# Menstrual Cycle Phase and Proprioceptive Ability: A Scoping Review

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## Summary

A scoping review exploring whether menstrual cycle (MC) phase in healthy, eumenorrheic populations may influence proprioception, a known performance and injury risk factor. Findings show inconsistent methods and reporting. Standardised inclusion, testing and reporting criteria is needed in future research to develop female-specific recommendations for injury prevention and performance development.

## Introduction

Menstrual cycle (MC) phase may influence lower limb injury risk [9] and performance outcomes [13]. MC phase specific fluctuations in proprioception have been suggested in the literature and may be a mediating factor. However, mechanisms are unclear, and research is limited in range and quality. The aim of this review was to identify existing evidence and highlight gaps to inform future primary investigations.

## Methods

Joanna Briggs Institute (JBI) Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. PubMed, EBSCOHost and other sources searched between 28th March 2024 and 19th August 2024 or search string: menstrual* AND (proprioception OR kinesthesis) OR (spatial orientation OR spatial processing). Studies reporting outcome measures for proprioception alongside >1 method to estimate or identify MC phase in eumenorrheic female populations included. Two independent reviewers screened for eligibility by title, abstract, and full text, respectively, before data was extracted for analysis and discussion. Ethical approval was not required for this review of existing literature.

## Results and Discussion

Eleven papers [1-8,10-12] were identified (Figure 1). Studies included 13 to 43 healthy female participants, aged 18 to 35 years with regular menstrual cycle, duration 26-35 days. None were taking hormonal contraceptives, pregnant, or diagnosed with health/gynaecological conditions.

All studies reported outcomes of proprioception in the lower limb proprioception (knee n=7, ankle n=2, both n=1), except one on upper limb (n=shoulder). Eight measured angular error in joint position sense (JPS) tests (active n=8, passive n=3). Three studies assessed passive movement detection, but only at the knee. Most studies reported at least one other variable alongside proprioception, including joint laxity, strength, function/stability, balance and/or symptoms of premenstrual syndrome (PMS). Inconsistencies in testing protocols make findings difficult to compare, such as variations in the target angle, range of motion, limb laterality, angular velocity and direction of motion for JPS and passive threshold tests. Blood and urine hormone concentrations were typically used to confirm menstrual phase for scheduling data collection visits. However, the outcomes were not always reported, and where they were there was minimal investigation into relationships with other outcomes, such as proprioception.

## Conclusions

Quality and quantity of evidence must be improved to determine if a relationship between MC phase and proprioception exists and to develop female-specific recommendations for injury prevention and performance development. Standardised inclusion, testing and reporting criteria is warranted in future research. Outcomes that could be used to identify possible mechanisms such as central or peripheral drive and hormonal changes between MC phases, should also be incorporated into experimental designs.

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