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Effect of body mass index on electroglottographic findings in Normals: A cross gender comparison

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Abstract
The goal of the current study was to determine the correlates of adult BMI as well as examine how body composition and energy balance connect to BMI. Data on several factors, including socioeconomic status, demographics, and BMI profile. The study was cross-sectional and used a random sample technique. BMI was computed using the subjects' height and weight from the screening process. The participants were categorized using the WHO's BMI categorization. An extensive investigation on adult body composition patterns and energy balance in relation to BMI categories was conducted using purposeful sampling. A schedule for interviews was created, and the investigator visited each family individually to gather data on the demographic profile, age, height, and weight. The investigator then estimated BMI using the height and weight information. Through the use of the 24-hour dietary recall method, energy consumption was determined. The nutritional value of Indian cuisine was used to interpret it. When gathering data on energy intake and expenditure, a period of two working days and one holiday was chosen to account for the possibility that eating and exercising habits can change on some days of the week. For this, the subjects' time spent on each activity was tracked over the course of 24 hours. In order to encourage a healthy lifestyle among the population under research, it was felt throughout the course of the current study that new public health initiatives, such as computer-based health education remedial measures, about lifestyle changes and food adjustment, are required. Testing the software's authenticity and dependability served as its evaluation.

Keywords: Including socioeconomic status, demographics, BMI

Introduction
Electroglottography or EGG is a non–invasive procedure which provides information regarding changes in vocal fold contact during phonation. EGG assesses the degree of vocal fold contact by measuring the electrical resistanceor impedance between the two electrodes placed around the neck. Complete vocal fold contact results in low impedance and direct current flow across the glottis. With decrease in vocal fold contact, the current takes a longer route through the tissues around the open glottis thus increasing the impedance. This increase in impedance results in change in voltage which is interpreted as the EGG response. At the point of maximum contact, the change in impedance is a maximum of about 1% of the total laryngeal conductance (Baken, 1992) [11]. As EGG utilizes relatively high frequency of current, it successfully bypasses the less conductive skin layer (Rothinberg & Mahshie, 1988). However, more amount of body mass resulting in obesity may be associated with increased tissue bulk in the laryngeal airway, neck, and chest wall, which thus may affect vocal function (Solomon et. al., 2011) [12]. In the same context, body mass is represented through a universal measure called body mass index (WHO, 2000).

Need of the study
Studies examining effect of body mass on laryngeal function have tried to explore the acoustic, perceptual, and aerodynamic variations (Solomon et. al., 2011; Barsties et. al., 2013) [12-13]. However, sparse research citationsexist for exploring the effect of body mass on electroglottographic findings. Morever with research indicating greater amount of subcutaneous fat in human females (Lassek & Gaulin, 2006) [14], it is essential to determine the influence of body mass on electroglottographic function and as well as to determine the gender variation in electroglottography across different body mass indices.

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Aim of the study
To explore the variation in EGG findings across different body mass indices and across gender.

Methodology
Participants
A total of 100 participants (50 males and 50 females) within the age range of 20 to 30 years participated in the study. All the participants were recruited from within the population of students pursuing academic courses at various institutions. All the participants consented for participation in the study.

Inclusion criteria
All the participants satisfied the following criteria:
1. All the participants were within the age range of 20 to 30 years.
2. All the participants had a normal voice quality as per their age and sex and as measured perceptually through GRBAS scale.

Exclusion criteria
The participants satisfying the following criteria were excluded from the study
1. Participants who were on regular medication which may affect vocal cord functioning.
2. Participants having a recent history of laryngeal or respiratory tract infection.
3. Participants diagnosed with chronic medical problems, respiratory diseases, neurological problems, history of smoking or regular consumption of alcohol.
4. Menstruating female participants.

Procedure
Body mass index was calculated for all the participants using a BMI calculating smartphone application software. The height of the participants was calculated in centimeters using a measuring tape and weight of all the participants was obtained in kilograms using a digital ISO certified weighing scale. The WHO (2000) procedure was followed for calculation of body mass index from height and body weight. Electroglottographic recordings were done in a sound treated room using the EG-PC3 electroglottograph system manufactured by Tiger DRS Inc. EGG calibration was done according to the manufacturer specifications.

Recording
All the participants were asked to seat in an upright position and gold plated disc electrodes were placed at roughly 1/3rd of the horizontal distance of the thyroid lamina on both sides. A Velcro neck strap used to keep the electrodes tightly in position atroughly 1/3rd of the vertical distance of the thyroid lamina. The participants were asked to say /æ/ for a minimum of 10 secs at a distance of about 6cm from the microphone head and the mouth. The EGG parameters such as EGG-jitter, EGG-shimmer, EGG SNR, EGG HNR, CI, CQ, CQP, Mean Fo and SD Fo, EGG-NNE and EGG tremor were computed.

Tabulation and Analysis
All the samples were tabulated using the Microsoft office package for windows 2010. Statistical analysis was done using the SPSS version 16.0 software.

Result
The mean age of the male participants was calculated to be 24.32 with a SD of 3.64. Similarly, the mean age of the female participants was calculated to be 23.86 with a SD of 3.73. The mean Body Mass Index of male participants was calculated to be 25.03 with a SD of 3.009. The mean Body Mass Index of the female participants was calculated to be 27.26 with a SD of 2.43. Comparison of EGG parameters across the different BMI values of male and female participants using ANOVA indicated no significant differences ($p > 0.05$). Comparison of EGG parameters of male and female participants using Paired "t" test produced mixed results. No significant difference ($p > 0.05$) was obtained for the contact index (CI) values of male and female participants. However, significant difference ($p < 0.05$) was obtained for the Contact Quotient (CQ), Opening Ratio (OR), Closing Ratio (CR), Contact Quotient Perturbation (CQP), Contact Index Perturbation (CIP) values of male and female participants. Comparison of body mass indices of male and female participants indicated no significant difference ($p > 0.05$).

Discussion
The differences in body mass indices of male and female participants were not statistically significant. This may due to homogeneity of the samples. Significant differences were obtained across the EGG parameters of male and female participants. This may be attributed to be due to the post pubertal changes in vocal fold anatomy or due to the natural occurrence of excess subcutaneous fatty tissue in females. This is in line with evidence from studies by Solomon et. al. (2011) [12] and Barsties *et al*. (2013) [13] in which they obtained significant difference across perceptual, aerodynamic and acoustic parameters.

Conclusion
Body Mass Index may have a significant impact on vocal functioning. However, in this study homogenous samples of body mass indices were obtained which resulted in no within gender variations across EGG parameters. Further research on different body mass indices or groups like underweight, overweight and obese may help in determining significant impact if any on vocal function as measured through EGG.

References
1. Di CM, Bentham J, Stevens GA, Zhou B, Danaei G, Lu Y, *et al*. Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19·2 million participants. Lancet. 2016;387(10026):1377.
2. Zhou B, Wu Y, Yang J, Li Y, Zhang H, Zhao L. Overweight is an independent risk factor for cardiovascular disease in Chinese populations. Obes Rev. 2002;3(3):147.
3. Parr CL, Batty GD, Lam TH, Barzi F, Fang X, Ho SC, *et al*. Body-mass index and cancer mortality in the Asia-Pacific cohort studies collaboration: pooled analyses of 424,519 participants. Lancet Oncol. 2010;11(8):741.
4. Cai L, He J, Song Y, Zhao K, Cui W. Association of obesity with socio-economic factors and obesity-related chronic diseases in rural Southwest China. Public Health. 2013;127(3):247.
5. Cao X, Zhou J, Yuan H, Wu L, Chen Z. Chronic kidney disease among overweight and obesity with and without metabolic syndrome in an urban Chinese cohort. BMC Nephrol. 2015;16(1):1-9.

6. Cawley J, Meyerhoefer C. The medical care costs of obesity: an instrumental variables approach. J Health Econ. 2012;31(1):219-230.

7. Odlaug BL, Lust K, Wimmelmann CL, Chamberlain SR, Mortensen EL, Derbyshire K, *et al*. Prevalence and correlates of being overweight or obese in college. Psychiatry Res. 2015;227(1):58.

8. Flegal KM, Panagiotou OA, Graubard BI. Estimating population attributable fractions to quantify the health burden of obesity. Ann Epidemiol. 2015;25(3):201.

9. Kang H, Shim J, Lee H, Park B, Linton JA, Lee Y. Trends in prevalence of overweight and obesity in Korean adults, 1998-2009: the Korean National Health and nutrition examination survey. J Epidemiol. 2014;24(2):109–116.

10. Ma GS, Li YP, Wu YF, Zhai FY, Cui ZH, Hu XQ, *et al*. The prevalence of body overweight and obesity and its changes among Chinese people during 1992 to 2002. Zhonghua Yu Fang Yi Xue Za Zhi. 2005;39(5):311-315.

11. Baken RJ. Electroglottography. Journal of Voice. 1992 Jan 1;6(2):98-110.

12. Solomon C, Breckon T. Fundamentals of Digital Image Processing: A practical approach with examples in Matlab. John Wiley & Sons; c2011 Jul 5.

13. Barsties B, Maryn Y. Test-retest variability and internal consistency of the Acoustic Voice Quality Index. Hno. 2013 May;61:399-403.

14. Lassek WD, Gaulin SJ. Changes in body fat distribution in relation to parity in American women: a covert form of maternal depletion. American Journal of Physical Anthropology: The Official Publication of the American Association of Physical Anthropologists. 2006 Oct;131(2):295-302.