

Identification of profiles of volatile organic compounds in exhaled breath by means of an electronic nose as a proposal for a screening method for breast cancer

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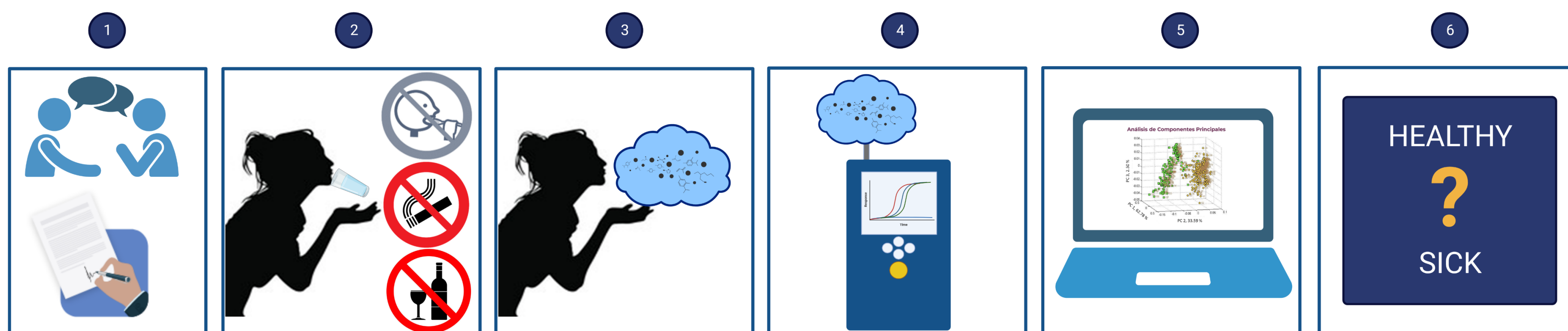
Background

Aim. The objective of the present study was to identify volatile chemical prints on exhaled breath called breath-print from breast cancer (BC) patients and healthy women by means of electronic nose and to evaluate its potential use as a screening method.

Method. A cross-sectional study of 443 exhaled breath samples from women, 262 women with BC diagnosed by biopsy and 181 healthy women as a control group was performed. The breath-print analysis was performed utilizing the Cyranose 320 electronic nose. Group data were evaluated by Principal Component Analysis (PCA), Canonical Discriminant Analysis (CDA) and Support Vector Machine (SVM) and the test's diagnostic power by means of ROC (Receiver Operating Characteristic) curves.

Results. The results indicated that the breath-print of BC patients is different from that of healthy women and that they present variability of up to 98.8% with a correct classification of 98%. Sensitivity, specificity, negative predictive value and positive predictive value reach 100% according to the ROC curve.

Methodology

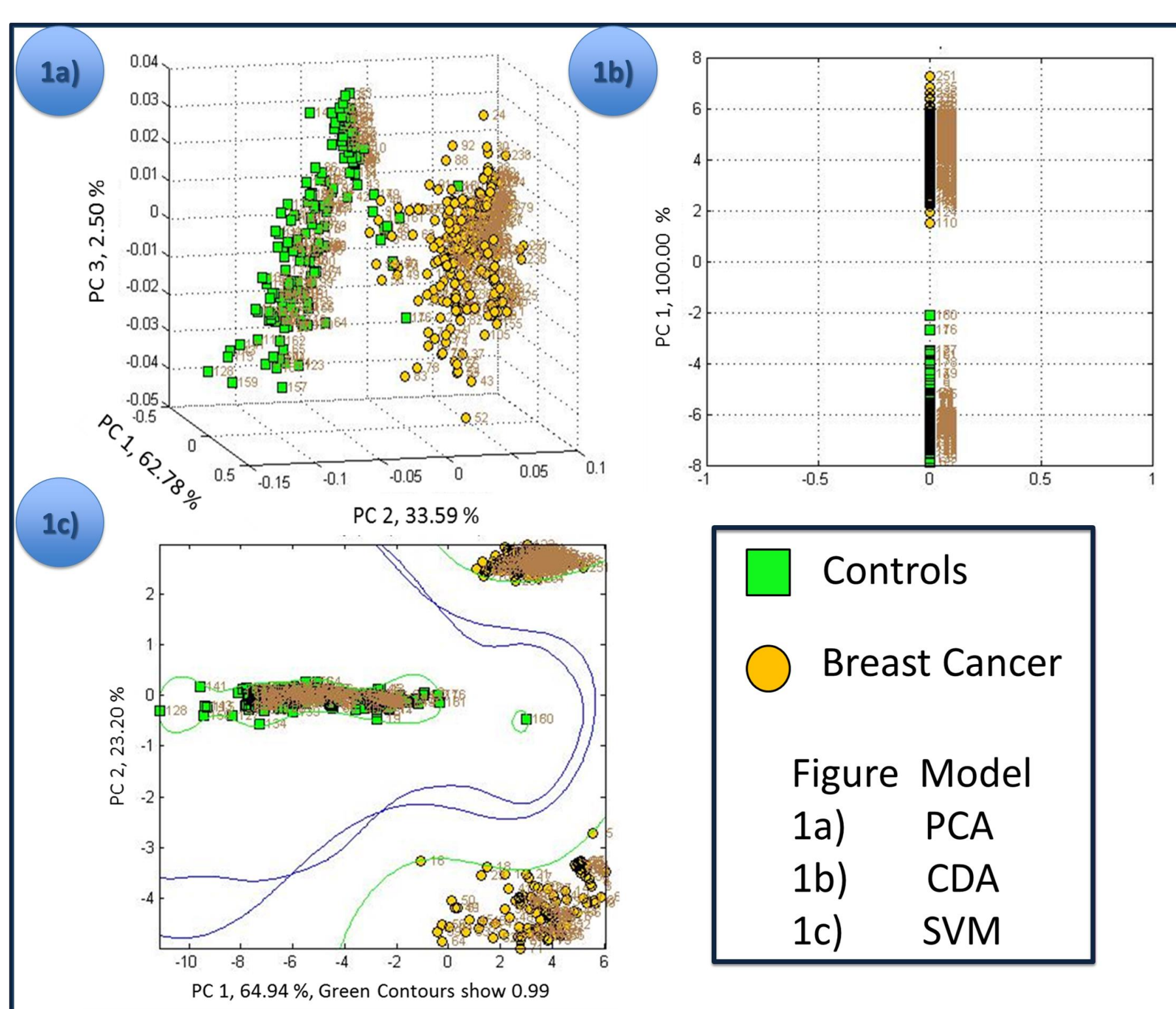


Results

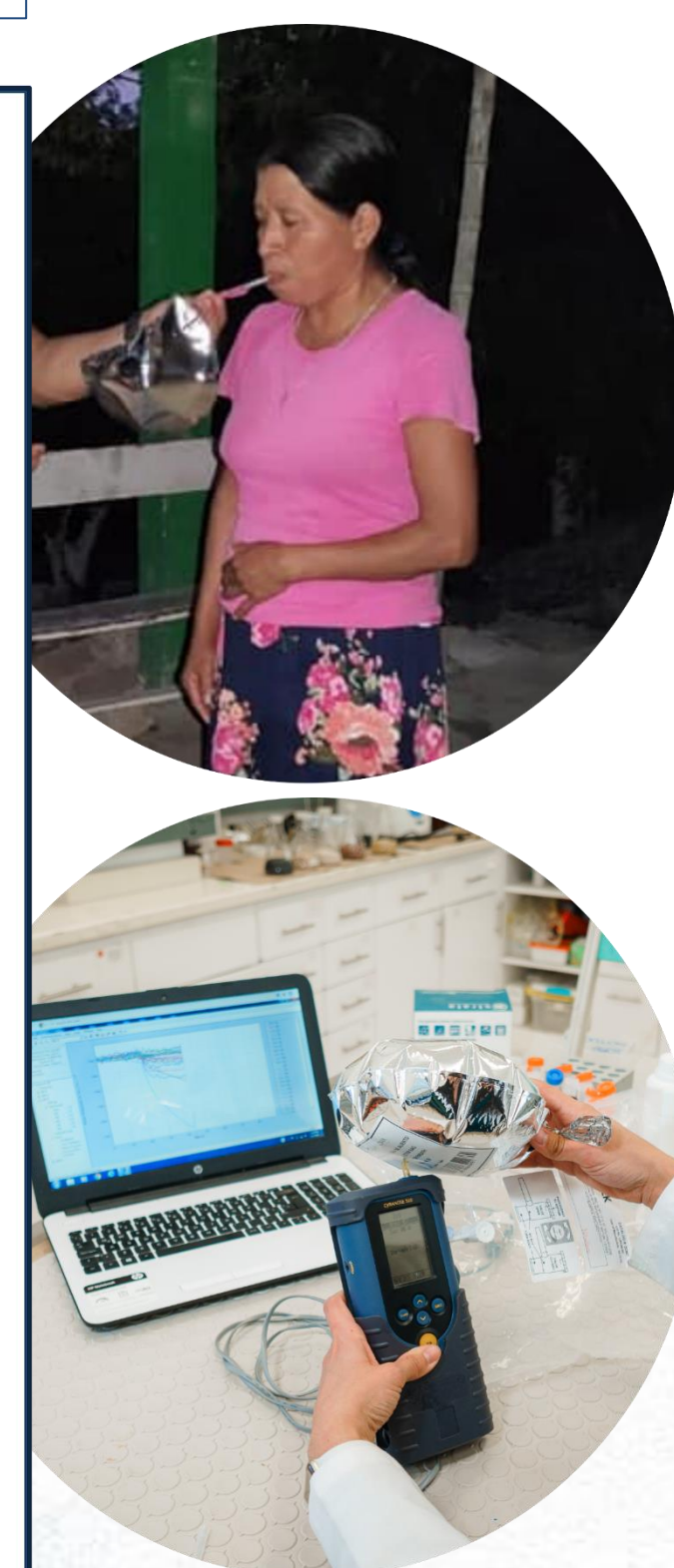
Table 1. Percentage of correct prediction obtained in canonical discriminant analysis with mean centering

Canonical discriminant analysis model	Number of PCs	Percentage of Correct Prediction	p- value
a) BC vs Controls	4	98.0	< 0.001
a) Age < 39 vs Controls	4	97.8	< 0.001
a) Age > 40 vs Controls	4	98.4	< 0.001
a) IDC vs Controls	4	98.3	< 0.001
a) Other types of cancer vs Controls	5	97.4	< 0.001
a) BI-RADS 2 3 vs Controls	4	97.6	< 0.001
a) BI-RADS 4 5 6 vs Controls	4	97.8	< 0.001

Figure 1. Different algorithm models obtained for Breast cancer patients and controls. PCA: Principal Component Analysis; CDA: Canonical Discrimination Analysis; SVM: Support Vector Machine

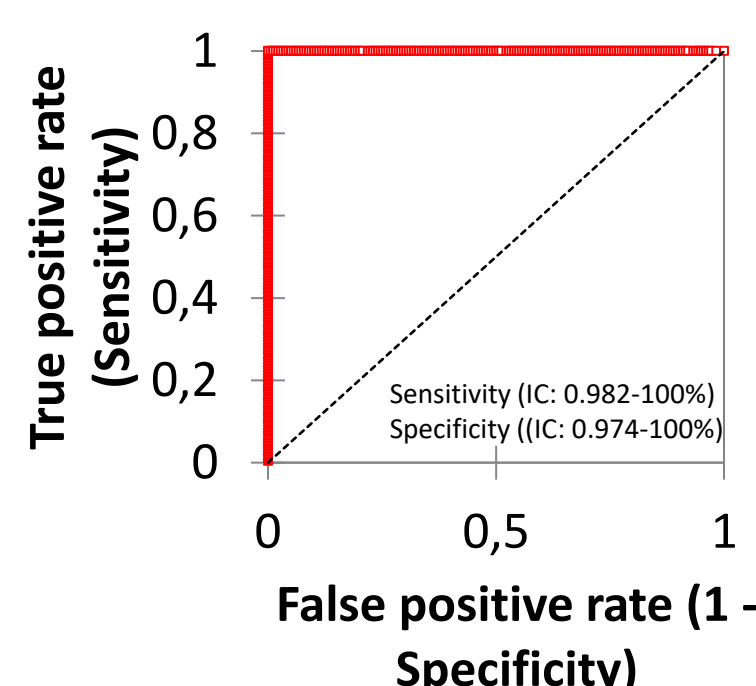


Application Scenario



Cross validation rate: 100%
Correct prediction rate: 98%

Figure 2. ROC curve for the diagnosis of BC when using the CAP1 axis. An AUC of 1.00 was obtained when using a cut-off point of 0.048.



Sensitivity CI(95): 98.2-100%
Specificity CI(95): 97.4-100%

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