Electronic-nose breath print distinguishes non-alcoholic fatty liver disease from healthy lean control: a pilot study

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BACKGROUND AND AIMS

Human breath contains numerous volatile compounds which reflect metabolic activity. Electronic nose (eNose) react rapidly to these volatile metabolites and provide breath prints. Non-alcoholic fatty liver disease (NAFLD) is the hepatic manifestation of metabolic syndrome. We hypothesized breath prints obtained from eNose could distinguish healthy individuals from those with NAFLD.

METHODS

The study was prospective single-center cohort study (ClinicalTrials.gov: NCT02950610) with training cohort and one-against all (leave-one out) cross validation verification (CVV). eNose (SpiroNose) is a custom-made device previously validated in respiratory and liver disease [1,2]. eNose was performed on well characterized NAFLD patients: a) Child’s A cirrhosis(n=30), b) NAFLD non-cirrhosis (n=30) and c) self-declared healthy (n=30). Data were analyzed using R (v 2.3.2). Data reduction to 3 principal components (PCs) explained 97.8% of total variance. Data was further classified by k-nearest neighbor’s (k-NN) algorithm, a non-parametric machine learning algorithm for classification.

RESULTS

In patients with NAFLD cirrhosis, eNose was able to accurately classify with 100% sensitivity (p<0.001, cross-validation verification [CVV] 96%) from healthy subjects, independent of age and gender

![1st and 2nd PC](image)

![ROC Curve](image)

Sensor 1, Sensor 2, Sensor 3 and Sensor 4 identified NAFLD cirrhosis patients with AUC 0.96 (standard error=0.043; p<0.001), 0.89 (standard error=0.046; p<0.001), 0.98 (standard error =0.016; p<0.001) and 0.96 (standard error=0.022; p<0.001) respectively.

eNose was able to differentiate between healthy from; non-cirrhotic NAFLD (p<0.001, CVV 96.8%) and NAFLD cirrhotic (p<0.001, CVV 95.1%).

This method, designed to reflect the generalization property of the k-nearest neighbour’s (k-NN) classifier, scored a classification rate of 96%.

CONCLUSIONS

Our study demonstrates the ability of eNose to accurately distinguish NAFLD from healthy individuals.

Thus, eNose technology can provide rapid, non-invasive point-of-care screening to risk stratify patients, which can reduce the burden of liver biopsy.

REFERENCES


CONTACT INFORMATION

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