Unveiling the menstrual cycle’s role in athletic performance and injury risk - in general and specifically in female judokas

EXPLORING PHASES, EFFECTS ON ATHLETES, AND CONTRACEPTIVE OPTIONS

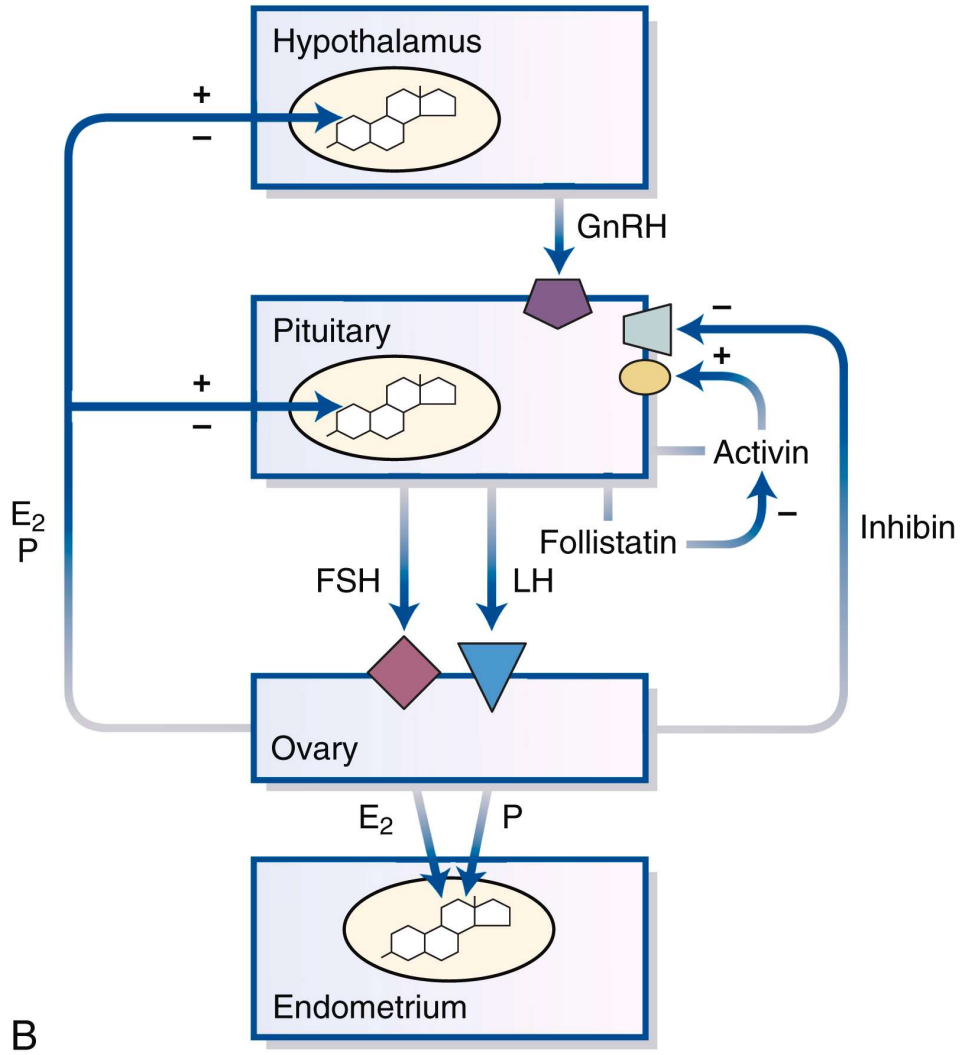
EUROPEAN JUDO UNION

EJU Medical Seminar 2025

AGENDA HIGHLIGHTS

- Overview of the Female Menstrual Cycle
- Menstrual Cycle Impact on Sports Performance
- Menstrual Cycle and Injury Risk
- Overview of Contraceptive Methods
- Key Take-Home Messages

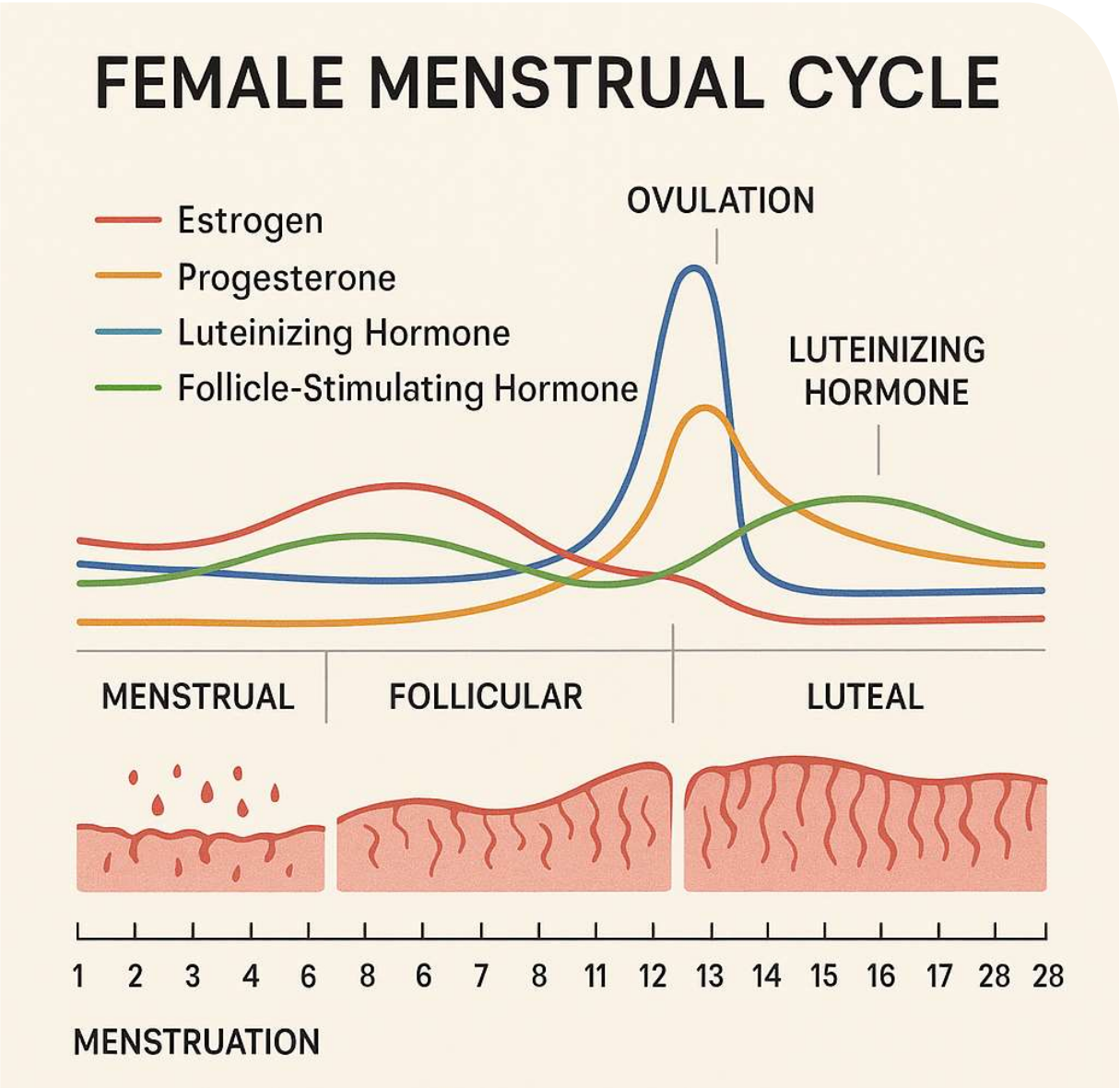
OVERVIEW OF THE FEMALE MENSTRUAL CYCLE



HYPOTHALAMIC-PITUITARY-OVARIAN AXIS

- Hypothalamus
  - Pulsatile GnRH secretion: FSH or LH secretion depends on pulse frequency
- Pituitary
  - Anterior part of the pituitary
  - Secretion of FSH in the beginning of the cycle
  - Pulsatile secretion of LH in the middle of the cycle
  - Secretion of follastin and activin
- Ovary
  - Secretion of estradiol from ovarian granulosa cells in follicular phase (dominant follicle)
  - Secretion of progesterone and estradiol from corpus luteum
  - Secretion of inhibin: negative feedback on pituitary

Bulun and Babayev. 2025. Williams Textbook of Endocrinology, chapter 15



Menstrual Phase Overview

The menstrual phase involves shedding of the uterine lining, marking the start of the cycle.

Follicular Phase

The follicular phase includes maturation of follicles and build-up of endometrium from the basal layer.

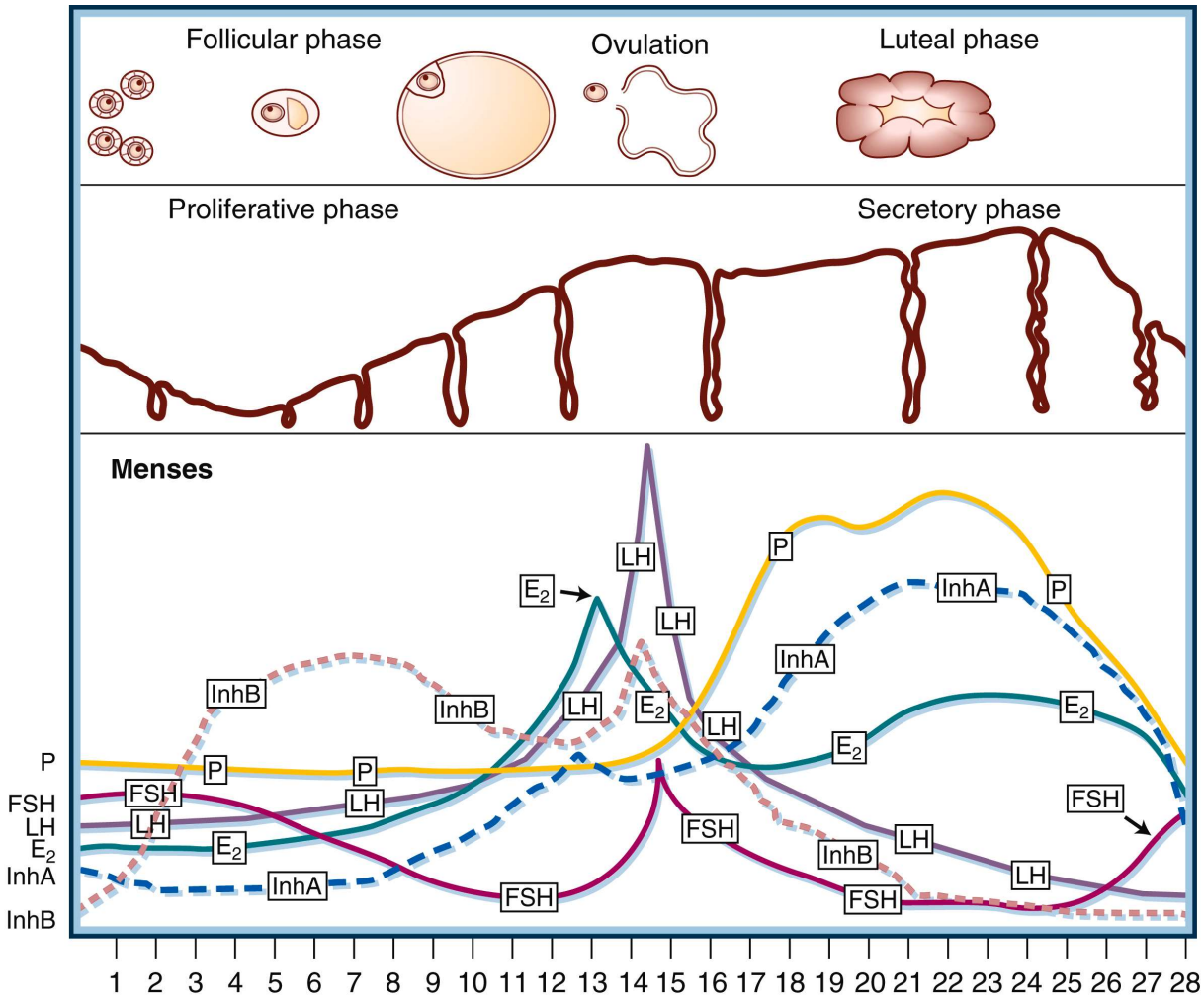
Ovulation Event

Ovulation is the release of a mature egg from the dominant follicle on the ovary, triggered by LH surge (34-36 hours prior).

Luteal Phase

The luteal phase involves transforming and maintaining the endometrium to get ready for a possible pregnancy.

MENSTRUAL CYCLE



Follicular Phase

FSH release from the pituitary: stimulates antral follicle growth and selection of one dominant follicle. Granulosa cells are stimulated to produce estradiol. FSH also leads to endometrial proliferation.

Inhibin B release: negative feedback on the pituitary.

Ovulation Event

Estrogen feedback to the hypothalamus and pituitary leads to a fast LH surge, which triggers the ovulation.

Luteal Phase

Follicle regresses to corpus luteum (CL), which produces large amounts of progesterone and (less) estradiol. Secretory transformation of the endometrium due to progesterone.

If no implantation of a pregnancy occurs, the CL regresses and estrogen and progesterone levels fall, which leads to endometrium release and menstruation.

Bulun and Babayev. 2025. Williams Textbook of Endocrinology, chapter 15

OTHER KEY HORMONES IN THE MENSTRUAL CYCLE

Thyroid stimulating hormone (TSH)

Hypothyroidism: heavier, more frequent, or longer-lasting periods, or even missed periods.

Hyperthyroidism: lighter or shorter periods, or amenorrhea (absent periods).

Cortisol (high physical or emotional stress)

Disrupts normal GnRH release from the hypothalamus, i.e. blocks LH-surge → anovulation

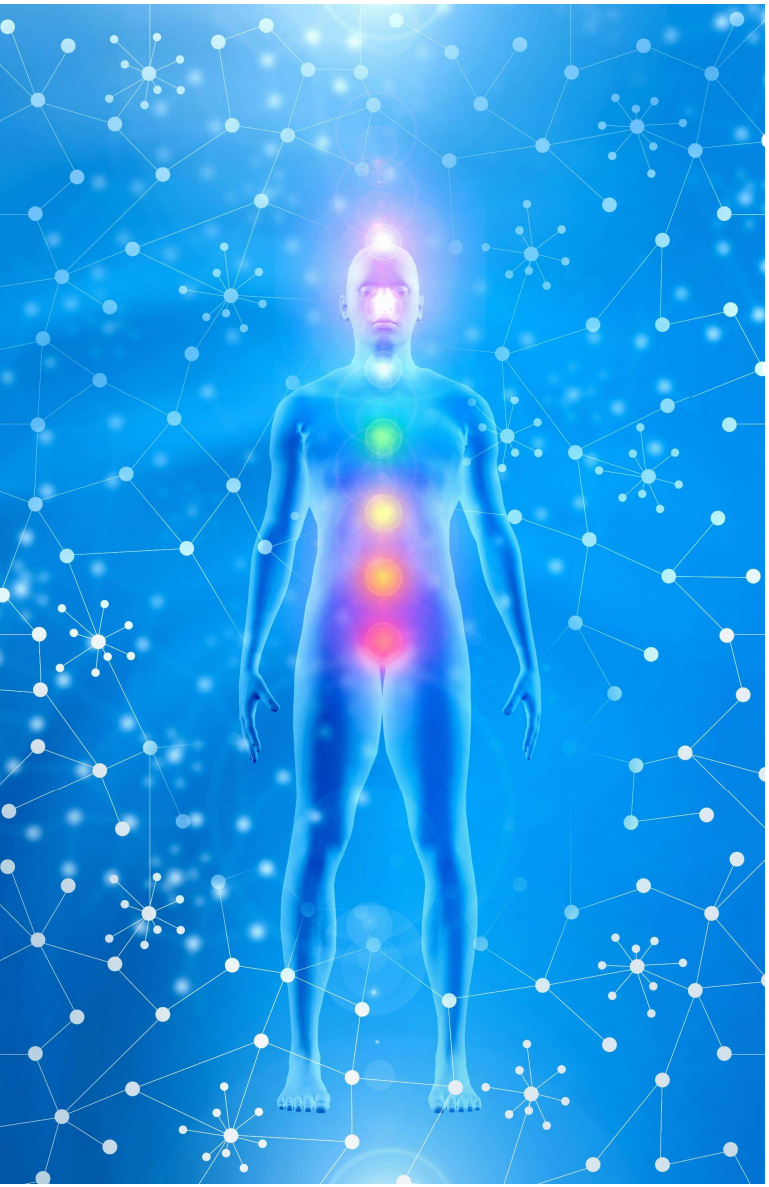
High cortisol can worsen symptoms of premenstrual syndrome (fatigue, mood swings, bloating)

Key substrate but not a hormone: LDL-cholesterol

Estrogen and progesterone are formed from LDL-cholesterol. Therefore, enough fat is necessary for a normal hormonal production!

Menarche: min. 17% fat
Regular cycle: min. 20% fat

Frish et al. 1974. Science,
Bulun and Babayev. 2025. Williams Textbook of Endocrinology, chapter 15



PHYSIOLOGICAL CHANGES THROUGHOUT THE CYCLE

Body Temperature Fluctuation

Body temperature varies throughout the cycle, impacting metabolism and physical performance. Rise in body temperature caused by progesteron

Metabolic Changes

Metabolism rates shift during the cycle affecting energy levels and nutrient processing.

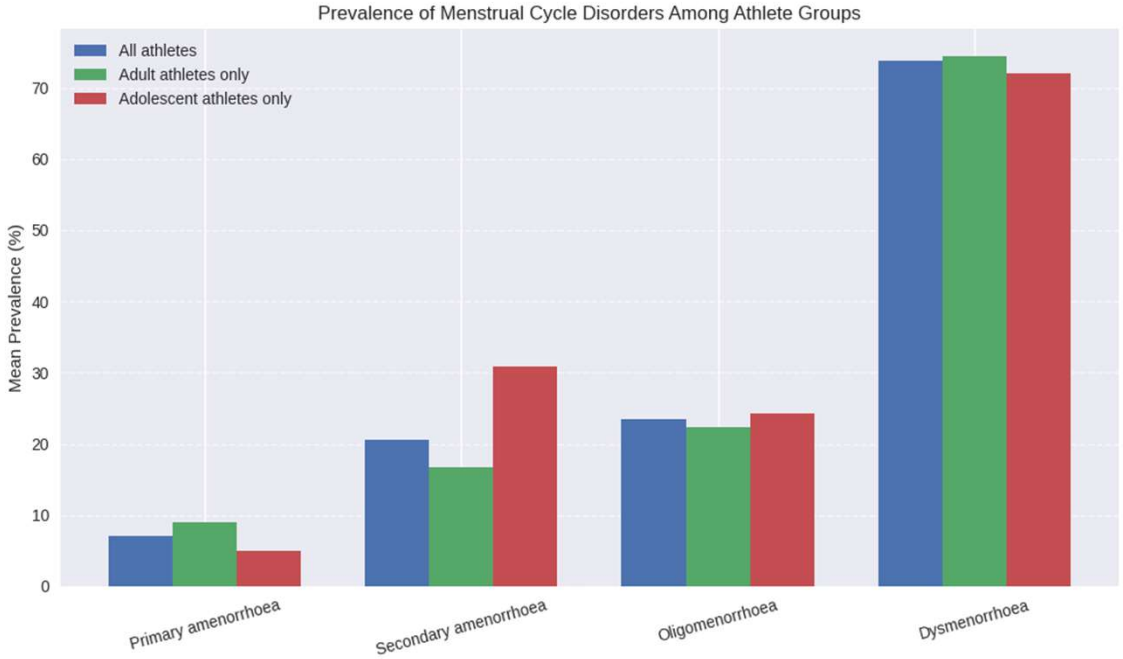
Fluid Retention

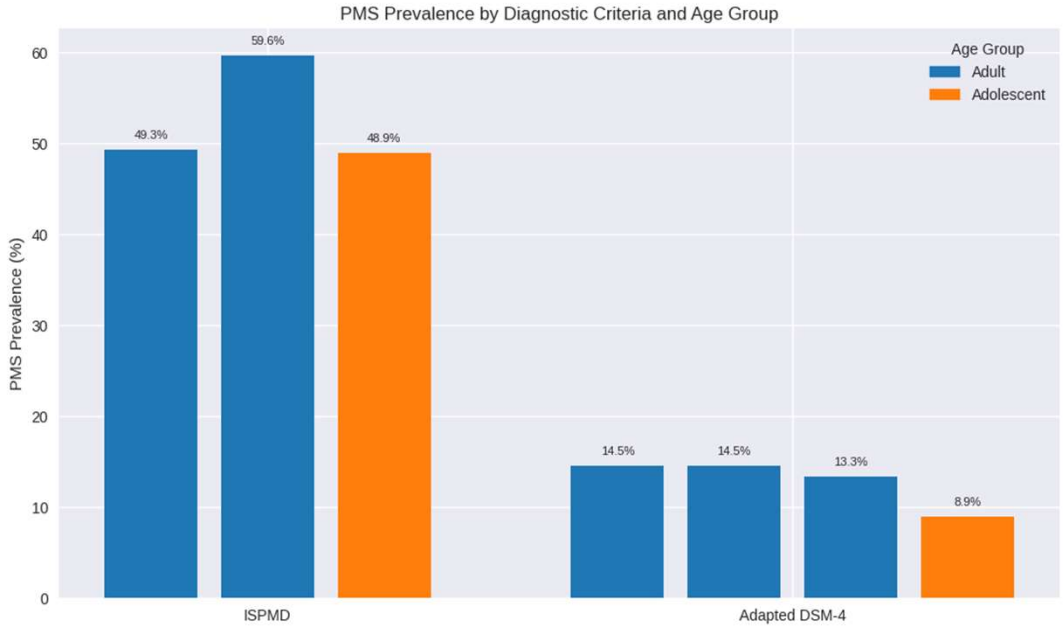
Fluid retention fluctuates, influencing body weight and comfort throughout the cycle. More fluid retention in luteal phase due to progesterone surge.

Cardiovascular Function

Cardiovascular functions fluctuate, affecting exercise tolerance and recovery times.

MENSTRUAL CYCLE DISORDERS AND CYCLE-ASSOCIATED DISORDERS IN FEMALE ATHLETES





Cycle disorders can be caused by energy deficit and can therefore be an important symptom of REDs!

Graphs based on information from Taim et.al. 2023; Sports Medicine

PREVALENCE OF MENSTRUAL CYCLE DISORDERS BY SPORT

Sport	*n*	Primary amenorrhoea	Secondary amenorrhoea	Oligomenorrhoea	Dysmenorrhoea	Heavy menstrual bleeding	Premenstrual syndrome	Premenstrual dysphoric disorder
Team sports	**9**	**0**	**2.4–30.0**	**11.1–29.4**	**8.2–34.6**	**7.8–11.9**	**59.6**	**NA**
Basketball [54, 60, 67, 100]	4	0	2.4–5.6	12.7–26.1	30.6	–	–	–
Handball [60]	1	–	–	16.0	–	–	–	–
Volleyball [54, 86]	2	0	0–30.0	11.1–40.0	34.6	–	–	–
Soccer [45, 57, 72]	3	–	3.1	13.8–29.4	–	–	59.6	–
Ball sports [93, 94]	2	–	–	–	8.2–14.1	7.8–11.9	–	–
Endurance/long distance	**5**	**0–10.0**	**0–35.0**	**15.0–34.6**	**NA**	**NA**	**NA**	**NA**
Cross-country running [47]	1	0	3.8	34.6	–	–	–	–
Distance/track running [59, 70, 98]	3	10	0–35.0	15.0–31.8	–	–	–	–
Distance running/triathlon [62]	1	–	15.5	–	–	–	–	–
Middle distance	**2**	**0**	**0–61.5**	**24.6**	**NA**	**NA**	**NA**	**NA**
Distance running [65]	1	–	61.5	–	–	–	–	–
Swimming [85]	1	0	0	24.6	–	–	–	–
Speed/strength	3	NA	0	NA	15.8–30.0	4.2–42.1	NA	NA
Sprinting [88, 93, 94]	3	–	0	–	15.8–30.0	13.7–42.1	–	–
Jumping [94]	1	–	–	–	25.0	4.2	–	–
Throwing [94]	1	–	–	–	18.9	17.0	–	–
Precision/skill-dependent	**9**	**3.3–22.1**	**9.5–44.1**	**8.3–28.6**	**NA**	**NA**	**48.9**	**13.3**
Ballet [46, 50, 54, 56, 75, 87]	6	3.3–20.0	9.5–44.1	28.6	–	–	–	–
Gymnastics [53, 86]	2	2.8	–	8.3	–	–	48.9	13.3
Rhythmic gymnastics [68]	1	22.1	–	–	–	–	–	–
Racquet sports [93, 94]	2	**NA**	**NA**	**NA**	**21.3–31.3**	**9.4–10.6**	**NA**	**NA**
Combat/weight-making	**1**	**NA**	**NA**	**NA**	**36.8–45.8**	**NA**	**NA**	**NA**
Taekwondo [67]	1	–	–	–	45.8	–	–	–
Judo [67]	1	–	–	–	36.8	–	–	–

Table from Taim et.al. 2023; Sports Medicine

MENSTRUAL CYCLE IMPACT ON SPORTS PERFORMANCE

PHYSICAL AND PSYCHOLOGICAL SYMPTOMS AFFECTING PERFORMANCE

Discussion in existing literature

Current literature from 1980s until now shows much heterogeneity in study methods, type of measuring the impact on sport performances and duration of follow-up/menstrual cycles.
Impact of menstrual cycle on sport performance is therefore a topic with a lot of debate.

Subjective impact

Athletes definitely report physical and mental impact of there cycle and cycle associated complaints on there sport performance, especially athletes with PMS.
Physical symptoms including bloating, cramps, and breast tenderness can reduce physical capability and endurance.
Mental symptoms like irritability and anxiety can impair focus and mental readiness during competition of training.

Symptom Awareness for Planning

Awareness of symptoms aids in scheduling training and competitions to optimize athletic performance, as it can happen that athletes need to cancel training due to severe PMS complaints or dysmenorrhea.

OBJECTIVE IMPACT

- **Mostly studied in lean sports/endurance sports, such as gymnastics, long distance running**
  - A lot of heterogeneity in these studies, showing different results (no impact vs. better VO2 max in follicular phase)
  - >> recent studies involve only 1-2 menstrual cycles, which is not enough to have strong conclusions or have a significant impact on performance changes.

- **Judo involves more explosive strength, balance and mental focus**
  - Improved strength and muscle building in the late follicular phase
  - Better adaptation of the body during late follicular phase
  - Ronca et al. : poorer cognitive function in ovulatory and especially during luteal phase

STRATEGIES FOR TRAINING AND COMPETITION ADAPTATION

Cycle Monitoring

Tracking menstrual cycles helps athletes plan training and competition to align with optimal physiological phases (for example mobile applications or coach management software).

Training Load Adjustment

(Late) follicular phase: train 3-5 times per week, with more focus on hypertrophic training rather than (strength) endurance.
Visible results after 6 weeks of training using this method. During weeks 1-6, there is first a period of neural adaptation.

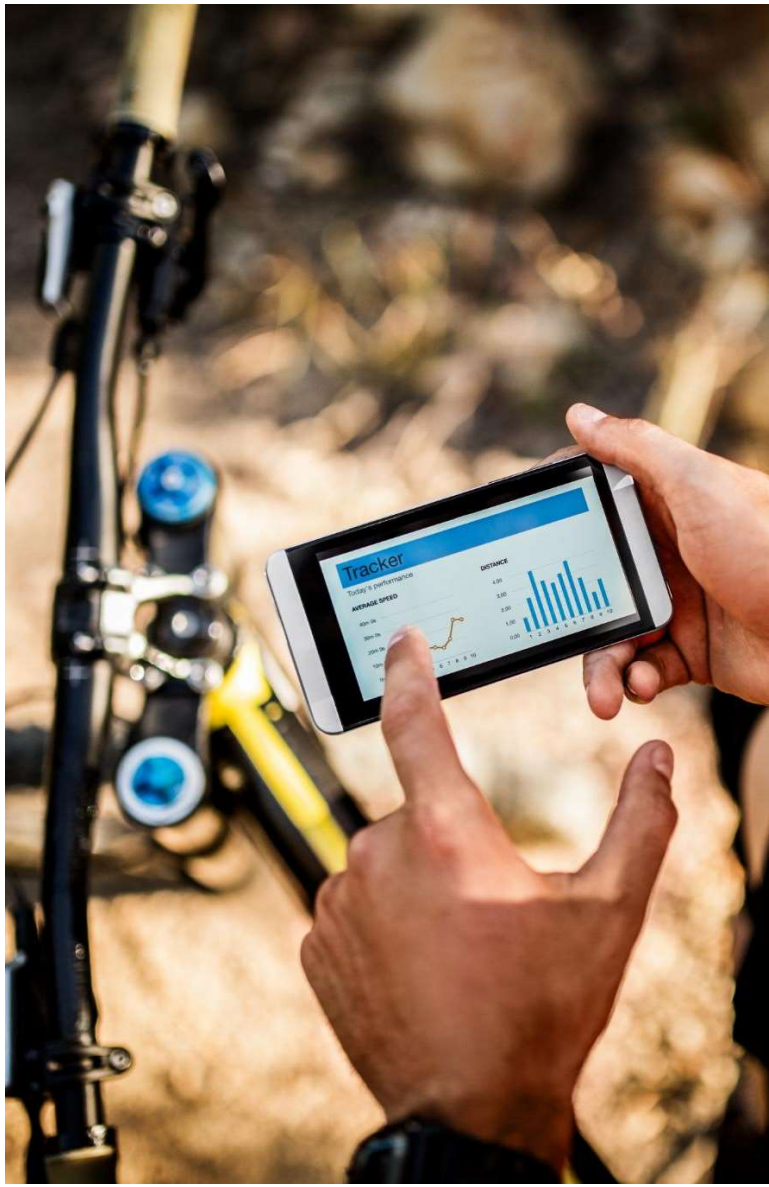
Luteal phase: train twice per week, with a focus on strength endurance

Event Scheduling

Planning major competitions during favorable menstrual phases enhances performance and reduces risks.

Symptomatic Treatment

Using treatments to manage symptoms allows athletes to maintain focus and physical readiness.



MENSTRUAL CYCLE AND INJURY RISK

FLUCTUATIONS IN INJURY SUSCEPTIBILITY ACROSS THE MENSTRUAL CYCLE

Increased Injury Risk at (pre-)ovulation

Estrogen increases laxity of ligaments and tendons and is associated with poorer neuromuscular control.

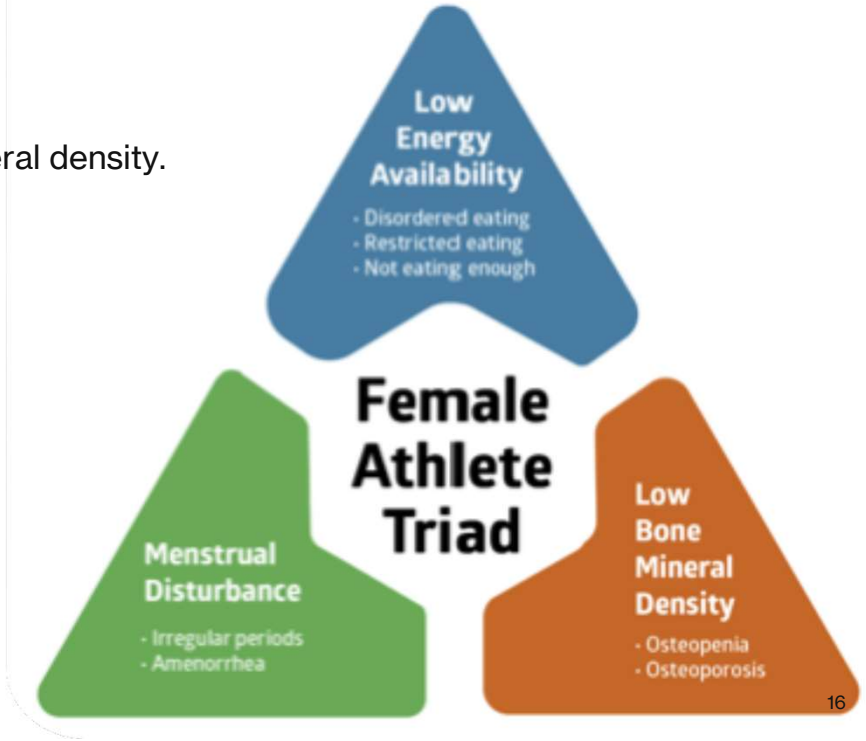
Higher risk of ACL injuries and muscle strain injuries.

Menstrual irregularity (MI)

FAT/REDs: interrelatedness of MI, low energy availability and diminished bone mineral density.

Hypo-estrogenic status:

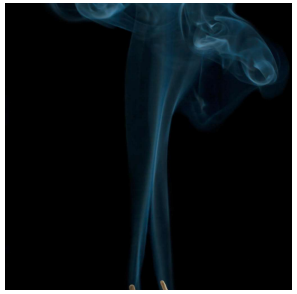
- More prone to bone stress injuries
- Impaired immunity
- At risk for cardiovascular disease
- Subfertility



MacMillan et al. 2024. Sports Medicine

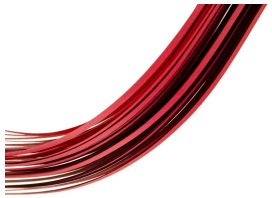
Angelidi et al. 2024. Endocrine reviews

COMMON MUSCULOSKELETAL INJURIES LINKED TO THE CYCLE



ACL Tears and Menstrual Cycle

Incidence of anterior cruciate ligament tears may increase during certain menstrual phases due to hormonal influences on ligament laxity.



Muscle Strains Risk

Muscle strains can be more common during menstrual cycle phases impacting muscle strength and flexibility.

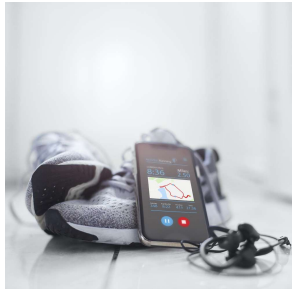
Joint Sprains Awareness

Joint sprains incidence may vary with menstrual cycle, highlighting the need for injury prevention awareness.

PREVENTION AND MANAGEMENT STRATEGIES

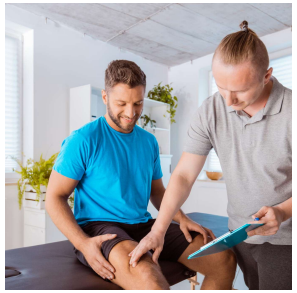
Injury Prevention Techniques

Prevention strategies include strength training and neuromuscular exercises to enhance muscle control and stability.



Workload Adjustment

Monitoring menstrual cycles helps adjust workloads to prevent overtraining and reduce injury risk.



Injury Management Approaches

Management includes physiotherapy and medical consultation to minimize injury severity and prevent recurrence.

OVERVIEW OF CONTRACEPTIVE METHODS

CONTRACEPTIVE PILL: TYPES, BENEFITS, AND CONSIDERATIONS

Types of Contraceptive Pills

Combined pills contain estrogen and progestin, while progestin-only pills serve as an alternative option.

Benefits of Contraceptive Pills

- Regulate menstrual cycles and reduce menstrual symptoms for many users.
- Increase type 1 muscle fibers
- Some research supports a protective effect of OC's on ACL tears

Considerations and Side Effects

- Weight gain in some athletes
- Less effective bone formation (lower estrogen levels?)
  → importance of good nutrition (calcium, vit D, etc.)
- Changes recovery after sport performance
- OC use might result in slightly inferior exercise performance on average (in group based studies), yet every individual is different (also in OC use)
  → Individual recommendations are necessary

Konopka et al. 2020. The American Journal of Sports Medicine
DeFroda et al. 2019. The physician and Sports Medicine
Elliot-Sale et al. 2020. Sports Medicine
Rickenlund et al. 2004. The Journal of clinical endocrinology and metabolism

HORMONAL IUD: MECHANISM, ADVANTAGES, AND SIDE EFFECTS

Mechanism of Action

Local progestin release:

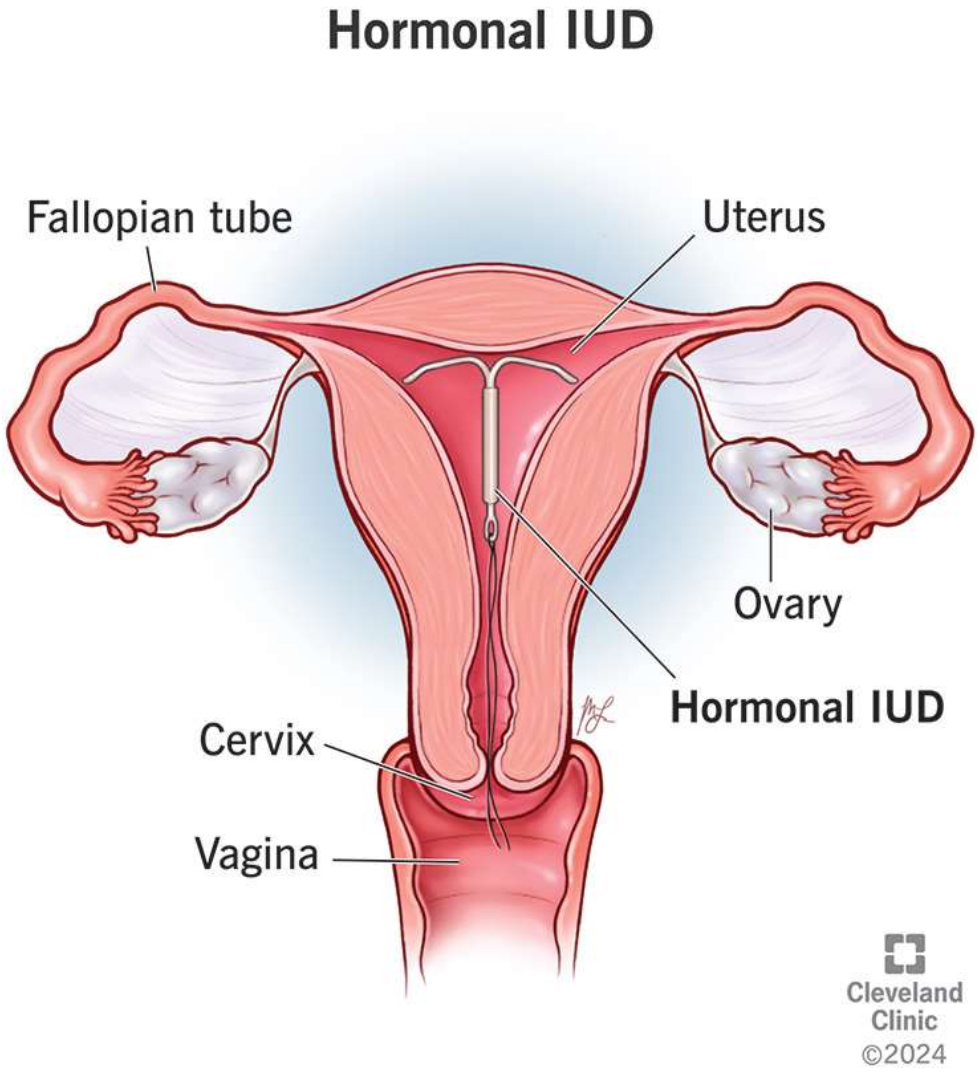
- Thinning of endometrial lining
- Thickening of cervical mucus
- Sometimes inhibiting ovulation (cave: risk of developing cysts!)

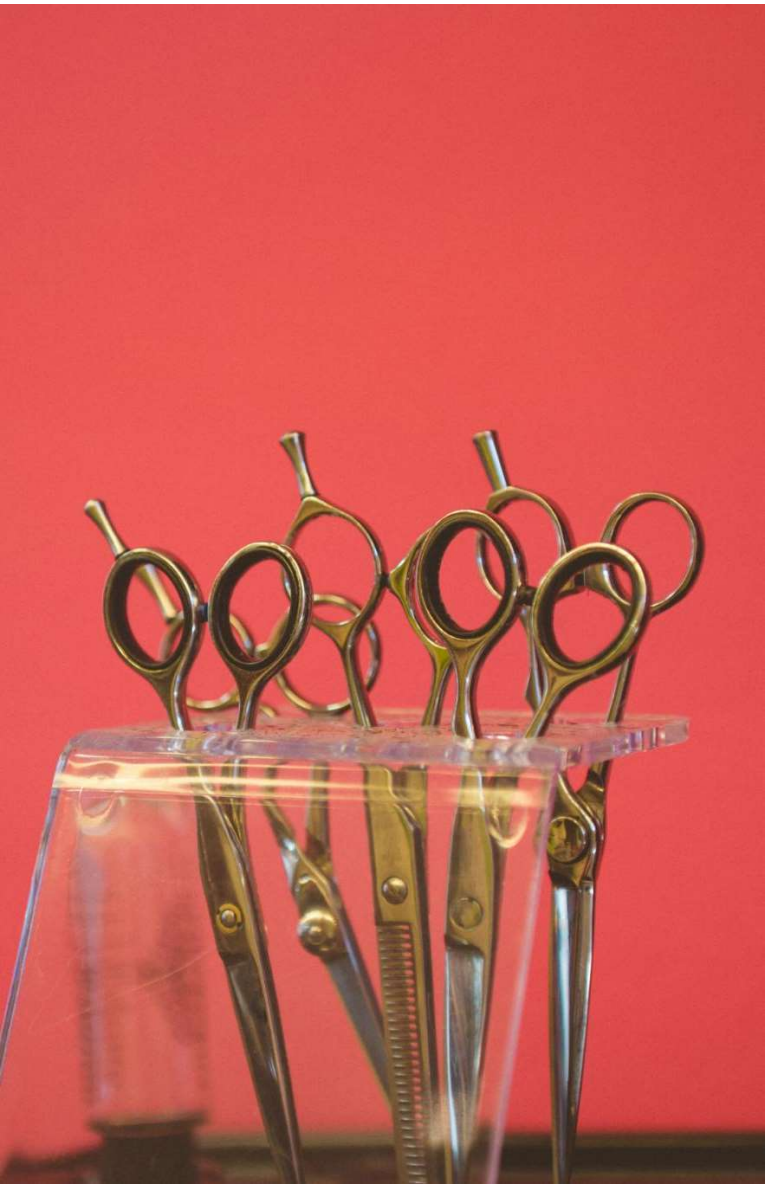
Advantages

Long-term contraceptive efficacy and reducing menstrual bleeding and associated dysmenorrhea

Possible Side Effects

- Spotting
- Hormonal effects in the first months after placement: mood changes or altered performance in some users.
- ~~Weight gain~~





COPPER IUD AND OTHER NON-HORMONAL OPTIONS

Copper IUD Mechanism

Copper IUDs prevent pregnancy by creating an environment hostile to sperm, without using hormones.

Barrier Contraceptive Methods

Barrier methods physically block sperm from reaching the egg, providing hormone-free contraception.

Natural Family Planning

Natural family planning involves tracking fertility signs to avoid pregnancy without hormonal intervention.

Advantages and Considerations

Non-hormonal methods avoid side effects but require user compliance and careful awareness.

KEY TAKE-HOME MESSAGES

MENSTRUAL CYCLE EFFECTS AND SPORTS

Menstrual cycle = complex hormonal balance

Menstrual cycle disorders are more present in elite athletes. Amenorrhea or oligomenorrhea may indicate energy deficiency (REDs), requiring training or even medical intervention!

Dysmenorrhea is most prevalent (>70%) and can be a reason for missing training sessions.

Sport performance

PMS complaints (luteal phase) can impact sport performance. Impaired cognitive functions and mental resilience in ovulatory and luteal phase.
Late follicular phase appears favorable for strength and muscle building (especially important in Judo).

MENSTRUAL CYCLE EFFECTS AND SPORTS

Injury Risk

Increased risk of muscle/tendon strain injuries and possibly ACL tears in (pre-)ovulatory phase, due to high estrogen levels.
Risk of reduced bone density.

Contraceptive methods

OC: cycle regulation, reducing PMS symptoms, protective factor for ACL tears?, but may affect performance/bone formation or cause weight gain in some athletes

Hormonal IUD: Local progestin release reducing dysmenorrhea and menstrual bleeding, but no effect on PMS complaints.

IMPORTANCE OF PERSONALIZED APPROACHES FOR ATHLETES

Individual Athlete Variability

Athletes have unique physiological cycles and responses that require personalized evaluation to optimize performance.

Tailored Training Adjustments

Training programs must be adjusted individually to enhance effectiveness and accommodate recovery needs.

Injury Risk Reduction

Personalized strategies help minimize injury risk by aligning training and recovery with athlete-specific responses.

CONCLUSION

Empowering Female Athletes

Understanding menstrual cycles and contraception helps female athletes optimize health and enhance performance with tailored strategies.

Collaborative Support System

Successful health and performance outcomes require collaboration between athletes, coaches, and healthcare providers.

MORE RESEARCH IS NECESSARY

- Remains a subject of much debate
- Only short periods/adjustments according to the cycle have been studied, with conflicting conclusions.
- Few studies are available on female elite judokas, especially on cycle disorders. Let alone on the impact on sport and injuries or how the training schedule can be adjusted accordingly.
- As part of Prof. Vermeir's PhD and my master's thesis as Gynecology resident, we would like to assess the menstrual cycle and its impact on elite female judokas and, if possible, propose any adjustments to training schedules.
  This will initially be done by completing a questionnaire and tracking the menstrual cycle.
- Any interested parties can contact myself or Prof. Vermeir.
  Lara.moons@ugent.be
  Peter.vermeir@uzgent.be (Promotor)