Recognizing the Level of Alcohol Intoxication in Sri Lankans through Changes in Suprasegmental Effects and Reaction Time

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Alcohol is generally considered to be a central nervous system depressant. That is why alcohol has become one of the leading causes of road traffic accidents in Sri Lanka as well as all around the world. In Sri Lanka, diagnosis of alcohol intoxication detection is done by either breathalyser balloon test or clinical examinations conducted by a Judicial Medical Officer (JMO). However these, the current methods used in Sri Lanka are plagued with deficiencies and shortcomings. Blood alcohol testing, the most accurate form of alcohol detection is not routinely available due to its cost and the breathalyser does not have any reproducibility or reviewability of test samples. Hence, there is a necessity in the country for an accurate, objective and inexpensive alcohol test which can measure the level of alcohol intoxication.

Since motor co-ordination is impaired under intoxication, it affects an individual's speech production and reaction time. However one of the common questions which arise is; whether is it possible to detect whether a person is intoxicated by observing their speech patterns and reaction time? Previous studies have suggested the use of voice recordings and reaction time as alternative method of alcohol detection and positive correlations have been demonstrated between both suprasegmentals of voice patterns and reaction time with alcohol intoxication.

A pilot study was carried out with six healthy Sinhala-speaking males between ages 20–50. They were recruited on voluntary basis after obtaining an informed consent. Each subject was asked to provide a voice recording on a pretested sample of Sinhala phrases and sentences immediately before consuming liquor and at 30 minutes and 60 minutes after consumption. On each occasion a breathalyzer alcohol reading and reaction time value was also taken using "Reflex Test" Mobile App.

The voice recordings were then analysed using phonetic analysis software (Praat) for changes in ten suprasegmental features of speech production. Suprasegmental features were extracted from the 3 words "සංස්කෘත", "සුරේන්ද්‍රගේ" and "ඉස්කෝලයේදී" present in each audio recording.

TABLE I
SUPRASEGMENTAL FEATURE BEHAVIOUR ON ALCOHOL INTOXICATION

Subject ID	Metric Unit	Behaviour
Fundamental Frequency	Hz	↓
Pitch	Hz	↓↑
Speech Duration	s	↑
Average Formants	Hz	↑
Intensity	dB	↓↑
Jitter (absolute)	s	↑↓
Shimmer (local)	dB	↑↓
Harmonics to Noise Ratio	dB	↑↓
Voiced to Unvoiced Ratio	-	↑↓
Degree of Voice Breaks	-	↑
Reaction Time	s	↑

Several statistically significant changes were found under intoxication which include decreased frequency, shimmer, voiced to unvoiced ratio and increased duration, harmonics to noise ratio, degree of voice breaks, jitter and formants. Some features such as pitch and intensity both increased and decreased under intoxication. Reaction time increased under intoxication (Table 1).

The results of the study conclude that certain changes in speech suprasegmentals can be correlated with alcohol intoxication. Hence, in future, a prediction model can be developed in order to identify the level of intoxication against a given voice sample and reaction time. This will lead to the development of a cost-effective and reviewable alternative method for diagnosing alcohol intoxication. Ethical approval for this study has been granted by the Ethical Review Committee, Faculty of Medicine, University of Colombo under the protocol number EC-14-062.