full 9 stepped cycle of proton conductance. These pathways together produce considerably more energy per glucose molecule than anaerobic oxidation owing to the participation of the full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016). In such way, any forms of deficiency of generation of the high-energy molecules as NADH of glycolytic origin would be lead to decrease of proton gradients, thereby limitation of cellular energy sources as ATP and heat energy. The normal condition of translocation of electrons, protons contained in the NADH

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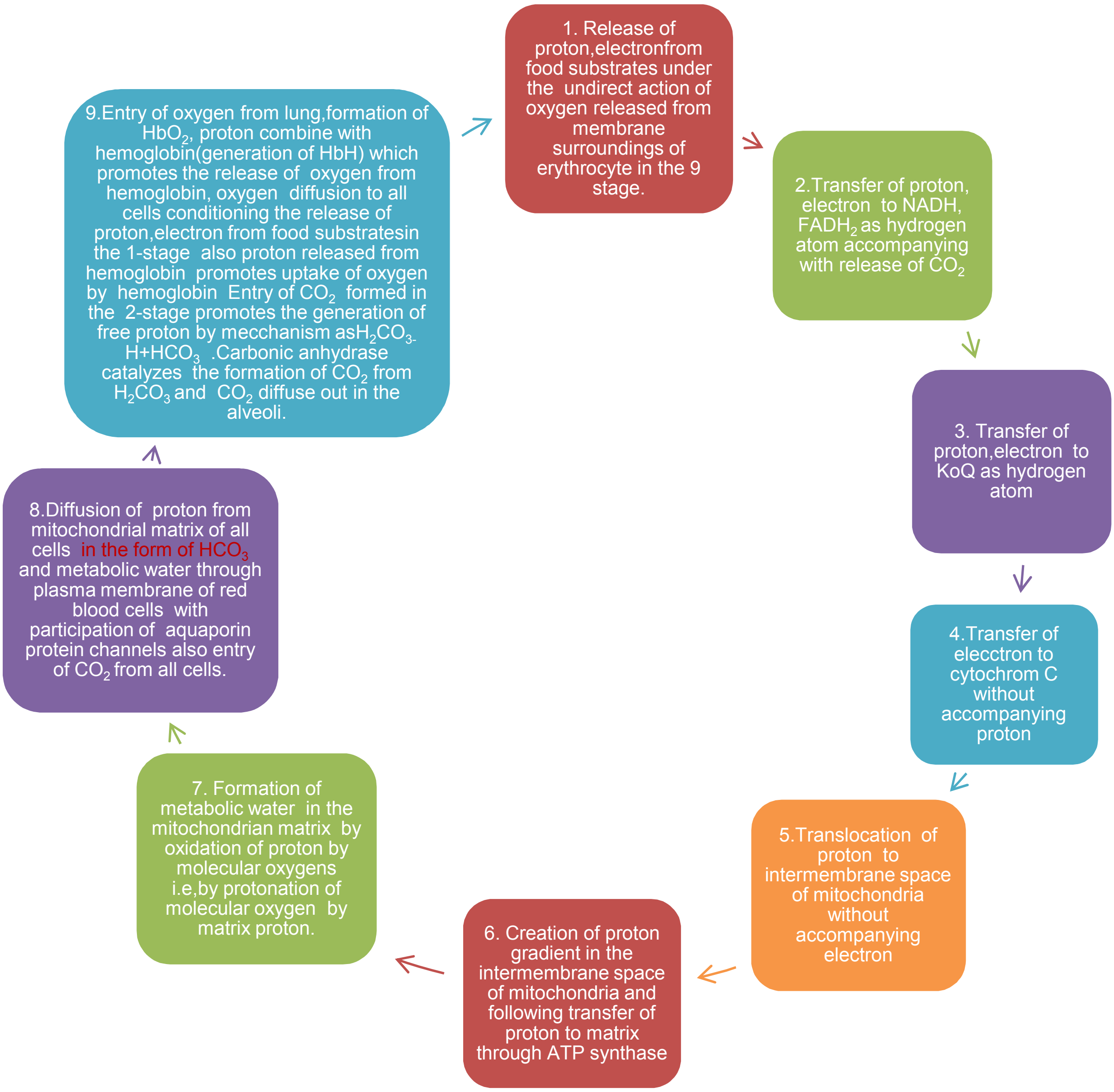
molecules of glycolytic pathway is connected with malate-aspartate shuttleto translocation across the semipermeable inner membrane of the mitochondrion for oxidative phosphorylation. The shuttle system is required because the mitochondrial inner membrane is impermeable to NADH-primary reducing equivalent of the electron transport chain. In the cytosol, malate dehydrogenase catalyses the reaction of oxaloacetate and NADH to produce malate and NAD^+. After malate reaches the mitochondrial matrix, it is converted by mitochondrial malate dehydrogenase into oxaloacetate, during which NAD^+ is reduced with two electrons to form NADH. The net effect of the malate-aspartate shuttle is purely redox as NADH in the cytosol is oxidized to NAD^+, and NAD^+ in the matrix is reduced to NADH. The NAD^+ in the cytosol can then be reduced again by another round of glycolysis, and the NADH in the matrix can be used to pass electrons to the electron transport chain so ATP can be synthesized.

fructose-1,6 biphosphate + aldolase = GAP+DHAP, fifth stage: GAP + DHAP + NAD + P = 1,3 biphosphoglycerate, at sixth stage: 1,3 biphosphoglycerate + ADP = ATP + 3-phosphoglycerate, eighth stage: 3 phosphoglycerate + phosphoglycerate mutase = 2-phosphoglycerate, ninth stage: 2-phosphoglycerate = H_2O + enolase = phosphoenolpyruvate, tenth stage: phosphoenolpyruvate + ADP = ATP + pyruvate. Also, in case of deficiency of malate-aspartate shunt, which functioned as oxaloacetate + NADH+H = NAD + malate in cytosol, second stage: transport of malate from cytosol to mitochondrion matrix, third stage: NAD + malate = oxaloacetate + NADH, fourth stage: oxaloacetate + glutamate = aspartate + alpha ketoglutarate, fifth stage: transport of alpha ketoglutarate from mitochondrion to cytosol, also transport of aspartate from mitochondrion to cytosol, sixth stage: aspartate + alpha ketoglutarate = oxaloacetate + glutamate, many parts of NADH formed in the glycolytic pathway would be left in



Glycolysis dependent synthesis of HADH have been existed in close dependent from presence of ATP molecules because this process have been conducted as follows as first stage: glucose + hexokinase + ATP = glucose-6 phosphate, second stage: glucose-6 phosphate + phosphoglucose isomerase = fructose-6 phosphate, third stage: fructose-6 phosphate + ATP + phosphofructokinase = fructose-1,6 biphosphate, fourth stage:

the cytosolwithout oxidation by malate dehydrogenase with forming of NAD^+, and not reaching the protons, electrons contained in NADH moleculesof glycolytic origin to mitochondrial matrix through inner mitochondrial membrane.

In such way, electron flow dependent bioenergetic reaction mediums of glycolysis as glucose + hexokinase + ATP =

glucose-6 phosphate, glucose-6 phosphate + phosphoglucose isomerase = fructose-6 phosphate, fructose-6 phosphate + ATP + phosphofructokinase = fructose-1,6 biphosphate, fructose-1,6 biphosphate + aldolase = GAP+DHAP, GAP+DHAP+ NAD+P=1,3 biphosphoglycerate, 1,3 biphosphoglycerate + ADP = ATP + 3-phosphoglycerate, 3 phosphoglycerate + phosphoglycerate mutase = 2-phosphoglycerate, 2-phosphoglycerate = H_2O + enolase = phosphoenolpyruvate, phosphoenolpyruvate + ADP = ATP + pyruvate became the very important factors of the NADH formation by glycolytic pathway, used to pass electrons to the electron transport chain so ATP can be synthesized. The protons and electrons contained in the NADH molecules of glycolytic origin would became unseparable parts of proton gradients which have been conditioned the formation of ATP molecules and heat energy.

In case of disturbance of normal condition of translocation of NADH molecules of glycolytic pathway by malate-aspartate shuttle would be decreased the possibility to gain 2.5 ATP molecules by one molecule of NADH produced in the glycolytic pathway. If in the membrane - redoxy potential three state line systems, belonging to the full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016) have been prevailed alpha state with high oxy potential it would lead to increase of the oxidized form of NAD molecules of the glycolytic origin in mitochondrial matrix site, thereby increasing the intensity of translocation of electrons and protons produced during glycolysis by the malate-aspartate shuttle from cytosolto matrix with elevation of heat energy, all these processes in Traditional Tibetan Medicine coded by fire element and Mkhris terms. If in the membrane-redoxy potential three state line systems, belonging to the full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016) have been prevailed betta state with high red potential, it wouldbe lead to increase of the reduced form of NADH molecules of the glycolytic origin in mitochondrial matrix site, thereby decreasing the intensity of translocation of electrons and protons produced during glycolysis by the malate-aspartate shuttle from cytosol to matrix with decrease of heat energy, all these processes in Traditional Tibetan Medicine coded by water and earth elements and Badgan terms. If in the membrane-redoxy potential three state line systems, belonging to the full 9 stepped cycle of proton conductance (Ambaga M,Tumen-Ulzii A2016) have been prevailed gamma state with low redoxy potential, it would be lead to paralleled decrease of the reduced and oxidized forms of NADH molecules of the glycolytic origin, thereby decreasing the intensity of translocation of electrons and protons produced during glycolysis by the malate-aspartate shuttle from cytosol to matrix and to decrease of ATP and heat energy formation, all these processes in Traditional Tibetan Medicine coded by rlung element and Rlung terms.

We came to conclusion that one of very useful condition of prevention of shortage of cellular energy sources, in which have been participated NADH molecules produced during glycolysisis the stimulation ofthe full 9 stepped cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016), thereby making the possibility to the intensification of anaerobic respiration and paralleled intensifying of aerobic respiration with oxygen, which would be appeared as increasing of the translocation of a electrons and protons from cytosol (contained in the NADH molecules) to mitochondrial matrix through inner mitochondrial membrane with involvement of intensified malate-aspartate shuttle.

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