**Abstract Presentations**

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# Development and validation of reference equations for lung function in healthy Sri Lankan Tamils

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# Background & Objective

- Lung function test is necessary in diagnosis and monitoring of respiratory diseases.

- Ethnic variations in lung function parameters are already reported.

- Reference equations for Sri Lankan Tamils are not available.

- This study aimed to establish reference norms for lung function parameters of Sri Lankan Tamils.

# Methodology

- A descriptive cross-sectional study.

- Sample size 1420; recruited healthy non smokers in 24 clusters in all 5 districts of Northern Sri Lanka according to the proportion of population.

- Participants in each age from 14-20 years and thereafter in age groups of half decades.

- Anthropometric measurements and Respiratory function tests were carried out. (Cosmed MicroQuark elctonic spirometer and asma plan peak flow meter).

- Data of 775 males and 687 females were analyzed.

- Validation was done in another 70 participants.

# Mean ±SD of lung function parameters

| Lung function parameters | 14-20 years | | | >20 years | | |
|---|---|---|---|---|---|---|
| | **Males (406)** | **Females (337)** | **P** | **Males (376)** | **Females (361)** | **P** |
| VC (L) | 3.38±0.69 | 2.57±0.39 | .000 | 3.36±0.63 | 2.30±0.47 | .000 |
| FVC (L) | 3.52±0.73 | 2.68±0.4 | .000 | 3.45±0.65 | 2.39±0.48 | .000 |
| $FEV_1$ (L) | 3.08±0.63 | 2.44±0.36 | .000 | 2.92±0.56 | 2.10±0.42 | .000 |
| $FEV_1$% | 88.17±5.27 | 90.85±4.89 | .000 | 84.80±5.01 | 87.63±4.58 | .000 |
| $FEF_{25-75}$(L/s) | 3.66±0.96 | 3.16±0.71 | .000 | 3.34±0.92 | 2.64±0.70 | .000 |
| $MEF_{75}$ (L/s) | 6.28±1.46 | 5.06±0.99 | .000 | 6.68±1.60 | 4.85±1.13 | .000 |
| $MEF_{50}$ (L/s) | 4.16±1.10 | 3.57±0.79 | .000 | 3.99±1.14 | 3.13±0.83 | .000 |
| $MEF_{25}$ (L/s) | 1.97±0.62 | 1.79±0.51 | .000 | 1.55±0.47 | 1.31±0.47 | .000 |
| PEFR (L/min) | 411.5±79.9 | 317.4±49.1 | .000 | 456.9±79.2 | 315.9±52.4 | .000 |

# Correlations and regression analysis

- Lung function parameters showed moderate to strong positive correlations ($p<0.05$) with height, sitting height, arm span and age.

- >After 20-years, age showed negative correlations.

- Different models of prediction equations were derived by multiple linear regression analysis.

- Based on feasibility to use, $R^2$ and SEE, age- height based equations were selected as final models.

- Age–arm span based equations are recommended in situations where height can't be measured accurately.

# Age- height based equations

| Population | Parameters | Equations | SEE | $R^2$ |
|---|---|---|---|---|
| **<20 years** | | | | |
| Male | | 0.054 height+0.108 age-7.363 | 0.448 | 0.626 |
| Female | **FVC** | 0.039 height+0.021 age-3.864 | 0.342 | 0.317 |
| **>20 years** | | | | |
| Male | | 0.046 height-0.022 age-3.311 | 0.469 | 0.481 |
| Female | | 0.033 height-0.018 age-1.985 | 0.364 | 0.436 |
| **<20 years** | | | | |
| Male | | 0.041 height+0.1 age-5.486 | 0.417 | 0.559 |
| Female | **FEV$_1$** | 0.034 height-2.964 | 0.304 | 0.299 |
| **>20 years** | | | | |
| Male | | 0.036 height-0.021 age-2.192 | 0.398 | 0.485 |
| Female | | 0.026 height-0.018 age-1.186 | 0.306 | 0.469 |

# Age-Arm span(AS) based equations

| Population | Parameters | Equations | SEE | $R^2$ |
|---|---|---|---|---|
| **<20 years** | | | | |
| Male | | 0.109 age+0.042 AS – 5.719 | 0.465 | 0.599 |
| Female | | 0.034 AS-2.818 | 0.345 | 0.305 |
| **>20 years** | **FVC** | | | |
| Male | | 0.035 AS-0.025age-1.764 | 0.470 | 0.479 |
| Female | | 0.028 AS-0.019age-1.421 | 0.358 | 0.453 |
| **<20 years** | | | | |
| Male | | 0.101 age+0.032AS-4.26 | 0.428 | 0.536 |
| Female | | 0.028  AS-2.157 | 0.309 | 0.274 |
| **>20 years** | **FEV$_1$** | | | |
| Male | | 0.027 AS-0.023age-0.943 | 0.400 | 0.481 |
| Female | | 0.022 AS-0.019age-0.738 | 0.301 | 0.483 |

# Comparison of lung volumes of different ethnic groups.

| Ethnicity | Males (standardized to 45 yrs, 170 cm height) | | Females (standardized to 45 yrs, 168 cm height | |
|---|---|---|---|---|
| | FVC (L) | FEV$_1$ (L) | FVC (L) | FEV$_1$ (L) |
| Present study | 3.52 | 2.98 | 2.48 | 2.16 |
| Sri Lankan Sinhalese (Uduphille, 1995) | 3.5 | 2.85 | 2.27 | 2.03 |
| Calcutta (Chattrage et al., 1993, 1988) | 3.73 | 2.99 | 2.50 | 2.15 |
| South Indians (Vijayan et al., 1990) | 3.68 | 3.03 | 2.71 | 2.26 |
| Pakistanian (David et al., 1978) | 3.80 | 2.86 | 2.72 | 1.98 |
| Malaysian (Ganou et al., 1978) | 3.22 | 2.88 | 2.35 | 2.08 |
| Chinese (Mary et al., 2006) | 3.95 | 3.22 | 2.86 | 2.35 |
| GLI 2012 (Quanjer et al., 2012) | 3.98 | 2.57 | 2.32 | 1.92 |
| Caucasian (Hankinson et al., 1999) | 4.68 | 3.69 | 3.89 | 3.12 |

# Validation analysis

## Correlation between measured & predicted values

|  | Males (n=38) | | Females (n=32) | |
| --- | --- | --- | --- | --- |
|  | FVC | FEV$_1$ | FVC | FEV$_1$ |
| Present equation | 0.750* | 0.705* | 0.723* | 0.752* |
| GLI 2012 | 0.728* | 0.685* | 0.637* | 0.747* |

## Limits of agreement between measured & predicted values

|  | Males (n=38) | | Females (n=32) | |
| --- | --- | --- | --- | --- |
|  | FVC (L) | FEV1 (L) | FVC (L) | FEV1 (L) |
| Present equation | -0.973-0.678 (1.651) | -0.189-1.131 (1.32) | -0.647 -0.708 (1.355) | –0.576-0.644 (1.22) |
| GLI 2012 | -0.636-0.899 (1.535) | -0.716-0.966 (1.682) | -1.068-0.445 (1.5131) | -0.808 - 0.419 (1.227) |

# Conclusion

- Lung volumes of present population shows differences from other ethnicities.

- Predicted values based on present equations shows better agreement with measured values of 70 volunteers than predicted values based on GLI equations.

- This study established reference norms for lung function parameters of Sri Lankan Tamils which can be used locally in diagnosis of respiratory diseases.