

Status of Lung Function during Menstruation Cycle: A Literature Review

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ABSTRACT

Introduction: menstruation cycle affects not only female's body even psychology too. Physiological and psychological changes occur during periods. Every female experiences this. Good vital capacity is a sign of healthy lungs. Healthy lungs reflect the quality of life. Question is during menstrual cycle there is any changes in status of lung function? Many researchers have been done on this. Some suggest changes occur while some deny with this. There is no consensus regarding exactly on status of lung function during menstruation cycle.

Objective: to review the available data on the possible effect of menstruation cycle on lung function. This article reviews panel studies of status of lung function during menstruation cycle and proposes future research directions.

Design: Review of Literature

Data synthesis- recent researches, Meta analysis and clinical oriented literatures were taken in the study.

Methodology: various articles from database like Pub Med, Cochrane and science direct were retrieved through a search by using keywords- FVC, FEV1, PEFr, menstrual cycle, pulmonary function etc. A total of 23 relevant articles were obtained.

Conclusion: literature review of present study concludes that there is influence of menstrual cycle on pulmonary functions.

Key words: FVC, FEV1, PEFr, pulmonary function, menstrual cycle.

Abbreviations: FVC- forced vital capacity, SVC- slow vital capacity, FEV1-forced expiratory volume in 1 second, MVV- maximum voluntary ventilation, PEFr- peak expiratory flow rate MIP- maximum inspiratory pressure, MEP- maximum expiratory pressure.

INTRODUCTION

Menstruation is a physiological process, which is associated with the ability to reproduce. The name "menstruation" comes from Latin "menses" meaning moon, with reference to the lunar month and lasting also approximately 28 days long. Its onset profoundly changes a young woman's

life. ^[1] Menstrual cycle is a physiological process that occurs in women. It is characterized by periodic vaginal bleeding owing to the shedding of uterine mucosa, which has its own effect on various systems and metabolisms. A normal menstrual cycle is dependent on the fluctuation in the ovarian hormones (estrogen and

progesterone) during the different phases of menstrual cycle-menstrual, proliferative, and secretory phases. The characteristic rhythmic changes in the rate of secretion of ovarian hormones produce corresponding changes not only in the reproductive system but in other organ systems as well. [2] It is suggested that lung functions exhibit not only diurnal variations but also show changes dependent on the different phases of menstrual cycle. [3] Several studies have suggested that respiratory function is influenced by female sexual hormones. Respiratory function is influenced by female sexual hormones, which could increase ventilatory response during the luteal phase. In contrast, no changes for pulmonary capacities, flows and volumes evaluated by spirometry were found in other investigations. [4] For assessment of

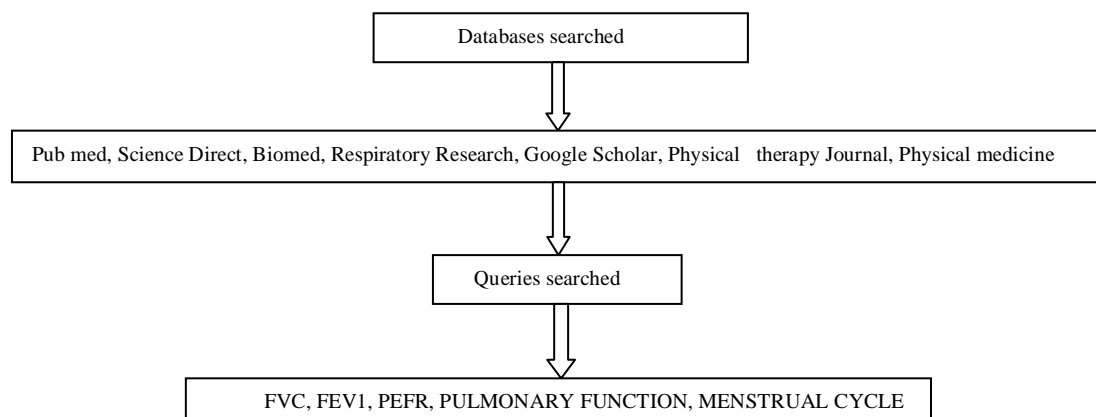
pulmonary function FVC, FEV1 and PEFR is usually measured. [5]

The purpose of this article is to review the published studies that examine influence of menstrual cycle on pulmonary functions in normal healthy females.

OBJECTIVE

This article reviews panel studies of menstrual cycle and its influence on pulmonary function and proposes future research directions. Many researches have been done on this. Some studies stated that there is relation between pulmonary function with menstrual cycle and in another hand some studies denied, results is conflict. So, we tried to have a clear picture by reviewing existing studies present in literature.

METHODOLOGY



To review the literature that describes pulmonary function status of normal menstruating females. Relevant articles in English were retrieved through a search of Science Direct, Springer Link, Medline, PubMed and Cochrane. A total of 23 relevant articles were obtained. One review of literature and no case study were found. Remaining all studies were experimental. Inclusion criteria were: normal healthy female with normal BMI, normal menstruating cycle and all the studies have been included till present. Studies published in the English language, recent research, Meta analysis, & clinical

oriented literature included in to present study. Exclusion criteria were: females with contraceptive pills, females with any cardio pulmonary and gynecological problems.

RESULT

A total 23 articles have been taken and studied. The review study is as describing below about author, nature, title and findings of studies.

KG Prarthna et al did a study "A study of forced vital capacity in different phases of menstruation cycle and its correlation with serum progesterone and body mass index in luteal phase among

healthy females” For this they took 50 healthy young females age between 18-25 years. They checked Forced Vital Capacity (FVC) and serum progesterone levels by portable spirometer and progesterone kit in IMMULITE[R] 1000 analyzer during their early follicular, ovulatory and luteal phases of menstrual cycle. They found that FVC had a better value during luteal phase in comparison of other two phases of the menstrual cycle. [6] Mannan et al did a study “Correlation of Serum Level of Progesterone with Peak Expiratory Flow Rate (PEFR) in Different Phases of Menstrual Cycle”. This study was conducted on 30 healthy young female volunteers with age ranges of 20- 24 years. Serum progesterone level and PEFR of all subjects during all three phases of menstrual cycles were measured by ELISA method and a portable Spirometer respectively. They concluded that changes occur during different phases of menstruating cycle especially in luteal phase and PEFR was positively correlated with progesterone level but was not statically significant. [5] Kaur Harleen et al demonstrated in their experimental study titled “effect of different phases of menstrual cycle on pulmonary functions” that pulmonary functions were significantly better in luteal or secretory phase of menstrual cycle, probably because of bronchodilator effect of progesterone. [7] William s. James et al in 2011 did a experimental study “ventilator and respiratory muscle function at rest and during exercise across the menstrual cycle” and their result indicated that menstrual cycle phase had no effect on the ventilator responses at rest, during submaximal exercise or maximal exercise and there were no differences in inspiratory muscle strength at rest or following exercise between the follicular and luteal phases of the menstrual cycle. [8] Mishra Abhilasha et al in 2015 conducted a study “Variation in pulmonary function tests parameters in different phases of menstrual cycle in healthy female medical students” they also found variations in different pulmonary function tests

parameters, during different phases of menstrual cycle in normal healthy females. Pulmonary functions were better in secretory phase. [2]

C S Rajesh et al in 2000 demonstrated in their study “status of pulmonary function tests in adolescent females of Delhi” that majority of the lung functions exhibit higher values in luteal phase of menstrual cycle as compared to follicular phase. [3] In 2014 Timon et al did the study on the reliability of spirometric tests during the menstrual cycle phases in healthy women. For this they took 23 healthy non-smoker women, aged 18 to 35 yr, performed several spirometric tests in three different phases of the menstrual cycle. They did not find any significant change in flows and volumes observed during the menstrual cycle. [4] In 2011 Shahin Dabhoiwala et al. did a study “Pulmonary Functions in Different Phases of Menstrual Cycle and its Relation with Serum Progesterone levels” for these 36 adolescent girls were taken and peak expiratory flow rate and forced vital capacity were checked during different phases of menstrual cycle. They found that FVC and PEFR significantly increased with serum progesterone while FEV1 was higher but not statistically significant and they found significant high serum progesterone and FVC, FEV1 and PEFR during secretory phase in their experimental study. [9] Omorogiuwa et al did an experimental study on peak expiratory flow rate and pulse Pressure values during different phases of menstrual cycle in 2015. They concluded the peak expiratory flow rate and the pulse pressure in the luteal phase were significantly higher. [10] In 2007 Jeon et al did the experimental study titled lung function in Korean adolescent girls: in association with obesity and the menstrual cycle and they demonstrated that pulmonary function is related to menstrual cycle and obesity. [11] Nandhini et al conducted an experimental study in 2006. 43 girls aged between 12 to 18 years were taken in their study and forced vital capacity, the forced

expiratory volume, the FEV1/FVC ratio and the forced expiratory were checked during different phases of menstrual cycle. They stated that pulmonary function parameters were better during luteal phase. [12] In 2015 Dimple et al demonstrated in their experimental study titled expiratory flow rate changes during menstrual cycle that respiratory parameters of women in reproductive age group show significant variation during different phases of menstrual cycle. [13] In 1998 Das et al conducted a study on effect of the menstrual cycle on timing and depth of breathing at rest and concluded FVC and FEV1 were unchanged during different phases of menstrual cycle. [14] Goyal et al did experimental study on effect of different phases of menstrual cycle on lung functions in young girls of 18- 24 years age in 2017.

They found different values of lung functions during different phases of menstrual cycle. [15] In 2016 Jasrotia et al demonstrated in their experimental study titled effect of menstrual cycle on pulmonary functions and respiratory efficiency and concluded that FVC and FEV1 were high in luteal phase. [16] Hsium Ing chen et al did study in 1988 titled effects of the menstrual cycle on respiratory muscle function and concluded inspiratory muscle function is affected by menstrual cycle and it was higher in mid luteal phase. [17] Elena saperova et al conducted a study on pulmonary function in different phases of menstrual cycle and stated that luteal phase had increased lung function parameters. [18] In 2016 Samsudeen et al performed a experimental study to know the effect of menstrual cycle on cardio respiratory efficiency in young girls with different groups of body mass index. They took 20 girls in normal, overweight and in obese group. Peak expiratory flow rates, respiratory endurance test and respiratory blast test were checked during different phases of menstrual cycle. They observed significant increased cardio respiratory efficiency in normal group during luteal phase. [19] In 2017 Amrith Pakkala et al.

conducted a study titled “Respiratory reserve capacity in the proliferative phase of the menstrual cycle with reference to obesity” 20 healthy young adult females between 19 to 25 years were selected and lung functions were measured . They noticed influence of estrogen in the proliferative phase. [20] Selma Bruno et al in their study “changes in peak expiratory flow and respiratory strength during the menstrual cycle” stated that there is no alteration of pulmonary capacities and volume in different phases of menstrual cycle. They conducted study in 17 young women and checked their spirometry and respiratory static pressures twice a week for three successive ovulatory menstrual cycles. They observed correlations between estradiol and progesterone levels and some resting ventilator parameters respiratory static pressures (MEP, MIP) and Peak expiratory flow and suggested a positive influence of female sexual hormones on muscle strength of the thoracic pump during the luteal phase. [21] In 2008 Mary Behan did a review titled “Sex Steroidal Hormones and Respiratory Control” 127 articles were reviewed. They concluded that Sex hormones affect the respiratory control. [22] In 2011 Girijja B et al. demonstrated in their study “effect of different phases of menstrual cycle on physical working capacity in Indian population” that resting respiratory rate and resting heart rate were high during luteal and menstrual phase. 40 girls were taken and the subjects were instructed to come to the lab during each of three different phases of menstrual cycle. Resting heart rate, respiratory rate and blood pressure were recorded. [23]

In 2017 Kavitha J.G et al. did the study titled “Pulmonary Function Tests in Different Phases of Menstrual Cycle in Young Girls of Kanyakumari District” 100 young girls participated in this study. The parameters were FVC, FEV1, FEV1/FVC, PEFR and MVV. They concluded that pulmonary function tests parameters were increased in the luteal phase of menstrual cycle. They gave possible reason that it

could be due to increase in progesterone during the luteal phase of menstrual cycle. Increase in progesterone during luteal phase causes bronchial relaxation and also stimulates the respiration. [24]

DISCUSSION

In the present study 23 articles were reviewed. The purpose of the study was to find out relation between menstrual cycle and lung functions. After reviewing we found that there is influence of menstrual cycle on lung function. Most of the studies favor that FVC and FEV1 increases during luteal or secretory phase. Dimple arora et al, Raksha hebbar k. et al, Rajani bala jasrotia et al, Kavita et al found in their studies that mean value of FVC and FEV1 were higher in secretory (luteal) phase and least in menstrual phase. [13,16,24] Mannan et al, Rajesh et al, Elena Saprova et al have also found similar results. They gave possible reason for this that progesterone is known to be a smooth muscle relaxant so, it may cause bronchodilation. Beynon et al studied the effect of progesterone on asthmatic patient. They found that low level of progesterone in premenstrual phase may cause relative decrement in the values of lung volumes and capacities. Values of PEFr, MVV, respiratory endurance test have also shown higher in luteal phase. [5,3,18] Tarun K Das et al in their study observed that inspiratory muscle activity did not alter during menstrual cycle. They demonstrated use of progesterone in hypoventilation syndrome. [14] Nandhini R. et al. had also found similar findings that pulmonary parameters were higher during luteal phase. They also suggested that possible reason for the fluctuating levels of the sex hormones in blood or of the mediators which circulate in the blood. [12] Jeon et al explained in their study that how does sex hormone acts on bronchial smooth muscle and β_2 adrenergic receptor function. [11] Omarogivwa et al, found cardiopulmonary function influences by menstrual cycle contrary Stephanie Megan showed PEFr was not much affected by

menstrual cycle. [10] Dabhoiwala et al found similar findings. They also narrated that the improvement of pulmonary function during secretory phase is due to increase in serum progesterone level. [9] On the other hand Timon Rafael et al stated that estrogens could have an influence on central nervous activity but not on peripheral reflex. They did not find any significant changes in pulmonary functions. [4]

Amrith Pakkala et al did not find any changes in FVC, FEV1 and maximum mid expiratory flow. [20] Mary Behan et al. said progesterone could also act by altering the release of neuromodulators such as serotonin in brainstem respiratory nuclei. [22] Mishra abhilasha et al. said progesterone induces hyperventilation through central, medullary and peripheral receptors. [2] James s. Williams et al. said no influence on the spirometric or ventilator responses. Chen et al. also denied that respiratory muscle function has an effect on menstrual cycle. [8,17] Girija B et al showed in their study that there is increased resting respiratory rate in luteal phase. [23] Sprova et al. supports that pulmonary functions are improved in luteal phase. The pulmonary function in luteal phase might be related to high progesterone level which induces hyperventilation by direct stimulation of respiratory center and increasing Oxygen consumption due to increased metabolic rate. Moreover progesterone may potentiate prostaglandin induced relaxation of bronchial smooth muscles. This relaxation is well marked during luteal phase. Role of progesterone as bronchial smooth muscle relaxant and its association with increased respiratory muscle endurance physiological concentration of progesterone causes increased mRNA content of progesterone receptor at hypothalamus during luteal phase. [4,6,7,13,14,21] The majority of lung functions exhibit higher values in luteal phase of menstrual cycle.

CONCLUSION

Literature review of present study concludes that pulmonary function status

during menstrual cycle alters but some literatures also support that pulmonary function do not change during menstrual cycle. So, result is quite conflicting. However, this study indicates that progesterone definitely affects the lung function. Almost every study accepts its role on respiratory functions. The majority of lung functions exhibit higher values in luteal phase of menstrual cycle. Not only diurnal variation even menstrual cycle can also affect the parameters of the pulmonary functions. So, while taking PFT, status of menstrual cycle should be considered. These changes may be kept in mind in assessment of changes in lung functions by serial testing and planning of therapeutic regimen in women. Aerobic exercises and deep breathing exercises should be carried out in menstrual phase to improve lung functions. There is need for continued research to address the complex mechanisms that underlie the role of ovarian hormones on respiratory functions during different phases of menstrual cycle.

Limitation

Many authors have failed to explain that why pulmonary function parameters were not influenced by menstrual cycle. They dint give possible reason behind their findings.

REFERENCES

1. Harshad Thakur, Annette Aronsson, Seema Bansode, Cecilia Stalsby Lundborg, Suchitra Dalvie and Elisabeth Faxelid. Knowledge, practices, and restrictions related to menstruation among young women from low socioeconomic community in Mumbai, India. *Frontiers in Public Health* 2014, 2(Jul 3), [72]. DOI: 10.3389/fpubh.2014.00072.
2. Abhilasha Mishra Variation in pulmonary function tests parameters in different phases of menstrual cycle in healthy female medical students *National Journal of Physiology, Pharmacy and Pharmacology* 2015 Vol 5 Issue 5; 357-360.
3. C. s rajesh, Pratibha Gupta, Neelam Vaney. Status of pulmonary function tests in adolescent females of Delhi. *Indian J Physiol Pharmacol* 2000; 44 (4): 442-448.
4. Rafael timon, Almudena Ramirez Balas, Jose C. Adsuar, Borja Delpozo-Cruz, Marcos Maynar. Reliability of Spirometric Tests during the Different Menstrual Cycle Phases in Healthy Women. *Iranian J Publ Health*, Vol. 43, No.7, Jul 2014, pp. 1009-1010.
5. SR Mannan, N Begum Correlation of Serum Level of Progesterone with Peak Expiratory Flow Rate (PEFR) in Different Phases of Menstrual Cycle *AKMMC J* 2012: 3(1).
6. K.G. Prarthana, T. Bharath, and P. Suja . A study of forced vital capacity in different phases of menstrual cycle and its correlation with serum progesterone and body mass index in luteal phase among healthy females.2013. *Journal of Evolution of Medical and Dental Sciences*, 2013, vol. 2, no. 30.
7. Dr. Harleen Kaur, Dr. Poonam G. Kohli, Dr. Rajiv Arora, Dr. Seema Maini. Effect of different phases of menstrual cycle on pulmonary functions *Indian Journal of Basic and Applied Medical Research*; December 2015: Vol.-5, Issue- 1, P. 266-269.
8. James S. Williams1, S. Megan Parsons. Ventilatory and Respiratory Muscle Function at Rest and During Exercise Across the Menstrual Cycle. *Journal of Exercise Physiology* October 2011, Volume 14 Number 5.
9. Dr. Shahin Dabhoiwala, Dr. Rajesh Kathrotia, Dr. Dharmesh Patel, Dr. Avnish Dave, Dr. Ashutosh Joshi, Dr. Elvy Oommen Pulmonary Functions in Different Phases of Menstrual Cycle and its Relation with Serum Progesterone levels. *NJIRM* 2011; Vol. 2(4);39-42.
10. Omoroguiwa, A; Ojiemudia, M Peak expiratory flow rate and Pulse Pressure values during the Luteal and Menstruation Phases of the Menstrual Cycle. *J. Appl. Sci. Environ. Manage.* Dec., 2015 Vol. 19 (4) 621 – 625.
11. You Hoon Jeon, Hyeon Jong Yang, and Bok Yang Pyun. Lung Function in Korean Adolescent Girls: in Association with Obesity and the Menstrual Cycle. *J Korean Med Sci* 2009; 24: 20-5 ISSN 1011-8934 .
12. Nandhini R., Subhashini A.S.variation in the Pulmonary Functions with the Phases of the Menstrual Cycle in Adolescent Females. *Journal of Clinical and Diagnostic Research*. 2012 April, Vol-6(2): 173-175.

13. Dimple, Parminder Kaur Sandhu, Kiran Mehta, Anterpreet Kaur, Nimarpreet Kaur. Expiratory flow rate changes during menstrual cycle. *Pak J Physiol* 2015;11(3): 3-5.
14. Tarun K. Das. Effects of the menstrual cycle on timing and depth of breathing at rest. *Indian J Physiol Pharmacol* 1998; 42 (4): 498-502.
15. Manish Goyal, S. K. Dwivedi, Ajit Singh Rajput. Effects of different phases of menstrual cycle on lung functions in young girls of 18-24 years age. *International Journal of Research in Medical Sciences* 2017 Feb;5(2):612-618.
16. Jasrotia RB, Kanchan A, Harsoda JM. Effect of menstrual cycle on pulmonary functions and respiratory efficiency. *IAIM*, 2016; 3(7): 233-238.
17. Hsiun-Ing Chen, Ya-Ru Tang. Effects of the Menstrual Cycle on Respiratory Muscle Function *ATS journal* December 13, 1988.
18. Elena Saperova, Dmitry Dimitriev. Pulmonary functions in different phases of menstrual cycle. *Faseb journal*. Vol. 27, No. 1_supplement. April 2013
19. Samsudeen nazrin, Archana rajgopalan. Effect of different phases of menstrual cycle on cardio respiratory efficiency in normal, overweight and obese female undergraduate students. 2016. *JCDR*; 10(12):1-4.
20. Amrith Pakkala, Ashok Laxman Bajentri1, Chitradurga Palaiah Ganashree2, Thippeswamy Raghavendra3. Hormonal influence on the adaptability of the pulmonary system to exercise in proliferative phase of menstrual cycle in a group of perimenopausal women. *International Medical Journal of Sifa University* January-April 2014 Vol 1 Issue 1;2-4.
21. Selma Bruno da Silva a, Elizabel de Sousa Ramalho Viana a, Maria Bernardete Cordeiro de Sousa. Changes in peak expiratory flow and respiratory strength during the menstrual cycle. *Respiratory Physiology & Neurobiology* 150 (2006) 211–219
22. Mary Behan, Julie M. Wenninger Sex Steroidal Hormones and Respiratory Control *Respir Physiol Neurobiol*. 2008 December 10; 164(1-2): 213–22.
23. Girija B, Veeraiah Effect of different phases of menstrual cycle on physical working capacity in Indian population. *Indian j physiol pharmacol* 2011 Apr-Jun;55(2):165-9.
24. Kavitha J.G, Pulmonary Function Tests in Different Phases of Menstrual Cycle in Young Girls of Kanyakumari District.2017. *JDMS*; 16(12):6-8.

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