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Abstract

Biomarkers of Low Milk Supply †

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It is estimated that 5–10% of breastfeeding mothers are unable to produce enough milk for their infants. Causes of low milk supply are multifactorial, including factors such as gene mutations, endocrine disorders and infrequent milk removal. All these factors affect the normal function of the mammary gland and potentially the concentrations of human milk components. Therefore, an array of milk components may act as biomarkers for the detection of low milk supply. Various biochemical assays were used to measure an array of milk components (fat, total protein, casein, whey, lactose, citrate, calcium, copper, iron, potassium, magnesium, sodium, phosphorous and zinc) in 48 women with low milk supply (<600 mL/24 h) and 65 with normal milk supply (>600 mL/24 h). Univariable linear regression and correlation analysis were used to examine associations between milk component concentrations and milk supply. The dataset was then randomly split into a training set (70%) and a test set (30%). Multivariable logistic regression with the training set was used to develop prediction models with various combinations of milk component concentrations, and the test set was used to validate the predictivity of these models.

Univariable linear regression showed that concentrations of fat ($p = 0.039$), total protein ($p = 0.002$), whey ($p = 0.001$), potassium ($p = 0.02$), sodium ($p = 0.001$) and zinc ($p = 0.001$) and the Na:K ratio ($p = 0.008$) were significantly different between samples from low- and normal-milk-supply mothers. In addition, total protein, casein, whey, lactose, citrate, calcium, potassium, sodium, phosphorous, zinc and the Na:K ratio were strongly correlated with each other ($r > 0.6$ or $r < -0.6$). The predictive model with fat content as the sole predictor had an accuracy of 61%, precision of 80% and recall of 52%, while the model with fat, total protein and lactose as predictors had an accuracy of 53%, precision of 100% and recall of 33% in predicting low milk supply. Further, the model with only sodium and potassium had an accuracy of 64%, precision of 80% and recall of 50%. The best predictive model included all measured milk components, and had an accuracy of 79%, precision of 84% and recall of 76% in predicting low milk supply.

These preliminary findings suggest that differences in milk composition between women with low and normal milk supply have the potential to be used in testing for the detection of low milk production.

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