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How *fdhF* Deletion Affects Ion Transport and ATPase Activity in *E. coli*?

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ABSTRACT

Formate dehydrogenase-H plays a key role in anaerobic metabolism, particularly in formate metabolism during fermentation. To assess its glucose-dependent role, proton (J_{H^+}) and potassium (J_{K^+}) fluxes, along with F_OF_1-ATPase activity, were examined in wild-type and *fdhF* mutant grown under low (2 g L^{-1}) and high (8 g L^{-1}) glucose. When cells were grown in the presence of low glucose and during assays similar amount was added mutant showed 40% higher J_{H^+} but 30% lower F_OF_1-conditioned flux, consistent with a 20% reduction in ATPase activity upon potassium supplementation, but there were no differences when extra formate, or potassium and formate together were supplemented. At the same time total J_{K^+} was lower compared to wild type, meanwhile DCCD does not affect the flux. Under high glucose, mutants displayed a 50% increase in total and DCCD-sensitive J_{H^+} fluxes, a 35% decrease in J_{K^+}, and a 50% drop in F_OF_1-conditioned flux. When cells were grown in a presence of high glucose and during assays similar amount was supplemented total J_{H^+} was similar in mutant and wild type, meanwhile DCCD-sensitive flux decreased by 25-35%, conversely total J_{K^+} increased by 35% and with DCCD potassium outflux was observed. Potassium had no effect on ATPase activity, but formate increased it by 25%. These findings suggest that under low glucose, accumulated formate stimulates proton efflux while inhibiting ATPase, whereas under high glucose, formate regulates ATPase via potassium, highlighting a glucose-dependent shift in formate's control of membrane bioenergetics.

Keywords: formate dehydrogenase H, F_OF_1-ATPase, J_{H^+}, J_{K^+}, glucose concentration

References:

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