Transport and Sorting of the Solanum tuberosum Sucrose Transporter SUT1 Is Affected by Posttranslational Modification

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Correction


Based on new results, we wish to correct specific statements made in Krügel et al. (2008).

The electrophysiological characterization of Zm SUT1 activation by oxidized glutathione (GSSG), as shown in Figure 4B of Krügel et al. (2008), was due to a change in pH value caused by the application of redox reagents to the medium. Here, we show that at constant pH, the application of GSSG has no affect on sucrose transport in oocytes (Figure 9A). DTT has only a minor inhibitory effect on sucrose uptake without any change of pH value. The Zm SUT1-mediated sucrose-induced currents were much higher at pH 3.5 than at pH 5.5 (Figure 1B), consistent with this new interpretation of our results.

Based on these new findings, the yeast uptake experiments reported in Figure 1 of Krügel et al. (2008) were repeated. Application of GSSG strongly affects the pH value of the broadly used 25 mM NaPO4 buffer, depending on the GSSG concentration. For example, when 20 mM GSSG was added to this buffer, the pH value decreased from the initial value of pH 5.5 to pH 3. Increasing the buffer strength from 25 mM NaPO4 (used in the Krügel et al. experiments) to 66 mM NaPO4 and buffering GSSG to the appropriate pH value resulted in uptake kinetics that were less sensitive to the application of GSSG. Under these increased buffer conditions, no pH change was measured upon addition of redox reagents. These new experiments clearly established that the previously reported effects of GSSG and GSH on sucrose uptake were primarily due to pH effects. The effect of redox reagents, under constant pH conditions, was much weaker than indicated in our published article. It cannot be excluded that the stimulus reported by Krügel et al. (2008) is partially due to targeting effects and/or secondary effects on the membrane potential.

Previous measurements of sucrose uptake performed at lower pH values (pH <4.5) gave rise to a decrease in uptake (AtSUT4 [Weise et al., 2000], DcSUT1, DcSUT2 [Shakya and Sturm, 1998], and AtSUT2 [Schulze et al., 2000]). However, in the case of the St SUT1, sucrose uptake was observed to increase steadily upon lowering the pH value (Figure 9C). For Zm SUT1, a similar increase in sucrose uptake was observed at low pH values, as demonstrated by electrophysiological measurements performed in Xenopus oocytes (Figure 9B).

Based on our new findings, Figure 1 (St SUT1-mediated sucrose uptake studies in yeast) and Figure 4B (the electrophysiological characterization of Zm SUT1) presented in Krügel et al. (2008) must be retracted and replaced by the new figure (Figure 9) presented here. However, all other findings reported in our article, regarding localization and protein dimerization, have been reconfirmed.

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Figure 9. St SUT1 pH Response Characteristics.

(A) Current recording from a Zm SUT1–expressing Xenopus oocyte at -30 mV holding potential. Transporter currents were evoked by perfusion at pH 7.4 or 5.5 in the presence or absence of 1 mM GSSG. GSSG was buffered to pH 5.5.

(B) Sucrose-induced current recording from a Zm SUT1–expressing Xenopus oocyte perfused with solution buffered at pH 7.4, 5.5, or 3.5, as indicated by the perfusion scheme above the current trace.

(C) pH dependency of St SUT1–mediated 14C-sucrose uptake in the yeast strain SUSY7. The pH optimum of St SUT1 is below pH 3.0 and contradicts earlier publications with other sucrose transporters.