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In vitro and *in vivo* evidences of sickling reversal induced by rehydration with high K+- isotonic solution

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Erythrocyte sickling and adhesion are favored by cellular dehydration, which increases the rate of hemoglobin polymerization and cell sickling. Potassium chloride co-transport and calcium-activated potassium channel (Gardos channel) mediate erythrocyte dehydration in sickle cell disease and β-thalassemia. We investigated the *in vitro* and *in vivo* effects of various concentrations of K+ ions in physiological solutions (PSS) as well as in *Cocos nucifera* water (CNw) which is known for its natural high potassium content and isotonicity. This study was aimed at ascertain the efficacy of high potassium isotonic solutions in rehydrating sickle cell and possibly reversing the sickling phenomenon at *in vivo* and *in vitro* situations. Erythrocytes from 20 sickle cell anemia (SCA) as well as 46 healthy subjects were studied. One part was treated with sodium metabisulfite (Na2S5O7) solution to induce maximum sickling as controls while the other was subjected to different high concentrations of K+ in PSS as well as *Cocos nucifera* water (40 mM, 80 mM and CNw – 65 mmol/L) respectively. The procedure was repeated for the normal HB AA subjects. Also, both groups of subjects were given 10 ml/kg body weight of coconut water to drink as a single dose for the *in vivo* experiment. Blood samples were collected longitudinally before and after the oral ingestion at 1 hour and at 24 hours for analysis of red cell indices as well as stained blood films used to ascertain the percentage sickled erythrocytes count before and after the treatment in both cases. Maximum percentage counts of sickled cells after the addition of Na2S5O7 (45%) were observed which decreased significantly ($P<0.05$, respectively) to about 2% with *Cocos nucifera* and 10% with 80 mM K+ PSS. The count in 40 mM K+-PSS was not statistically significant. In both Hb AA and SS subjects, MCH and MCV remained relatively stable when compared with the pre-ingestion sample ($P>0.05$, respectively) while MCHC increased significantly in both groups as early as 1 hour and sustained till the 24th hour. MCHC was equally raised in the *in vitro* samples ($P<0.05$, respectively). The morphology of red cells also indicated a lesser count of sickled red cells after the oral ingestion. *Cocos nucifera* water and other high potassium ion solutions can activate the rehydration of sickled erythrocytes by probably de-activating the Gardos channel to increase the mean corpuscular hemoglobin concentration (MCHC) and thereby restoring the normal red cell shape. We suggest a probable pharmacological value of the *Cocos nucifera* water as well as other formulated high potassium but isotonic fluids in SCA management.

Biography

Olutayo Ifedayo Ajayi holds a Diploma in Hematology and Blood Transfusion Science and a Fellowship Diploma in Clinical Chemistry from the Medical Laboratory Council of Nigeria. He later proceeded to University of Benin to study Human Physiology where he bagged his MSc and PhD degrees. He has many publications in both local and international journals. He is currently an Associate Professor and Head of Department of Physiology at University of Benin in Nigeria.

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