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## Clinical Assessment of Hydration Status using the MX3 Hydration Testing System

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**Study 1: Point of Care Salivary Osmolarity (SOSM) Testing for Rapid and Quantitative Detection of Dehydration in Children with Diarrhoea**

**Introduction:**

Diarrhoea is a leading cause of childhood mortality, accounting for approximately 8% of deaths among children under-five worldwide. Clinical intervention to prevent mortality rates associated with diarrhoea requires rapid and efficient detection of potentially life-threatening dehydration. The current gold standard for assessment of dehydration in Indonesia is the World Health Organisation (WHO) clinical score for dehydration. However, many areas in Indonesia’s archipelago lack enough physicians that can determine dehydration status through physical diagnosis. There is a need for a rapid, quantitative test for dehydration which can be delivered by first-line health professionals.

**Objective:**

In this study we are exploring the use of MX3 Hydration Testing System (HTS) to assess hydration status and detect diarrhea-induced clinical dehydration using SOSM.

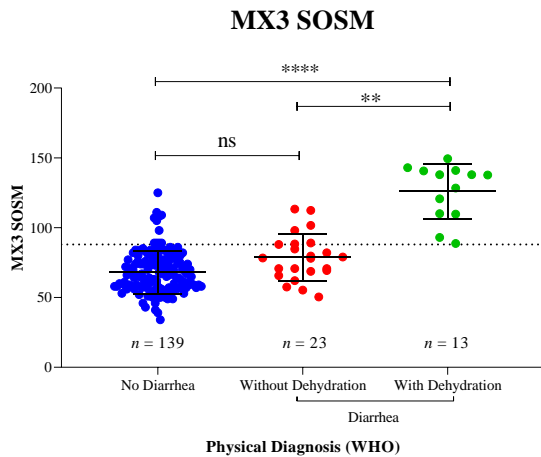
**Methods:**

Paediatric patients presenting with diarrhoea at regional health centres are assessed with both the WHO clinical dehydration score and the MX3 HTS. To account for the difficulty of collecting consistent samples from unwell paediatric patients and normal salivary variability we conduct 3 MX3 SOSM measurement from each child and use the average SOSM value in our analysis.

**Results:**

Our preliminary data shows that there is a highly significant difference in MX3 SOSM between children with diarrheal dehydration and both healthy children and children with diarrhea without signs of clinical dehydration (**Figure 1A**). Based on our analysis of this preliminary data an MX3 SOSM of 88 is a highly sensitive (100%) and specific (90%) hydration assessment threshold in this application (**Figure 1B**).

**A**



**B**

	Dehydrated	Hydrated
MX3 SOSM ≥ 88	13	18
MX3 SOSM < 88	0	144

Sensitivity: 100%

Specificity: 90%

**Figure 1.** A) SOSM measurements from paediatric diarrheal patients with and without dehydration measured with the MX3 HTS. Bars show mean ± standard deviation. Statistical analysis \*\*p < 0.01 \*\*\*\* p < 0.0001, ns = not significant, Kruskal Wallis multiple comparisons test. B) Performance of a SOSM threshold of 88 to identify dehydration in paediatric patients.



## Study 2: Salivary and Urinary Hydration Biomarkers in Adults with Hypertension

### Introduction:

Older people are vulnerable to dehydration due to various disease, mental and physical states which reduce thirst sensation. Additionally, older people may lack the ability to drink independently. Approximately half of older adults are thought to be chronically dehydrated, which has been shown to contribute to increase morbidity and mortality. Salivary osmolarity, as tested with laboratory equipment, has been previously demonstrated to an effective diagnostic marker of dehydration in elderly hospital patients (Fortes 2015, Mentis 2019). Diuretic use has also been shown to increase the risk of dehydration in older patients. There is a need for a rapid and non-invasive hydration assessment method in this population.

### Objective:

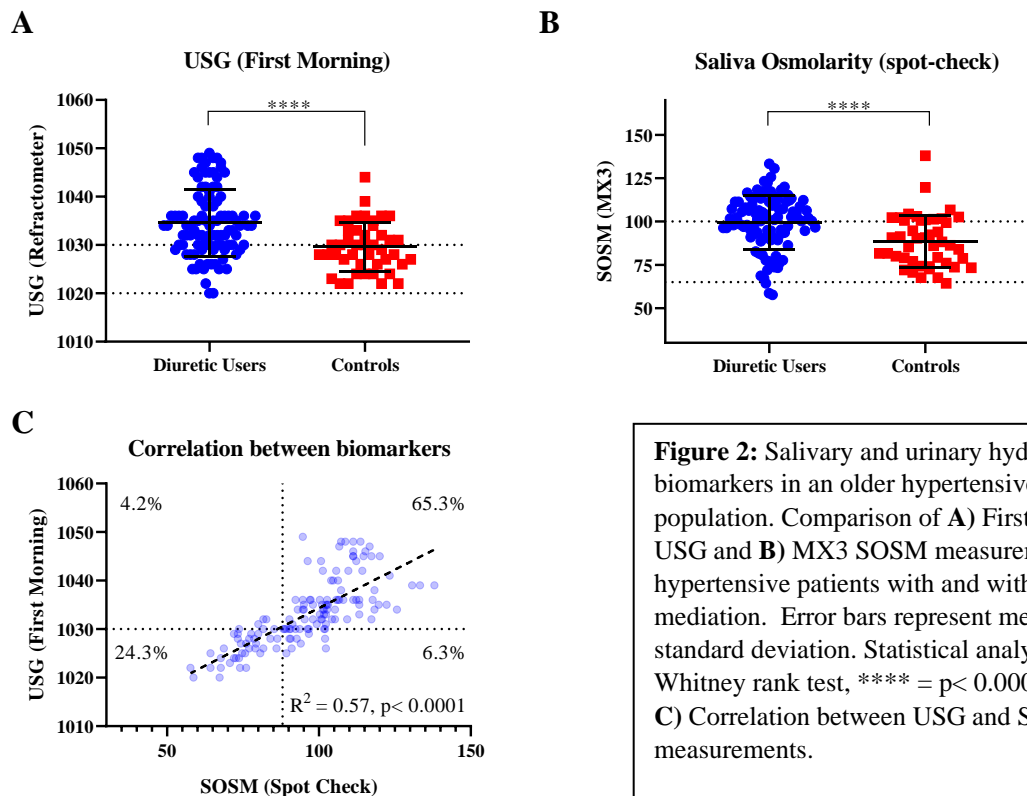
In this study we are exploring the use of MX3 SOSM and first-morning USG measurements to detect difference in hydration status between elderly hypertensive patients with and without diuretic medication.

### Methods:

Older patients with hypertension, with or without diuretic medication are assessed with the MX3 HTS and by first-morning urine specific gravity (USG). To account for normal salivary variability, we conduct 3 MX3 SOSM measurement from each patient and use the average SOSM value in our analysis. First-morning urine samples are self-sampled by each patient for later analysis.

### Results:

Our preliminary data shows that there is a small but highly significant increase in both MX3 SOSM and USG in patients on diuretic medication (**Figure 2A-B**). An interesting observation is that almost no patients would be considered well-hydrated by either metric ( $USG \leq 1.020$ ,  $SOSM < 66$ ). We observed a strong and highly significant correlation between MX3 SOSM spot checks and first morning urine measurements in this population with 90% of patients sharing the same hydration classification with both tests using a SOSM threshold of 88 and a USG threshold of 1.030 (**Figure 2C**).



**Figure 2:** Salivary and urinary hydration biomarkers in an older hypertensive population. Comparison of **A**) First morning USG and **B**) MX3 SOSM measurements in hypertensive patients with and without diuretic medication. Error bars represent mean and standard deviation. Statistical analysis: Mann-Whitney rank test, \*\*\*\* =  $p < 0.0001$ . **C**) Correlation between USG and SOSM measurements.