Effects of Sex Hormones and the Menstrual Cycle on Knee Joint Laxity in Physically Active Females: A Critically Appraised Topic

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Clinical Scenario: In recent years, females have exhibited increased physical activity and sport participation than ever before. Recent studies have identified a rising incidence rate of ACL injuries and indicate that the risk of ACL tears is greater in females than males. Knee laxity and physiological variation in women during the menstrual cycle have demonstrated increased ligament laxity, therefore, varying hormone concentrations may contribute to changes in ligamentous mechanical properties. Despite these findings, it remains unclear whether fluctuating sex hormone concentrations directly correlate to measurable changes in knee laxity. **Clinical Question:** How do fluctuations in sex hormones throughout the menstruation cycle impact knee joint laxity among physically active females? **Data Sources:** A computerized search of electronic databases was completed. Search terms used to guide the search include sex hormones, knee joint laxity, and physically active females. **Study Selection:** The literature search yielded 51 total studies of which four adequately met inclusion and exclusion criteria. Selected studies explored the influence of sex hormones on knee laxity in physically active females with regular menstrual cycles and no use of contraceptives. **Data Extraction:** Observed outcome measures include analyzing hormone and measuring knee laxity throughout the menstrual cycle. **Summary Measures:** Across the four studies, anterior knee laxity was observed during ovulation (4.71mm $\pm$ 0.86). Two of the four studies revealed estradiol peaks during ovulation (187.27 pg/mL $\pm$ 27.26), while the remaining 2 studies found highest estradiol concentrations during the luteal phase (176.24 pg/mL $\pm$ 79.91). **Evidence Appraisal:** The Critical Appraisal Skills Program (CASP) and Oxford Center for Evidence Based Medicine (OCEBM) were utilized to appraise the quality of evidence included. **Search Results:** Databases including PubMed, EBSCO host, Medline, and CINAHL, were systematically searched for relevant studies. Initially, 51 studies were identified, with 12 duplicates removed. Following screening, 14 remained for further eligibility assessment. After thorough evaluation, four studies were selected for this Critically Appraised Topic. **Data Synthesis:** Two studies utilized a 95% confidence interval to examine changes in knee laxity concerning fluctuations in hormone levels within subjects. **Evidence Quality:** Reviewed manuscripts exhibit inconsistency in outcome measures and limited significance to enhance patient-centered evidence. **Summary of Key Findings:** Each study analyzed hormone concentration levels through blood draws and measured knee laxity using the KT-2000 arthrometer. Increased anterior knee laxity was observed during ovulation in two studies. Two of the four studies revealed peak estrogen levels during ovulation, while the remaining two studies found peak estrogen concentrations during the luteal phase. **Clinical Bottom Line:** Based upon the included studies, there is compelling evidence to suggest that sex hormone fluctuations across the menstruation cycle can impact the magnitude of knee laxity in physically active females.

 ISSN Online 2577-8188