

Screening of Dried Matrix Spot Collection Devices to be Used for Nutritional Biomarker Analysis

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Abstract

Dry Matrix Spots (DMS) are dried spots of body fluids, including blood, serum, urine, saliva and breast milk. DMS have been employed as a convenient sample matrix to collect in non-clinical and remote settings. DMS can be collected by staff with minimal training, and for a limited time, they can be stored and transported without a cold-chain. Historically, nutritional biomarkers (NB) were collected using S&S (now Whatman) 903 cards in the form of dried blood spots (DBS). This form of blood collection provided multiple benefits, but limitations existed related to volume estimates, chromatographic effects, and storage stability. Using this type of sample collection, the separation of erythrocytes (RBCs) from serum does not occur. Aging of the blood, exposure to elevated humidity and temperature can alter the concentrations of most analytes.

Objective To evaluate blood collection devices to identify ones best suited to obtain DMS for measurement of NBs.

Methods We obtained samples of 10 commercial blood collection devices. Criteria were established to identify successful collection devices. Ideally, devices should separate RBCs from serum without gradient or chromatographic effects, provide adequate and quantifiable volume, reproducibility, moderate stability with minimal refrigeration, and simple collection. NBs were chosen from those identified by BOND working groups¹. The analytical methods to evaluate the NBs must be sensitive (\geq ppb), affordable, reproducible (\pm 15%), accurate (\pm 15%) and rugged.

Results Essentially all commercial products did not meet the criteria. Many do not separate RBCs from serum, do exhibit chromatographic effects, or provide too little serum for analytical testing. We have identified a device (Vive-Bio, Atlanta, GA) that allows the separation of RBCs in a vertical fashion with the concurrent separation and collection of a hemoglobin-free serum sample into a highly absorbent collection pad. The transfer efficiency is high providing adequate volume to perform analytical tests (\sim 60%, \sim 10 μ L). We have conducted preliminary short-term stability studies on several NBs.

Conclusions A blood collection device has been identified which achieves the vertical separation of RBCs from serum. Advantages of this device over traditional DBS include: availability of RBCs for quantification of RBC folate, better serum volume estimation, direct serum measures of zinc, ferritin, RBP, AGP, CRP, thyroglobulin, homocysteine, methylmalonic acid, vitamins B12 and D.

Support or Funding Information

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We recommend

Palmitic and Stearic Free Fatty Acids Are Consistently Found in Materials used for Dried Blood Spot Collection

Jan Gunash et al., FASEB J, 2017

Protein quantification in dried blood spots by MRM mass spectrometry (981.8)

Andrew Chambers¹ et al., FASEB J, 2014

Estimating the RBC omega-3 index and breast milk DHA from dried samples collected on filter paper

William Stephen Harris, FASEB J, 2012

Dried plum reverses bone loss in postmenopausal women

Shirin Hooshmand et al., FASEB J, 2011

Validation of a Macronutrient Mixed Challenge Beverage for Personalized Nutrition Applications using a Reduced Sampling Period

Barbara L Winters et al., FASEB J, 2017

Driven by Potential Cost Savings, Convenience, Proteomics Explores Dried Blood Spot Analysis

GenomeWeb, 2013

Spot On Sciences Looks to Broaden Use of Dried Blood Spots in Clinical Testing, Molecular Analyses

GenomeWeb, 2013

SISCAPA Assay Tech Exploring Dried Blood Spot Sampling for Mail-in, Longitudinal Proteomic Testing

GenomeWeb, 2014

AB Sciex, Alturas Partner on Workflows for Dried Blood Spot Analysis

GenomeWeb, 2011

NanoInk Begins Offering Dried Blood Spot Analysis for Protein Biomarker Research

GenomeWeb, 2011