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Letter to the Editor

Reliability of Spirometric Tests during the Different Menstrual Cycle Phases in Healthy Women

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Dear Editor in Chief

Several studies have suggested that respiratory function is influenced by female sexual hormones. Considering a normal 28-day menstrual cycle, three phases can be distinguished: menstrual, follicular and luteal. Respiratory function is influenced by female sexual hormones, which could increase ventilatory response during the luteal phase (1). In contrast, no changes for pulmonary capacities, flows and volumes evaluated by spirometry were found in other investigations (2). These conflicting results may be due to that those studies have not evaluated either, the test reliability or the smallest real difference (SRD) during the menstrual cycle phases. Reliability and SRD are important prerequisites for the correct interpretation of spirometric data, which indicate to the clinician whether or not a genuine and real change has occurred. Therefore, the aim of this study has been to check the reliability of spirometric tests during the menstrual cycle phases and to investigate if spirometric variables are modified across the menstrual cycle.

Twenty-three healthy non-smoker women, aged 18 to 35 yr, performed several spirometric tests in three different phases of the menstrual cycle (menstrual, follicular and luteal). In this way, basal body temperature was taken daily upon waking in order to estimate the date of ovulation and to define menstrual cycle phases. Technician provided proper instructions and demonstrated the appropriate techniques before starting the tests. Values of forced expiratory volume at 1 s (FEV1), forced vital capacity (FVC), peak expiratory flow (PEF) and maximum voluntary ventilation (MVV) were tested. Spirometric values were verified in accordance with the standard of acceptability and criterion of reproducibility recommended by American Thoracic Society and European Respiratory Society (3).

In connection with statistical analysis, the sample size was calculated to achieve a power of 0.95. Data indicated that a minimum of 23 participants were required. Reliability was determined according to the intraclass correlation coefficient (ICC) with 95% confidence intervals across the 3 test sessions. However, more information was needed to analyze how much difference must exist to detect a real variation in a spirometric variable, and therefore standard error of measurement (SEM) and smallest real difference (SRD) were studied as well.

No significant change for flows and volumes were observed during the menstrual cycle (Table 1). All measurements had an intraclass correlation coefficient greater than 0.90. In addition, measurement errors were assessed. Values of SEM (SEM%) ranged from 2.2 % to 3.0 % and values of SRD (SRD%) ranged from 6.5 % to 8.3 %.

Table 1: Spirometric variables during the different menstrual cycle phases. Absolute and % predicted values are presented (Mean ± Standard Deviation)

Spirometric variables	Menstrual phase	Follicular phase	Luteal phase	*P*
FEV1 (L/s)	3.38 ± 0.37	3.36 ± 0.34	3.35 ± 0.41	0.666
FEV1%	104.2 ± 11	103.0 ± 10	102.6 ± 12	0.666
FVC (L)	3.61 ± 0.46	3.67 ± 0.43	3.60 ± 0.47	0.180
FVC%	100.7 ± 12	102.4 ± 12	99.7 ± 13	0.180
PEF (L/s)	7.81 ± 0.92	7.87 ± 0.99	7.72 ± 1.02	0.552
PEF%	108.0 ± 12	109.2 ± 12	106.5 ± 13	0.552
MVV (L/min)	145.23 ± 21.34	147.57 ± 20.93	144.22 ± 22.58	0.178
MVV%	113.1 ± 15	115.6 ± 14	112.4 ± 16	0.178

No significant differences by ANOVA

Therefore, there is no evidence that respiratory response is modified by sexual hormones in healthy women. Similar results were obtained in other studies that reported no changes in FVC and FEV1during the different menstrual cycle phases (4). In this way, Hayes et al (5) reported that estrogens could have an influence on central nervous activity but not on peripheral reflex (certainly involved in the respiratory mechanism). On the other hand, ICCs for test-retest during the menstrual cycle were excellent for spirometric measurements. To our knowledge, no previous study has reported the reliability of spirometric tests during the menstrual cycle phases in healthy women. However, using only the ICC can give a false impression about the reliability of a measurement (6). Measurement errors should also be small and the method sufficiently sensitive to detect real changes. The standard error of measurement findings of the present study suggested that the test-retest differences of less 3% for spirometric variables during the different phases of the menstrual cycle should be considered as measurement noise. On the basis of the percentage of smallest real difference observed in the present study, the size of the relative change (SRD%) should exceed 6.5 % for FEV1, FVC and PEF and 8.3 % for MVV, to indicate a real change for a single individual. Therefore, these measurements could be used to detect real changes for a single individual following an intervention program, regardless of the menstrual cycle phase.

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