

WG1

Urine collection methods for non-toilet trained children in environmental exposure assessment

DiMoPEX



Arné Oerlemans, Gwendolyn Beckmann, Paul T.J. Scheepers

Department for Health Evidence, Radboud Institute for Health Sciences, Radboud university medical centre, P.O. Box 9101, 6500 HB, Nijmegen, The Netherlands.

INTRODUCTION

Young children differ from adults in their exposure and susceptibility to environmental chemicals because of various factors such as biometry, physiology, behavior and diet. Their increased vulnerability to environmental stressors makes it important to obtain appropriate urine samples for exposure assessment and conducting exposure analysis. However, collecting urine from non-toilet trained children has been shown to be methodologically and practically challenging (Lee and Arbuckle 2009). Collection methods should not introduce contamination or affect the integrity of the sample and must be acceptable to the participants.

AIM

Evaluation of various urine collection methods for non-toilet trained children which could be applied in a non-clinical setting to obtain biomonitoring data.

METHODS

Selected methods for urine collection include a disposable polyacrylate diaper, a urine bag, a collection pad containing a hygroscopic polymer (Peespot®, Roelofs-Thijssen et al. 2013) and the clean catch method (Fig. 1). Advantages and limitations of these methods were evaluated with respect to minimum required sample volume, potential for contamination, timing of collection, and burden on participants. The success rate was defined as the percentage of suitable samples from the total number of sample collection attempts. An attempt was considered successful if it yielded a urine sample with a volume of at least 5 mL and free of faeces contamination. In addition, the user rating of each method was evaluated on a 0-10 scoring range.

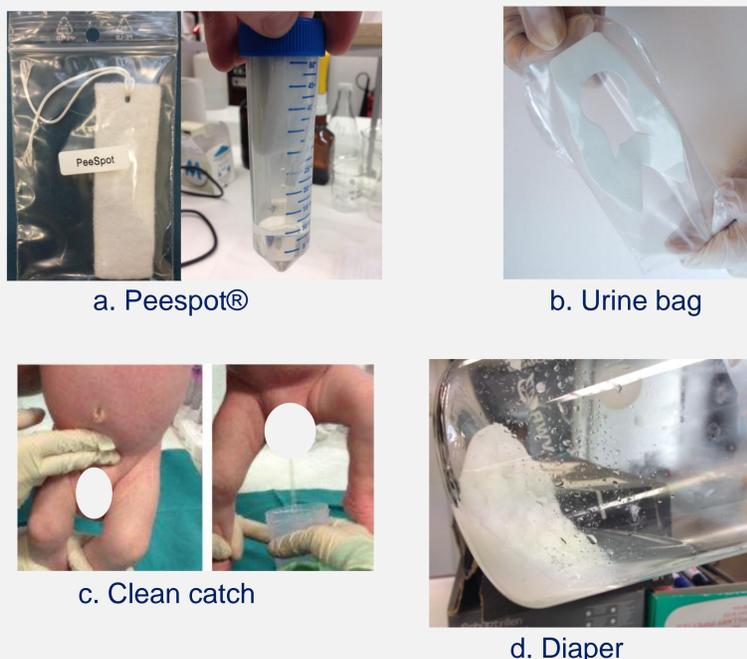


Fig. 1 Selected urine collection methods for non-toilet trained children.

DIAPER EXTRACTION

Urine was extracted using the following procedure:

- Remove polyacrylate granules
- Add 150 mL CaCl₂-solution 150 g/l (Fig. 2)
- Shake for 30 min
- Measure creatinine directly in supernatant
- Take supernatant and add organic solvent
- Further extraction and analysis (LC/MS/MS)

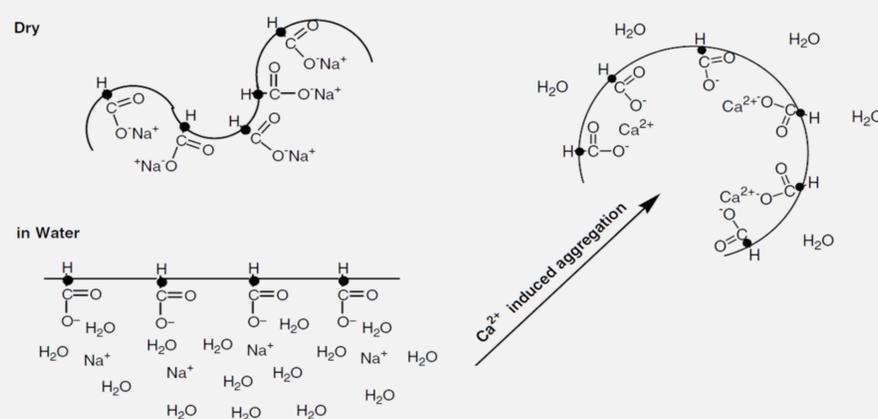


Fig. 2 Collapse of polyacrylate in presence of Ca²⁺ (Hu et al. 2004).

RESULTS

In total there were 24 attempts per collection method. The success rate of the diaper was highest with 67% and the diaper scored a 9 as user rate (Fig. 3).

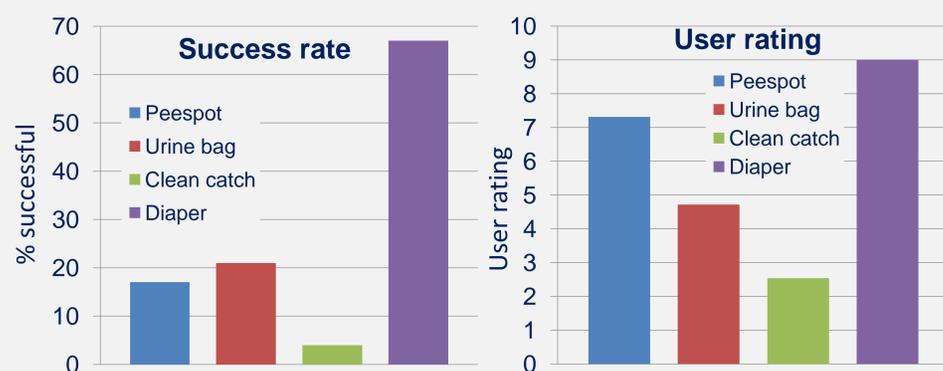


Fig. 3 Success rates (left) and user ratings (right) of urine collection methods.

CONCLUSIONS

A disposable polyacrylate diaper is suitable urine collection method for non-toilet trained children and therefore this method will be further evaluated for the exposure assessment of xenobiotic substances and their metabolites, including clinical parameters such as creatinine and osmolality.

References

- Hu et al. (2004) J Expo Anal Environ Epidemiol. 2004 Sep;14(5):378-84.
Lee and Arbuckle (2009) J Expo Sci Environ Epidemiol. 2009 Nov;19(7):625-33.
Roelofs-Thijssen et al. (2013) Clin Biochem. 2013 Sep;46(13-14):1252-6.