

The Impact of FocA Channel on ATPase Activity of *Escherichia coli* During Fermentation of Mixed Carbon Sources

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ABSTRACT

Formate, a major product of fermentation in enterobacteria like *E. coli*, can account for up to one-third of carbon from glucose. Formate/formic acid can be re-imported to the cell through the FocA channel, a pentameric membrane protein that plays a crucial role in formate distribution during fermentation. This study examined FocA's role in *E. coli* ATPase activity during fermentation of glucose and glycerol or glucose, glycerol, and formate, using wild-type (WT) BW25113 and *ΔfocA* strains. *N,N'*-dicyclohexylcarbodiimide (DCCD) was used to determine the F_oF₁-ATPase input in the whole enzyme activity. During fermentation of glucose and glycerol the addition of formate (10mM) during assay did not affect the ATPase activity in WT, but in the *ΔfocA* the activity was inhibited by 25%. DCCD sensitive enzyme activity was also 30% lower in *ΔfocA* compared to WT, which suggests that decrease of total activity was conditioned by F_oF₁-ATPase. During the fermentation of glucose, glycerol and formate, the addition of formate during assay increased enzyme activity in WT by 25%, while in the case of *ΔfocA* the enzyme activity was not affected. Interestingly, the input of F_oF₁-ATPase was 35% and 30% lower in WT and *ΔfocA* respectively during fermentation with formate. The addition of formate during assay increased F_oF₁-ATPase activity by 40% and 50% in WT and *ΔfocA* respectively. The data suggest that in the WT, the presence of formate during growth sensitizes the cells to additional formate, leading to increased ATPase activity upon its addition, while in the absence of FocA channel this response is not exhibited. This indicates a possible regulatory role of FocA in formate sensing or in mediating energy-related responses to formate during fermentation.

Keywords: formate/formic acid, ATPase, fermentation, *E. coli*

References:

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