The Effect of Menstrual Cycle on Singing Voice: A Systematic Review

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Summary: Objective. Research has reported the difference in a woman's voice across the different stages of the menstrual cycle. A review of the studies in singers on the influence of menstruation on the singing voice will enable a better understanding of these changes.

Methods/Design. A systematic literature search was carried out on PubMed, CINAHL, Scopus, Cochrane, and regional electronic databases. The keywords "menstrual cycle," "voice change," and "singer" were used in different combinations. Only those articles that discussed the effect of menstrual cycle on the singing voice were included in the final review.

Results. Six studies in the English language were identified and included in the review. Hormonal variations occur to a great extent during menstrual cycle, and these variations can influence the voice of singers. A great variability was found in the included studies. There are limited studies that have been carried out exploring the relationship between menstrual cycle and the singing voice.

Conclusion. Even though the studies included in the review point out toward the changes in the singing voice associated with menstrual cycle, there is a need for more studies to be carried out in diverse singing populations and in different outcome measures.

Key Words: menstrual cycle–voice–singers–hormonal variations–systematic review.

INTRODUCTION

The vocal folds play a key role in the production of voice and are affected by internal and external environments.[1] The hormonal environment has a major influence on the quality of the human voice.[2] The physiological effect of the menstrual cycle on the voice has been a topic of research for many decades. Recent literature has suggested the association between voice change and the menstrual cycle. Hormonal fluctuations during the menstrual cycle have a significant impact on the vocal folds and voice.[3–13]

A variety of voice changes have been reported across the different stages of the menstrual cycle. During the premenstrual period, women report of side effects that result from changes in the levels of estrogen and progesterone, or the balance of both. There is water retention in the body tissues, which causes bloating. This also leads to slight swelling or thickening of the vocal folds, which could impede the movements during the production of voice. It could also result in sluggish laryngeal movements and submucous fold hemorrhage, which could lead to hoarseness, difficulty in coordinating voice, uncertain or unsteady pitch, and loss of high notes. These voice changes are termed as dysphonia premenstrualis. Symptoms of dysphonia premenstrualis include decreased vocal efficiency, reduced flexibility, breathiness, fatigued voice, loss of high notes, hoarseness, intonation problems, and muffled voice.[1,9,14,15] These voice changes may be more apparent to the singer herself rather than the listener.[16] In olden days, many European Opera houses offered "grace days" to singers during their premenstrual period to avoid any damage to the vocal folds and vocal stress. These practices no longer exist in Europe and were never practiced in the United States or other places.[17]

At ovulation, the fundamental frequency is higher as compared with other times of the cycle.[18,19] Objective voice analysis using acoustic measures, maximum phonation duration, and s/z ratio did not reveal significant differences across the different phases of the menstrual cycle. However, perceptual voice evaluation (clinician rated as well as patient self-rated) revealed a statistically significant difference among the different phases of the cycle.[20] Voice changes occur across the different stage of the menstrual cycle, although they are predominantly noticed during the premenstrual period.[21]

The above mentioned studies highlight the voice-related changes that occur across the different phases of the menstrual cycle. Singers are often called as "vocal athletes" as singing puts heavy demands on their voice. As a result of years of training and singing practice, singers develop a higher phonatory agility, strength, and stamina.[22] The present review was undertaken to identify and review the existing literature on the influence of menstrual cycle on the singing voice.

METHOD

The review was designed and conducted as per the guideline of the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement (PRISMA).

Types of studies and participants

The search strategy was designed to identify various studies on the influence of menstrual cycle on the voice of singers. We explored and included all accessible human studies on singers, which included peer-reviewed published articles and dissertations. The

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search was kept open to include singers from any form of singing style to include as much studies available.

Search methods for identification of the studies

The search was carried out in October 2015. To identify and include a wide range of studies, there was no date limit set during the search. The search was carried out in the following online databases: PubMed, CINAHL, Scopus, and Cochrane. The regional databases IndMED and the digital research repository of the All India Institute of Speech and Hearing, Mysore, India, were also included. The back references of papers included in the review were hand searched to identify any related studies. Search terms such as menstrual cycle, voice change, and singer were used to develop a search strategy using Boolean operators (AND, OR) as per the database being searched.

Inclusion criteria

To be included in the review, the study is required to be published in the English language, an original primary research, and carried out on trained female singers who may or may not report voice problems. Review articles and editorials were excluded. Studies with the primary focus on the influence of hormonal medicines or oral contraceptive medication on singing voice were excluded.

Outcomes

All the studies were required to have investigated the influence of menstrual cycle on the singing voice using any objective or subjective technique. The objective techniques could be acoustic measures, laryngeal visualization/imaging, or any other instrumental evaluation. The subjective techniques could include perceptual evaluation or self-reported measures. The outcome measures were not restricted to include a wide range of studies.

Study selection

The studies obtained from all the databases were compiled together with a reference management system, and the duplicates were removed. The titles and abstracts of the studies were screened independently by two authors based on the predetermined inclusion criteria. As the dissertations did not have an abstract, the chapters on methodology, summary, and conclusion were screened to determine the eligibility. In both these stages, disagreements were discussed to arrive at a common consensus. In the next stage, full-text of the article was retrieved for the shortlisted abstracts. Additionally, the reference lists of the selected articles were hand searched to identify any potential articles that could have been missed out.

Data extraction

For each of the included studies, the complete study was scrutinized to extract information using predesigned data extraction form. The form included predesigned tables, which enabled a cross-study comparison of data. The data extracted included study type, sample size, participant characteristics, tasks/evaluation procedure used, and voice-related changes reported.

Methodological quality appraisal tool and level of evidence analysis

A methodological quality appraisal tool was developed to suit the requirements of the current review. The tool was designed based on previous systematic reviews and guidelines for conducting quality appraisal for studies included in systematic review.[23,24] The scoring was as follows: 0–33.9% = weak, 34–66.9% = moderate, and 67–100% = strong. The level of evidence analysis was carried out using the GRADE (Grades of Recommendation, Assessment, Development, and Evaluation Working Group) approach.[25] As per this approach based on the methodology used, randomized trials are rated high quality, downgraded randomized trials or upgraded observational studies are rated as moderate quality, observational studies are rated low quality, and case series/case reports are rated as very low quality of evidence.

RESULTS

The search results from all the databases were merged using a reference management software, and a total of 51 studies were obtained. Eight duplicates were identified and excluded. The remaining 43 titles were screened for eligibility, and of which, 13 satisfied the inclusion criteria. The abstracts of these 13 studies were reviewed, and 8 were found to be suitable for full-length review.

The full-length articles were obtained for the eight studies, and six studies were found to be eligible for the present systematic review. The remaining two studies were eliminated as one studied the effect of the menstrual cycle and oral contraception on singing voice, whereas the other was a review paper. In this manner, six studies were included in the systematic review. Figure 1 illustrates the PRISMA chart for the systematic procedure followed. Table 1 shows the characteristics of the studies included in the systematic review.

The methodological appraisal of the included studies was carried out using the tool explained in Table 2. The scoring for the individual items and total scores are as shown in Table 3. It can be noted that two studies were rated as moderate quality, whereas four studies were rated as strong quality. All the studies used observational study design; therefore, as per the GRADE approach, all the studies were rated as low level of evidence.

DISCUSSION

The present review was undertaken to systematically identify the existing literature studying the influence of menstrual cycle on the singing voice. Six studies were identified, which reported the voice changes across the different stages of the menstrual cycle. Considering the nuances of conducting randomized clinical trials in such areas of study, the review obtained was limited to low level of evidence.

The systematic review was performed by keeping no restriction in time limit, using broad search terms, and incorporating multiple electronic databases. The decision to include regional database and dissertation repository was largely to cover unpublished yet openly available studies. This was done to include maximum literature in support of voice changes associated with the menstrual cycle in female singers irrespective of the singing