UiT The Arctic University of Norway

Faculty of Health Sciences

The perception of the menstrual cycle, cycle-related symptoms, and hormonal contraception in female endurance athletes: The FENDURA project

Tina Pettersen Engseth

A dissertation for the degree of Philosophiae Doctor – February 2024

Photo: Team Aker Dæhli

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Summary

Background: The current understanding of the menstrual cycle (MC) and hormonal contraceptive (HC) use in female athletes is scarce and the impact on training, performance, and recovery is inconclusive. Still, many athletes perceive MC/HC use and related symptoms to interfere with training, performance, and recovery. However, as most previous studies often include athletes from multiple different sports, or focus on team sports, there is a clear need for endurance-athlete specific research.

Objective: The overall objective of this PhD thesis was to explore the prevalence of HC use and the self-perceived influence of both the MC and HC use, including cycle-related symptoms, on training, performance, and recovery of female endurance athletes.

Methods: This project included a large cohort of competitive female endurance athletes. In *Paper I*, a cross-sectional design was applied using a retrospective questionnaire. *Paper II* and *III* were prospective cohort studies using self-reported measures. *Paper III* employed urinary ovulation tests each cycle to verify MC phases.

Results: Of all athletes, 68% used HC, of which 64% employed progestin-only HC. Sixty percent of the HC users reported non-contraceptive reasons for HC use, with cycle-related symptoms being the primary stated reason. The majority perceived a neutral or solely positive influence (81%) of HC usage on training and/or performance (*Paper I)*. Self-reported recovery measures appeared to be negatively influenced by mid-luteal phase (*Paper III*) and pre-bleeding days (*Paper II*). Furthermore, cycle-related symptom severity was negatively associated with both self-reported sleep quality and physical readiness to train (*Paper II*).

Conclusion: We found a higher prevalence of total HC use and an increased proportion in usage of progestin-only HC compared to previous studies. The most common reason for HC use was to attenuate negative cycle-related symptoms, with the majority of HC users perceiving a neutral or solely positive influence of HC use on training and performance. Furthermore, mid-luteal phase, pre-bleeding days, and cycle-related symptoms severity appear to negatively influence self-reported measures of recovery in HC and non-HC users. However, it is important to consider the presence of other possible stressors, as the MC/HC cycle and related symptoms are just one of many factors that can potentially influence recovery.

Sammendrag

Bakgrunn: Den eksisterende forståelsen av menstruasjonssyklusen (MC) og bruk av hormonelle prevensjonsmidler (HC) blant kvinnelige idrettsutøvere er mangelfull, og påvirkningen på trening, prestasjon og restitusjon er utilstrekkelig kjent. Likevel opplever mange utøvere at MC/HC-bruk og relaterte symptomer påvirker trening, prestasjon og restitusjon. Ettersom de fleste tidligere studier inkluderer utøvere fra forskjellige idretter eller fokuserer på lagidretter, er det et klart behov for forskning spesifikt rettet mot utholdenhetsutøvere.

Problemstilling: Det overordnede målet for denne PhD-avhandlingen var å utforske utbredelsen av HC-bruk og selvopplevd påvirkning av MC og HC-bruk, inkludert syklus-relaterte symptomer, på trening, prestasjon og restitusjon hos kvinnelige utholdenhetsutøvere.

Metode: Dette prosjektet inkluderte en stor gruppe kvinnelige utholdenhetsutøvere. I *Paper I* ble det brukt et tverrsnittsdesign og et retrospektivt spørreskjema, mens i *Paper II* og *III* ble prospektive kohortstudier med selvrapporterte målinger benyttet. I tillegg ble eggløsningstester benyttet for å verifisere MC faser i *Paper III*.

Resultat: Blant alle utøvere brukte 68 % HC, hvorav 64 % benyttet et kun-gestagenpreparat. Av alle HC-brukere rapporterte 60 % ikke-prevensjonsrelaterte grunner til HC-bruk, hvor syklusrelaterte symptomer var den mest vanlige årsaken. Flertallet opplevde at HC-bruk hadde en nøytral eller utelukkende positiv påvirkning (81 %) på trening og/eller prestasjon (*Paper I*). Selvrapporterte restitusjonsparametere så ut til å være negativt påvirket i midtre lutealfase (*Paper III*), samt i dager før blødning (*Paper II*). Videre var alvorlighetsgraden av syklusrelaterte symptomer negativt assosiert med både selvrapportert søvnkvalitet og «readiness to train» *(Paper II*).

Konklusjon: Sammenlignet med tidligere studier fant vi en høyere utbredelse av HC-bruk og en økning i bruk av kun-gestagenpreparater. Den vanligste grunnen til HC-bruk var relatert til å dempe negative syklusrelaterte symptomer. I tillegg opplevde flertallet en nøytral eller positiv påvirkning av HC-bruk på trening og prestasjon. Videre kan det virke som midtre lutealfase, dagene før blødning og alvorlighetsgraden av syklusrelaterte symptomer har en negativ innvirkning på selvrapporterte restitusjonsparametere. Likevel er det viktig å ta hensyn til andre mulige stressfaktorer, da MC/HC-syklus og relaterte symptomer, bare er en av mange faktorer som potensielt kan påvirke restitusjon.

List of tables

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List of papers

This thesis is based on the following research papers, and referred to in the text by their Roman numerals:

I. Engseth TP, Andersson EP, Solli GS, Morseth B, Thomassen TO, Noordhof DA, Sandbakk Ø, & Welde B. **Prevalence and self-perceived experience with the use of hormonal contraceptives among competitive female cross-country skiers and biathletes in Norway: The FENDURA project.** *Front. Sports Act. Living.* 2022 April 14;4(873222). Doi.org/10.3389/fspor.2022.873222

II. Engseth TP, Osborne J, Solli GS, Morseth B, Andersson EP, Topranin VDM, Taylor M, Noordhof DA, Sandbakk Ø, & Welde B. **Influence of menstrual/withdrawal bleeding on self-reported symptoms and recovery during an annual cycle in endurance athletes: The FENDURA project. (***Submitted/in review*)

III. Topranin VDM, Engseth TP, Hrozanova M, Taylor M, Sandbakk Ø & Noordhof DA. **The influence of menstrual cycle phase on measures of recovery status in endurance athletes: The FENDURA project.** *Int. J. Sports Physiol. Perform.* 2023 September 19;18(11). Doi.org/10.1123/ijspp.2022-0325

Abbreviations

BMI:	Body mass index
COC:	Combined oral contraceptive
EFP:	Early follicular phase
HC:	Hormonal contraceptive
HR:	Heart rate
Implant:	Subdermal implant
IUS:	Intrauterine system
LFP:	Late follicular phase
MC:	Menstrual cycle
MLP:	Mid-luteal phase
OP:	Ovulatory phase
POC:	Progestin-only oral contraceptive
REDs:	Relative Energy Deficiency in Sport

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1 Introduction

Women's participation in competitive sport has increased considerably over the past several decades, with the Tokyo Olympics 2020 setting a landmark as the first Olympic Games with an equal number of medals available for both sexes, as well as a record female participation rate of 49%.[1,2] However, a significant disparity persists in the representation of female participants within sport and exercise science research.[3] Consequently, the training, recovery and nutrition guidelines, which have been mainly developed through research conducted on male participants, have been also assumed to apply to women.[3] This necessitates coaches to rely on their own experience and intuition when working with their female athletes, thus, inadvertently reinforcing the notion that men are the setpoint, or golden standard, whilst women can be considered to be simply small men.[4]

1.1 Women are not 'small men'

It is well established that women and men have many physiological differences, with changes starting during puberty through the large increase in production of the different sex hormones; mainly testosterone in men, and estrogen and progesterone in women.[5] Compared to men, women have lower bone density, smaller bone size and higher bone fracture rates.[6,7] Women also have higher fat mass [8], and lower muscle mass, as well as different muscle fiber-type composition with lower percentages of muscle fiber type II.[9] Moreover, both the upper airways, lungs, and heart are smaller in women compared to men.[10,11] Consequently, maximal oxygen uptake is approximately 5–10% lower in women, even when normalized for fat-free body mass, presumably due to the higher hemoglobin concentrations and larger heart size.[8,11] Furthermore, women have a lower respiratory exchange ratio, indicating women are less reliant on carbohydrate oxidation as a fuel source during endurance training.[12,13] These physiological differences become particularly apparent after puberty and have a large impact on various sports performance variables.[8,11]

In sporting events, the performance difference between the world's best male and female athletes is approximately 8–12%, however, this discrepancy can vary from less than 5% to more than 12% depending on the specific sporting discipline.[8] For instance, the differences in energy metabolism between sexes may be linked to variations in muscle fiber-type composition and potentially results in slower contractile properties and more fatigue-resistant muscles in women.[14] This might play a role in ultra endurance sports, where the sex differences in performance tend to be less than 5%.[8] In

sports where upper-body exercise performance is dominant, the sex differences are somewhat greater than those observed in activities involving lower limbs or whole-body.[8] These differences can be explained by the relatively greater sex differences in upper-body muscle mass and power favoring the men.[8] When investigating sex differences in upper-body power, the findings reveal more pronounced differences than those reported in lower- and whole-body power assessments.[15]

In summary, previous evidence has clearly demonstrated that sex-specific hormones result in distinctly different endocrine profiles between women and men, which likely affect physiology and sporting performance. Therefore, it seems paradoxical that foundational training principles, proven to optimize performance development and avoid injuries and/or overtraining,[16] are mainly derived from scientific research conducted on men.[3,17] A study by Cowley et al. [3] revealed that studies exclusively conducted on women are significantly underrepresented, accounting for only 6% of sport and exercise science research. Moreover, their findings suggest a clear data gap regarding the current knowledge of female physiology.[3] Notably, few studies examining strength and endurance training have considered the possible impact of the menstrual cycle (MC) or use of hormonal contraceptives (HCs) as potential factors influencing the training and performance outcomes.[18,19]

1.2 Female sex hormones

In Norway, girls typically enter puberty at a median age of 10.4 years, with the median age for the first menstruation (menarche) being 12.7 years.[20] During puberty, there is an increase in production of estrogen and progesterone primarily in the ovaries, and these sex hormones start fluctuating across the MC.[21,22] These hormones play a critical role in the female reproductive system [23,24] and further influence various physiological functions such as bone health, energy metabolism and modulation of target tissues including the vascular-, central nervous-, and immune systems, as well as the skin, lungs and kidneys.[21,22,25,26] Additionally, both estrogen and progesterone contribute to thermoregulation, where estrogen lowers,- and progesterone increases, the core body temperature.[27] After ovulation, the peak levels of progesterone contribute to a rise in core body temperature, as well as increased heart rate (HR), and might negatively influence perceived exertion and performance.[28] Moreover, both progesterone and estrogen show substantial effects on mental function, with the highest prevalence of reported negative feelings such as anxiety and depression during the late luteal phase, when the sex hormone levels declines.[29]

Estrogen might have beneficial effects on exercise adaptations, recovery, bone growth, and muscle-mass and strength,[30-32] while at the same time influencing women's body composition by increasing fat in the subcutaneous tissue, which results in a higher fat percentage for women compared to men.[22,28] Furthermore, estrogen deficiency is associated with an impairment of skeletal muscle mass and -strength, as well as the ability to optimally recover from exercise.[26,30,33] Overall, both estrogen and progesterone can have a significant impact on women's physiological and psychological functions, and it is therefore possible that these hormones, which fluctuate over the MC, might influence training, performance, and recovery.[31,34]

1.3 The menstrual cycle

Estrogen, progesterone, follicle-stimulating hormone, and luteinizing hormone naturally fluctuate during the MC, which in its most basic terms can be divided into the follicular and luteal phases, separated by ovulation.[35] Each phase can further be divided into early, mid- and late phases, with or without ovulation considered as a discrete phase.[35]

1.3.1 A "normal" menstrual cycle

Eumenorrhea, from ancient Greek for "good monthly flow", refers to a normal/regular MC.[36] In research and medicine, a eumenorrheic MC must meet the following criteria: a cycle length within the range of ≥21 days and ≤35 days; evidence of luteinizing hormone surge (i.e., ovulation); a correct hormonal profile (i.e., mid-luteal progesterone concentrations ≥16 nmol·L^{-1}); and, no hormonal contraceptive (HC) use within the past 3 months.[35,36] In a eumenorrheic MC, there are four phases with significant fluctuations in both estrogen and progesterone that can be used when investigating the effects of ovarian hormones on different aspects of physiology and performance [35]:

- Phase 1, the early follicular phase (EFP), from the onset of menstruation (bleeding) until day 5, where estrogen and progesterone levels are low.
- Phase 2, the late follicular phase (LFP) when estrogen peaks 14–26 h before ovulation, while progesterone remains low.
- Phase 3, the ovulatory phase (OP), 24–36 h after ovulation and when estrogen concentration is lower than in the late follicular phase, while progesterone remains low.
- Phase 4, the mid-luteal phase (MLP), 7–9 days after ovulation and where estrogen concentration is high and progesterone peaks.

A visualization of the MC phases is presented in **Figure 1**.

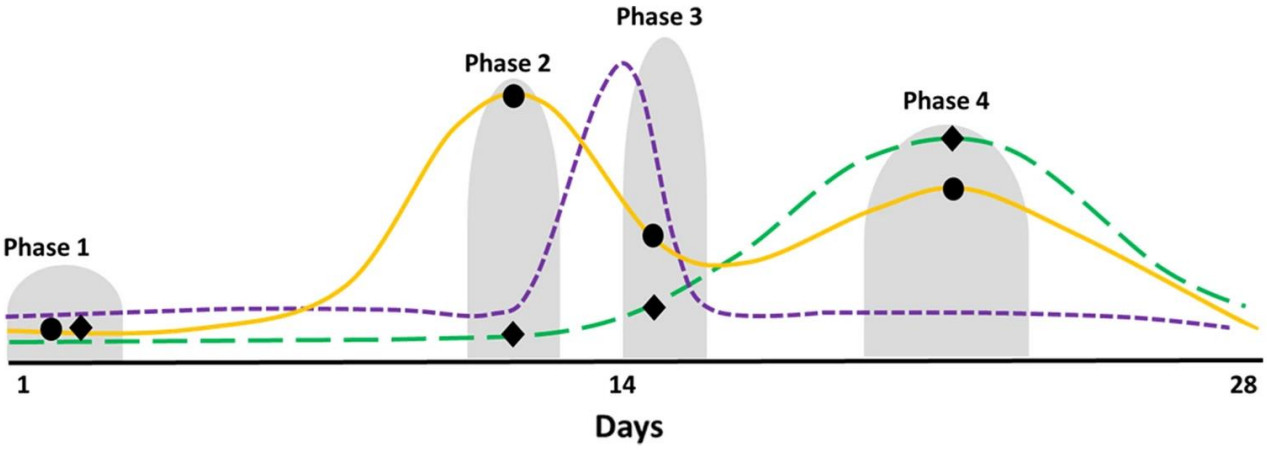

Figure 1. Overview of the menstrual cycle phases. Phase 1, early follicular phase; Phase 2, late follicular phase; Phase 3, ovulatory phase; Phase 4, mid-luteal phase. The solid yellow line represents estrogen with the black dots representing mean estrogen concentration in different phases. The long-dash green line represents progesterone with black diamonds representing mean progesterone concentration in different phases. The short-dash purple line represents luteinizing hormone. The figure has been retrieved with permission [37] from Elliott-Sale and colleagues [35].

To verify these MC phases, the use of three different verification steps is recommended: 1) calendar-based counting; 2) urinary ovulation testing; and 3) serum hormone analysis.[38] Eumenorrheic women can, however, experience variations in cycle characteristics, with differences both between and within individuals.[36,39-42]

1.3.2 Menstrual disturbances

The term menstrual disorders is used to describe ovarian dysfunctions, abnormal uterine bleeding, as well as symptoms associated with negative cycle-related symptoms, that causes personal or functional impairment.[43] Ovarian dysfunctions and abnormal uterine bleedings can further be categorized as severe and subtle menstrual disturbances.[43,44] Severe menstrual disturbances include oligomenorrhoea (i.e., cycle lengths between 35–90 days), as well as primary and secondary amenorrhea, which are characterized as failure to reach menarche and the absence of menstruation for ≥3 months, respectively.[43,44] Subtle menstrual disturbances include luteal phase deficiency

(short or inadequate luteal phase, or mid-luteal progesterone levels of <16 nmol·L^{-1}) and anovulation.[43,44]

Female athletes are known to be more prone to menstrual disturbances caused by ovarian suppression than the general population.[43] This is especially true for endurance sports, such as cross-country skiing and biathlon, due to the high volume and intensive endurance training, which have been associated with low energy availability and can potentially can lead to menstrual disturbances.[43,45] Low energy availability is caused by an inadequate energy intake compared to the exercise energy expenditure,[46] where serious and/or prolonged low energy availability can lead to impaired physiological and/or psychological functioning, defined as 'Relative Energy Deficiency in Sport' (REDs).[46,47] This condition includes impaired bone health, skeletal muscle-, cardiovascular and reproductive function, sleep disturbance and mental health issues, which in turn might negatively impact sport performance outcomes like endurance and power performance, training response, recovery, and motivation.[46] As part of REDs, menstrual disturbances and impaired bone health caused by low energy availability, are also known as the female athlete triad.[46] Raising awareness of the potential indicators and impact of REDs is important to optimize athletes' well-being, health, and performance. As such, menstrual function is a crucial indicator of female athletes' health status.

1.3.3 Cycle-related symptoms

Cycle-related symptoms (e.g., abdominal cramps and bloating, heavy bleeding, nausea, lower back pain, weight change, acne, and sleep disturbances) are experienced by around 70–80% of menstruating women,[48,49] and can have a considerable impact on women's quality of life.[50] The cycle-related symptoms are thought to be related to fluctuation of estrogen and progesterone, as well as production of prostaglandins when progesterone decreases in the days prior to and during menstruation.[50] Prostaglandins are released to expel the endometrium, but excessive prostaglandin secretion can cause pain and lead to dysmenorrhea (painful menstruation).[51] Additionally, genetic factors may also play a role in the occurrence of cycle-related symptoms, where dysregulation of serotonin is associated with symptoms of depression and fatigue.[50,52] It has been hypothesized that women of fertile age with premenstrual syndrome (up to 50% of the population), or the more severe form, known as premenstrual dysphoric disorder (2–8%),[48] are more sensitive to hormonal fluctuations during the MC, possibly due to vulnerability in the serotonergic system.[29,50]

The severity and presence of cycle-related symptoms experienced are highly individual,[53] although most prevalent in the late luteal and EFP.[34] For some women the negative symptoms can even interfere with factors such as perceived sleep quality [49,54,55] and work,[53] as well as increase perceived stress.[56] To alleviate cycle-related symptoms, HCs are often used to manage symptoms.[57-59] However, cycle-related symptoms are reported in HC users as well,[48,60-63] although some findings suggest a higher prevalence of cycle-related symptoms in non-HC users compared to HC users.[48,61] As cycle-related symptoms are one of the main reasons for HC use in the athletic population,[62,64] it can be speculated that women with more severe symptoms tend to use HCs to alleviate these symptoms, which could be a reason for why some findings indicate similar symptomology between HC users and non-HC users.[62]

1.4 Hormonal contraception

The first hormonal delivery method approved in the USA in the late 1950s, were combined oral contraceptives (COCs) which worked as contraception against unwanted pregnancies.[65] Since then, the synthetic estrogen dose in COCs has decreased and progestins, and progestin-only HCs, have been further developed to try and lower the risk of venous thromboembolism, a known potential side-effects of COCs.[66] Hormonal contraception comes in various delivery methods, but can be divided into two different types: progestin-only and combined HCs.[67] An overview of HCs available in Norway is presented in **Figure 2**.

1.4.1 Progestin-only hormonal contraception

Progestin-only HCs include daily oral- and 3-months injectable contraception (injection), as well as the long-acting reversible methods intrauterine systems (IUSs) and subdermal hormonal implant (implant).[68] All progestin-only delivery methods can cause changes in bleeding patterns, where users can experience cyclical monthly bleedings, unscheduled bleeding and spotting, as well as amenorrhea.[67]

Currently, there are four different intrauterine system (IUS) brands and one implant approved in Norway.[69] The IUSs does not primarily suppress ovulation, but rather provides a local progestin effect including endometrial atrophy and cervical mucus thickening, while for the implant, ovulation suppression is the primary mechanism to prevent pregnancies.[67] Intrauterine systems, together with implant, have shown to be highly effective in preventing pregnancies, with prevention rates almost equal to female sterilization.[70] Due to their high effectiveness as contraception, as well

as the lack of venous thromboembolism risk, IUSs and implant are recommended by the Norwegian Medicines Agency to all women starting on HCs.[71,72] Regarding progestin-only oral contraceptives (POCs) and injection, both prevent pregnancies by suppressing ovulation, in addition to thickening cervical mucus and cause endometrial atrophy.[67,69] In Norway, there are currently four POCs and one injectable brand available in Norway.[69]

1.4.2 Combined hormonal contraception

Combined HCs are a type of preparations containing synthetic estrogen and progestins. The combined HCs are often taken in a cyclic manner with 21–24 days of active pill, ring, or patch use and an inactive (hormone-free) interval, resulting in withdrawal bleeding.[67,73] The concentration of the synthetic hormones varies between the different delivery methods and brands and can be further divided into daily oral contraception, or non-daily short-acting reversible contraceptives, vaginal ring and transdermal patch.[68]

The primary mechanisms of COCs, transdermal patch, and vaginal ring are to prevent ovulation,[70] as well as to induce changes in cervical mucus to prevent sperm passing.[68,74] While there are a numerous of combined oral contraceptive (COC) brands available in Norway, there are only two brands of vaginal ring and one transdermal patch.[69]

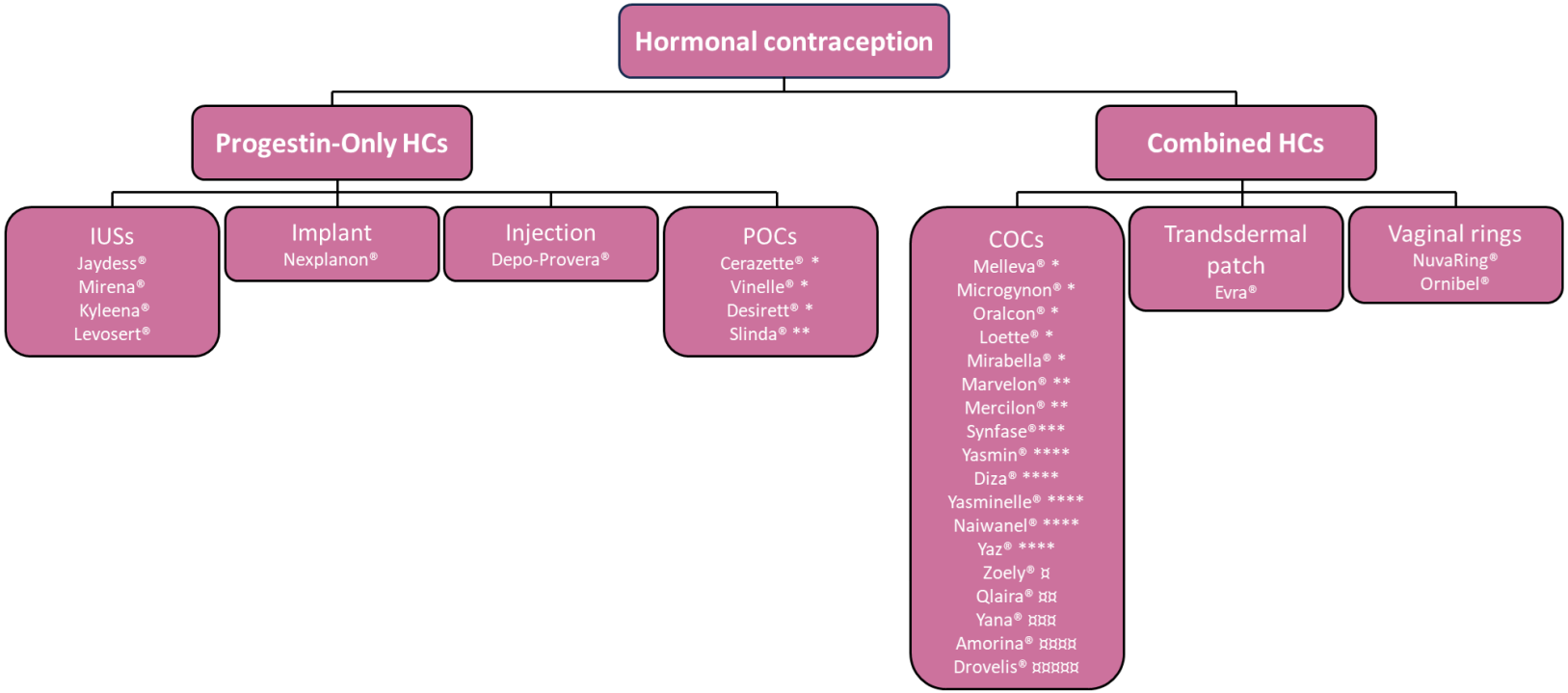

Figure 2. Overview of hormonal contraceptives (HCs) available in Norway. Intrauterine Systems (IUSs), 6–20 µg levonorgestrel in 24 h over 3–8 y; Implant, ~40 µg etonogestrel in 24 h over 3 y; Progestin-only oral contraceptives (POCs), * 75 µg desogestrel, ** 4 mg drospirenon; Injection, 150 mg medroxyprogesterone acetate; Combined oral contraceptives (COCs), * levonorgestrel 100–150 µg and 20–30 µg ethinyl estradiol (EE), ** desogestrel 150 µg and 20–30 µg EE, *** noretisteron 0,5–1 mg and 35 µg EE, **** drospirenon 3 mg and 20–30 µg EE, ¤ nomegestrolacetat 2,5 mg and 1,5 mg estradiol, ¤¤ dienogest 2–3 mg and 1–3 mg estradiol valerate, ¤¤¤ dienogest 2 mg and 30 µg EE, ¤¤¤¤ norgestimat 250 µg and 35 µg EE, ¤¤¤¤¤ drospirenon 3 mg and 14,2 mg estetrol; Trandsdermal Patch, norelgestromin 6 mg and 600 µg EE; Vaginal rings, etonogestrel 11,7 mg and 2,7 mg EE [69].

1.4.3 Side-effects

Apart from preventing pregnancies, HCs also have other benefits. Hormonal contraceptives, both progestin-only and combined, can alleviate dysmenorrhea (painful menstruation), menorrhagia (heavy bleeding), premenstrual syndrome and may treat mild to moderate acne.[58,59] Moreover, both combined and progestin-only HCs are used as treatment for endometriosis- and polycystic ovary syndrome symptoms.[75-77] However, there are also different negative side-effects related to HC use, where the most severe side-effect is related with the risk of venous thromboembolism in combined HCs.[78] Other side-effects related to HC use are, for instance, mood disturbances, weight gain, fatigue, nausea.[58,59,69,78,79] In progestin-only HCs, the main reason for discontinuation appears to be related to changes in bleeding pattern, which can become both irregular and unpredictable.[80] The progestin-only HCs can also lead to cessation of menstruation (amenorrhea), however, in many cases this is considered a positive effect.[58] Although many athletes report positive effects include greater control, less, or even cessation of bleeding,[64] exogeneous hormones in HCs will suppress the endogenous hormones, which will change the hormone profile and potentially mask menstrual disturbances.[44]

1.5 Influence of the menstrual cycle and hormonal contraception on training, performance, and recovery

The fluctuating ovarian sex hormones have a large impact on several functions in a woman's body,[81,82] which, as described in **1.1**, results in many physiological differences compared to men. Therefore, it is likely that the fluctuating hormones can affect both objective and subjective measures related to training and performance.[82]

1.5.1 Effect of the menstrual cycle and hormonal contraception on objective measures of training, performance, and recovery

To understand the impact of female sex hormones on exercise and performance variables, it is necessary to shift research focus towards investigating these hormone fluctuations rather than merely considering them as potential confounding factors.[82] To do so, it is crucial to control for the hormone fluctuations to verify the MC phases,[38] as the ovarian hormones can be altered by external factors such as menstrual disturbances.[35] Therefore, it is recommended to use a three-step verification method (i.e., calendar-based counting, urinary ovulation testing, and serum hormone verification).[38] For HC users, it is recommended to stratify groups based on the type, delivery

method, and formulations of exogenous hormones to ensure the groups are as homogenous as possible.[35] Furthermore, in cases where athletes use combined HCs, and thereby will have active and inactive phases of exogeneous hormones, it is recommended to distinguish between these phases.[35]

Drawing upon the existing body of research, various systematic reviews have investigated the influence of MC and HCs on exercise performance, strength/power, and adaptation to resistance training.[18,19,31,42,83,84] In the systematic review by McNulty et al.,[31] exercise performance was compared between MC phases, with findings indicating a slightly reduced performance during the EFP compared to all other phases. According to McNulty et al.,[31] this decrease in performance might be due to the different mechanisms related to the ovarian sex hormones, as for instance estrogen is thought to have an anabolic effect on skeletal muscle and influencing energy metabolism. When compared to naturally menstruating women, individuals using COCs appears to have a trivially reduced exercise performance, while no differences were found between different phases of the COC cycle.[19] This reduction in performance is speculated to be due to the downregulated endogenous hormones from COC use, as the hormonal profile for COC users is comparable to the EFP in naturally menstruating women.[19,31] However, the methodological shortcomings in the studies reviewed, characterized by large heterogenicity (e.g., inclusion criteria and study design) and lack of MC/HC cycle verification and thereby compromising the overall quality of the studies, impede definitive conclusions and recommendations.[18,19,31,42,83,84]

Although there is no clear evidence that MC phases or HC use affect strength and muscle hypertrophy, research has proposed that MC phases may have a small effect on measures of recovery, indicating a greater need for recovery in the EFP.[42,85] In addition, one review reported that the use of COCs may impair recovery from exercise-induced muscle damage compared to naturally menstruating women.[84] Nevertheless, this review also stated that interpretation of the findings was challenging due to the large risk of bias.[84] Importantly, when investigating HC use and non-HC use, there are several confounding factors that needs to be considered.[19] For instance, the many different delivery methods, or the reasons for use, as HCs are often used for symptom management and/or treatment. Concerningly, the vast majority of research investigating the influence of HC use on various training-, recovery-, and performance measures have focused on COCs.[86] Therefore, the influence of other delivery methods on the different performance and training variables is sparse,

even though it has been noted that the type and dosage of synthetic estrogen and progestins may have a potential impact on different training/performance outcomes.[18]

With the lack of high-quality evidence to prescribe training and performance guidelines based on the MC or HC use, an individual approach has been recommended [19,31,42] and using a qualitative approach for analyses of the literature has also been suggested.[42] Carmichael and colleagues [87] addressed this issue in a narrative review by exploring findings from studies investigating both objective and subjective measures of performance. Their findings showed a relatively large negative impact of the late luteal phase on perceived performance outcomes, while the evidence for objective measures were inconclusive. It was further discussed that the negative impact during the late luteal phase could be due to cycle-related symptoms and/or the drop in ovarian sex hormones during this phase.[87] This might explain the findings of Dam et al.,[88] where psychological measures and well-being, and not physiological measures, were identified as predictors of variations in power performance. This highlights the possible influence of perceived measures on sporting performance.[87]

1.5.2 The self-perceived influence of the menstrual cycle and hormonal contraception on training, performance, and recovery

As described above, the current knowledge about how the MC and HC use affect objective measures related to training, performance and recovery are inconclusive.[19,31,42,83-85,89] Therefore, a personalized approach has been recommended when considering response to training and performance across the MC or with HC usage. Still, many athletes perceive the MC/HC use and related symptoms to interfere with training, performance, and recovery.[62-64,87,88,90-97]

In the study by Prado et al., [93] the findings suggest that although no changes were found in physiological responses between MC phases, the psychological responses showed higher levels of depression and hostility, and lower levels of motivation and vigor in the late luteal phase compared to the follicular phase. Differences in psychological measures between MC phases were also found by Garcia et al.,[92] with the most negative influence on behavior changes, anger, anxiety, and pain during menstruation and the late luteal phase. Bruinvels, Hackney and Pedlar [34] also discuss the impact of cycle-related symptoms on performance and overall wellness, such as sleep, recovery, and mood. They highlight that sports scientists should have an open approach and investigate all aspects of the MC, where the pre-menstruation is especially mentioned as a crucial phase, although arguably an ignored area in sports science research.[34]

In the narrative review by Carmichael et al., [87] it is apparent that athletes perceive their performance to be influenced by the MC phases, with a negative influence especially during the late luteal and EFP. As described in **1.3.3,** this is when negative cycle-related symptoms are most prevalent, and those who experience more severe symptoms, appears to be most affected.[63,91,96,98-102] In the study by McNamara, Harris, and Minahan,[99] athletes that reported more symptoms and pain, and/or the use of painkillers, were more likely to perceive an impact on their performance. In addition, most of the athletes expressed a belief that their optimal performance window was immediately following their bleeding days. Studies on recreational women have found an association between cycle-related symptoms experienced and avoidance and/or changing of training- participation and schedules.[49,91,101] Although most athletes (~80%) experience cycle-related symptoms, [61,62,64,90,99] the percentages who change/refrain from training are only between 4–22%.[64,90,98] For athletes that adjust their training, the most common changes are reported to be reduction of intensity and/or duration.[90] The low proportion of athletes changing their planned activity, might be a possible explanation for why Garcia et al. [92] found no change in %HR maximum or average treadmill speed when investigating self-selected exercise intensity. Notably, the participants were less motivated to start exercise and felt more affective valence during menstruation. In the study by Armour et al.,[102] cycle-related symptoms were associated with fatigue and reduction in perceived performance, where those that experienced heavy bleeding were more likely to experience fatigue. The negative impact of cycle-related symptoms on perceived performance was also found in the study by McNulty et al.[63] Interestingly, the non-HC users in their study perceived the recovery time to be longer during menstruation, while they found no differences between the HC phases (i.e., pill-taking vs pill-free days). However, their findings indicated an association between the severity of cycle-related symptoms and the perceived extended recovery duration in both HC users and non-HC users.[63]

There is a wide range of cycle-related symptoms experienced by women, and the symptoms vary broadly between individuals.[103] Moreover, it appears that many women, both in the general- and athletic populations, use HCs as symptom management and to manipulate their MC.[62,64,94,98,104] However, most studies that have investigated the effect of HCs focus on COCs, while there is a sparse knowledge about experiences and perceptions of progestin-only HC usage.[86] Although previous studies have reported combined HCs as the most common type in the athlete population,[64,90,98] the prevalence of progestin-only HC usage have increased markedly in the general population in Norway in recent years,[72] which potentially can also have influenced the prevalence

among athletes. As the specific effect of HCs on the ovarian hormone profile depends upon the delivery method used,[44] the different delivery methods should be considered when designing research studies.[35]

With over 50% of the athletic population using HCs, understanding the reasons for usage and how HCs influences self-reported measures that might interfere with factors potentially affecting recovery, training adaptations and performance is crucial. Hormonal contraception can, as described in **1.4.3**, mask potential menstrual disturbances.[44] For endurance athletes, the prevalence of menstrual disturbances is higher than in the general population, although comparable with aesthetic sports.[43,105,106] As most studies that have investigated the influence of MC/HC use on perceived recovery, training, and performance, are primarily based on retrospective questionnaires and often include multiple sports, or team sports,[62,64,94] there is a clear need for endurance-athlete specific research with a longitudinal approach to be undertaken.

1.6 Training and recovery in endurance athletes

To perform at the highest level in cross-country skiing and biathlon, the physiological demands (in general) require yearly training volumes of 700 to 950 hours, where the intensity is distributed with approximately 90% low intensity, and between 3%–7% and 5%–8% moderate to high intensity, respectively.[107] In Norwegian female cross-country skiers and biathletes competing at regional to international level, the annual physical training volume is recently reported to be 650 and 750 hours, respectively, of which ~90% consisted of endurance training.[107] Utilizing a high amount of low-intensity training is proposed to improve efficiency and aerobic capacity, as well as develop tolerance for high training loads through a more rapid recovery.[108]

To optimize athletes' long-term development and adaptation to training, as well as maximize performance, a balance between appropriate stress and adequate recovery is crucial.[109,110] While training induces adaptive effects and stress reactions,[111] recovery is a complex and multifaceted restorative process involving various body systems, including both physiological and psychological aspects.[109,112] Thus, an athlete's recovery status will be influenced by physical, mental, and social stress, as well as sleep and nutrition.[109,113] As such, there is a possibility that the MC and cycle-related symptoms might influence different recovery measures, and thus extend the recovery course.[34,52] For instance, Cristina-Souza et al. [52] found training monotony and strain to be higher during the follicular phase compared to the OP and associated with perceived cycle-related

symptoms. As women train and compete with both fluctuating ovarian sex hormones, possible negative influence of cycle-related symptoms, and/or the suppression of sex hormones through use of HCs, it is essential to undertake research that investigates various recovery measures in this context.

1.6.1 Measures of recovery

Recovery is a complex term used to describe the physiological and psychological process to restore resources and regain performance after applied stress and strain. [109,113,114] Therefore, the most accurate test of recovery is the performance in competitions. However, this is not feasible on a daily basis and athletes are therefore dependent on objective and subjective measures to monitor their recovery status.[113] To do so, monitoring of training load (e.g., intensity and duration), fitness/performance indicators (e.g., maximal oxygen consumption, HR response, blood lactate, and rate of perceived exertion), and various aspects of fatigue and recovery (e.g., subjective fatigue, mood, soreness, sleep and readiness to train) can provide important information about an athlete's response to training, recovery status and well-being.[110,115-117] Systematic monitoring of different recovery measures ensures better control for evaluating recovery status, and thereby helps prevent nonfunctional overreaching, overtraining syndromes, and further injuries or illnesses.[109,118] Nevertheless, it is important to recognize that the different measures only provide partial and often indirect insights into the understanding of recovery. Additionally, different measures can give contradicting feedback, and thus must be evaluated accordingly.[113] The different recovery measures used in this PhD thesis are described in more detail below.

Readiness to train/compete

Performance is described as the golden standard to assess readiness, and the physical and psychological well-being in athletes.[117] However, using highly demanding tasks to test athletes' readiness is not feasible in sport practices.[109,117] Hence, an athlete's self-perceived readiness might be a more applicable determinant of recovery,[109] as findings suggest subjective measures can reflect both acute and chronic training-related changes.[117] In fact, monitoring physical and mental readiness to train/compete is found to identify and distinguish functional overreaching and acute fatigue by using simple visual analog scales.[116] Since monitoring of physical and mental readiness to train is easy to undertake 'in the field', athletes are encouraged to record these factors in their training practices.[43,116] Ackerman and colleagues [112] also recommend using readiness to train as one possible measure to assess decreased recovery, one of the REDs components. Thus, readiness to

train/compete can provide valuable information about recovery in addition to the ability to perform. It is also worth noting, that it is not only the training-specific stressors that can influence an athlete's readiness, as various sources of stress in everyday life,[119] as well as cycle-related symptoms [43] might have a potential impact. For instance, a need for extended recovery time in the pre-menstrual and menstrual phases has been proposed,[34] suggesting that possible readiness to train can differ across MC phases. However, more research is necessary to investigate this association.

Perceived sleep quality

Sleep is an essential factor for maintaining efficient recovery and thus plays a significant role in general well-being.[109] However, sleep can be disrupted by different factors, such as psychological disturbances, which is frequently associated with underrecovery,[109] and indicators of low energy availability, and REDs.[46,47] Interestingly, there appears to be conflicting findings between objective and subjective measures of sleep quality,[120] but subjective measures may better reflect training response and recovery than objective measures.[117]

Other factors that might influence sleep quality are the hormonal fluctuations during the MC, as well as cycle-related symptoms.[51,121] One recent study found perceived sleep quality to be impaired during pre-menstrual days (the five last days before the onset of bleeding) compared to other phases of the MC. When potential confounding factors, such as perceived stress and social support, were included into the analyses, the findings were no longer significant, and the authors proposed that stress and social support were more important determinants than the MC.[122] Notably, this study consisted of several limitations such as combining HC users and non-HC users into a single group, as well as a lack of MC phase verification and any detection of menstrual disturbances.[122] The study by Baker and Driver,[123] where detection of ovulation as included, found perceived, but not objective sleep quality to be poorer during premenstrual- and menstrual days, compared to other phases of the MC in young women without premenstrual syndrome symptoms.

Cycle-related symptoms have been associated with impaired sleep quality and sleep disturbances, with those who experience cycle-related symptoms having a 2.5 to 3 times greater likelihood to report anxiety, depression, sleepiness and pain.[50] Additionally, primary dysmenorrhea (painful menstruation) has been related to shorter sleep duration and later bedtime.[51] For athletes, experiencing cycle-related symptoms is one of the most common reasons for using HCs.[62,64] However, studies investigating the impact of HCs on sleep quality provide conflicting findings, and a recent meta-analysis showed no differences between HC users and non-HC users.[124] Interestingly,

doses of synthetic progestins and route of administration might affect various aspects of sleep.[125] Since perceived sleep quality is an important factor to evaluate recovery, more studies focusing on athletes that use, or are not using, HCs are warranted.

Resting heart rate

Endurance training over time may lead to a lower resting HR, and monitoring resting HR is therefore proposed as an easy-to-use tool to evaluate adaptations from endurance training.[126] Additionally, training as an acute stressors, normally increase resting HR and decrease HR variability in the short term through the activation of the sympathetic system in the autonomic nervous system.[127] Thus, monitoring changes in resting HR over shorter (day-to-day) and longer training periods can provide useful information about cardiovascular fitness and performance development, as well as detect fatigue and non-functional overreaching.[109,112,126,128,129] Heart rate measures, when considered together with training logs, performance tests, and other wellness and recovery measures, can provide a comprehensive and individualized overview of an athletes' training status.[109,128,130]

The individual approach includes understanding of the normal day-to-day variations in resting HR, which may be up to 13%.[126] Moreover, potential changes in resting HR and HR variability across the MC and HC cycle have been observed.[127,131,132] The possible increase in HR during the luteal phase of the MC is relatively small (+1.6% [127]; ~+3 beats/min [133]), but may be indicative of the higher metabolic rate,[134] and/or rise in basal body temperature reported during this phase.[133] A similar pattern, with slightly increased resting HR during the last two weeks with active pills, is found in progestin-only oral contraceptive (POC) users, while in contrast COC users appear to have a divergent pattern, with higher HR during the first days after withdrawal before decreasing throughout the active pill weeks.[132] However, studies investigating differences in resting HR across HC cycles in female endurance athletes is lacking, and therefore needs additional research.

1.7 Rationale of the thesis

Current knowledge about the athletes' perceived influence of MC and HC use on training, recovery, and performance are mostly based on cross-sectional studies conducting retrospective questionnaires, or prospective studies tracking athletes over a relatively short period of time.[61-64,90,97] The reasons for HC use appear to be mostly due to a wish for MC manipulation or symptom management, however, the more in-depth reasons why athletes choose to manipulate their MC is not fully understood. Moreover, there is sparse knowledge about progestin-only HCs, as most studies have focused on COCs.[86] Thus, few studies have compared athletes' experiences with the different types of HC.

Furthermore, the understanding of how different days or phases in the MC/HC cycle influence self-reported measures of recovery are lacking, while at the same time, it has been suggested that athletes have a greater need for recovery during pre-bleeding and bleeding days.[85] As pre-bleeding days have been largely ignored within sports science research, it is essential that future studies investigate this potentially important time period within the MC/HC cycle. Similarly, longitudinal observational studies are also necessary to gain a more nuanced understanding of how perceived recovery can be influenced by the MC/HC cycle. Finally, it is important to use recommended methods to verify the eumenorrheic MC when evaluating how MC phases can influence perceived recovery.

2 Aims of the thesis

The overall objective of this PhD thesis was to explore the prevalence of HC use and the self-perceived influence of both the MC and HC use, including cycle-related symptoms, on training, performance, and recovery of female endurance athletes. This overall objective was further divided into separate aims that were examined in three papers (*Paper I-III*) using different methodologies and approaches.

Aims of the different papers:

Paper I: Previous studies provide limited insight into differences between HC types, reasons for HC use and how the different types of HC influence training and performance of female endurance athletes. By employing a cross-sectional design and a questionnaire, the first paper therefore aimed to:

1. Investigate the prevalence of different types of HC (progestin-only vs. combined HCs) used by female cross-country skiers and biathletes competing at a national and/or international level.
2. Explore the athletes' reasons for HC use.
3. Compare negative symptoms related to the MC/HC cycle experienced by HC users and non-HC users.
4. Characterize the self-perceived influence of HC use on training and performance.

Paper II: Athletes specifically perceive that the pre-bleeding and bleeding days, along with cycle-related symptoms negatively interfere with their training, performance, and recovery. However, most studies examining athletes' self-perceived influence of the MC or HC use, as well as associations with cycle-related symptoms, rely on retrospective questionnaires. By using a longitudinal prospective design and self-reported measures, the second paper aimed to investigate the:

1. Differences in self-reported symptoms and recovery measures between pre-bleeding, bleeding, and non-bleeding days in HC users and non-HC users.
2. Associations between symptom severity and recovery measures.

Based on data presented in the methods in *Paper II*, a *supplementary analysis* was conducted, with the aim to characterize individual bleeding patterns in non-HC users and HC users. These analysis will be presented alongside *Paper II* in the results section of chapter **5.2.1** and discussed in chapter **7.4**.

Paper III: To enhance the quality of research and enable more meaningful comparisons between studies, Elliott-Sale and her colleagues [35] have presented a comprehensive set of methodological considerations and recommendations for conducting studies involving female participants. They emphasize the significance of four distinct phases within the MC, each characterized by substantial fluctuations in both estrogen and progesterone concentrations. These phases provide valuable opportunities to investigate the impact of ovarian hormones on variables such as performance and recovery in naturally menstruating athletes. By applying both the calendar-based counting and urinary ovulation prediction tests, the aim of *Paper III* was to:

1. Investigate the influence of MC phase on measures of recovery status, such as resting HR, perceived sleep quality, and physical and mental readiness to train among naturally menstruating female endurance athletes.

3 Scientific approach

As there is no consensus of how the MC and HC use may influence training, recovery and performance, and the use of a more individual approach has been recommended, it was imperative to undertake applied research inspired by the abductive approach [135,136] in this dissertation. The abductive approach is pragmatic, as it offers openness to new theories similar to the inductive approach, while building on existing research findings, comparable to the deductive approach.[135,136] Thus, the abductive approach can complement existing research and may potentially allow for generalizability to a greater extent than the inductive approach, as the established theories might provide explanations to the findings.[135] When applying an abductive approach, there are four criteria which has to be considered, the first of which aims to ensure that the phenomenon is both relevant and prominent in the research setting chosen.[135] Secondly, it is important that all sources are captured. Thirdly, the project design should enable replication between comparable settings, and fourthly, it should ensure the collection of rich and complete data that captures all relevant perspectives of the phenomenon.[135] In this context, the collaboration with, and the involvement of, the federations, coaches, and athletes were crucial. The sporting federations were actively involved in developing the project's ideas, and they organized information meetings with both coaches and athletes, thus helping with the recruitment process. The work with coaches and athletes ensured that the project was as undemanding as possible, so that elite athletes would be able to participate without this negatively affecting their daily training, performance, and recovery. Moreover, the athletes and coaches had the opportunity to influence the project by providing their opinions on what their concerns and interests were.

Involving athletes and coaches in the research development process ensured that the project was applicable and of interest to the users in the field of practice, and thereby gave us the opportunity to follow and observe numerous highly trained athletes over a long-term period. In this context, as approximately half of the athlete population uses some type of hormonal contraception,[64,90,94] it was essential that the research questions and design also considered and included this group of athletes (i.e., HC users), despite the associated increase in sample heterogeneity. However, there is already considerable heterogeneity concerning the MC and HC use, as cycles and experiences can vary largely both between and within individuals.[40] Although an abductive approach allows generalizability, it is crucial to acknowledge that each female athlete is one unique case. Each athlete has their own unique experience of how their MC, or different HCs, influence their training,

performance, and/or recovery. In many cases, the athletes themselves also perceive that they have insufficient knowledge about aspects related to female health, as well as how the MC and HCs influence training, performance, and recovery.[90,137] Thus, designing a research project where the athletes were given the opportunity to gain greater understanding of how their unique MC/HC cycle affected various parameters related to their training and performance was critically important. As systematic monitoring approach has been recommended,[19,31,34,100] and so using the athletes' own diaries was considered an appropriate and applied method to collect research data. Additionally, this project could be considered as a potential first step towards implementing new parameters into the athletes' training diaries and enable them to discover patterns related to their cycles.

Together with questionnaires, using the athletes training diaries was considered an undemanding and applicable method to collect data, especially considering that topics related to the MC and hormonal contraception are arguably considered taboo in sports community.[44,61,90,100,137-139] In previous studies, athletes have reported that they experience that both the MC and HC use affect their training and performance, however, this is not something they discuss with their coaches.[90,137] At the same time, athletes perceive that neither they, nor the coaches, have enough knowledge about the topic,[90,137] which probably results in many athletes dealing with these issues in silence. Issues related to the MC or HC use have long been considered as embarrassing, awkward, and taboo, and something private that athletes do not talk to their coaches about, especially male coaches.[90,100,138,139] Since the majority of coaches in Norway are men,[4] this factor was also considered in our project. Furthermore, it has been discussed that MC/HC cycle tracking might help ending the taboo, and such a method is therefore desired.[140]

By employing observational day-to-day data in addition to questionnaires, we had the opportunity to extend the knowledge of how athletes perceive to be influenced by the MC and HC use. As the athletes' responses in questionnaires might be reflected by where they are in their cycles, how much knowledge they have regarding the MC and/or HC use, as well as recall bias,[140] using both methods (i.e., questionnaire, training diary) on the same sample, allowed us to explore the association between cross-sectional and longitudinal observational data. The methods complemented each other, and especially the open-ended questions provided interesting and novel knowledge about the athletes' experiences. To be applicable, the project was designed to collect data that the athletes were mostly familiar with, although with some new parameters to include MC/HC cycle tracking. With such an open design, it was essential to be well acquainted with, and up to date, on previous

studies in this field, and further explore the dataset inductively and be receptive to themes and topics that emerged. Overall, the work with this dissertation and its related studies have initiated rich discussions with the collaborators, as well as provided knowledge for the athletes involved. It is because of the close cooperation with coaches, federations and not least the athletes themselves, that we managed to design this project where so many athletes were willing to contribute over a relatively long period. Thus, this provided an opportunity to learn and understand more about the athletes' lived experiences related to MC/HC issues.

4 Methods

The methods described in this thesis presents data from three research papers (*Papers I-III*) originating from a research project conducted within the FENDURA research group between 2019 and 2021.

4.1 The FENDURA project

The FENDURA (Female Endurance Athlete) project (2020–2024) was granted funding by the Tromsø Research Foundation in 2019 and includes three work packages with three PhD positions and two post-doctoral researchers. The overall objective of the FENDURA project is "…to provide the scientific basis for optimising long-term training responses and performance development of female athletes in endurance sports and in the prevention of health-related side-effects specific to female athletes".[141] The current PhD-project is the FENDURA's 'work package 2' and focuses on the self-perceived influence of the MC and HC use, along with cycle-related symptoms and side-effects, on the athletes' training, performance, and recovery.

4.2 Study design and participants

In work package 2, we included a large cohort of recreational, national, and international level female endurance athletes, and this PhD project employed different methodologies and approaches to answer the overall objective and the specific aims of work package 2.

4.2.1 Collaborators

The design and recruitment process were conducted in close collaboration with former athletes, as well as coaches and staff members of the Norwegian Biathlon Federation, the Norwegian Ski Federation, and the Norwegian Top Sport Centre (Olympiatoppen).

4.2.2 Overall design

An illustration of the WP2 project design and timeframe is presented in **Figure 3**. *Paper I* employed data from the first questionnaire (Q1) including only cross-country skiers and biathletes. *Paper II* consisted of Q1 at baseline, along with follow-up questionnaires at 6 months (Q2) and 12 months (Q3), as well as daily recording of training sessions, health status, menstruation/withdrawal bleedings and recovery measures in an online training diary (Olympiatoppen or Bestr). *Paper III*

consisted of Q1 at baseline, followed by urinary ovulation tests conducted each cycle and daily records of training sessions, health status, menstruation/withdrawal bleeding and recovery measures for a duration of 4 months.

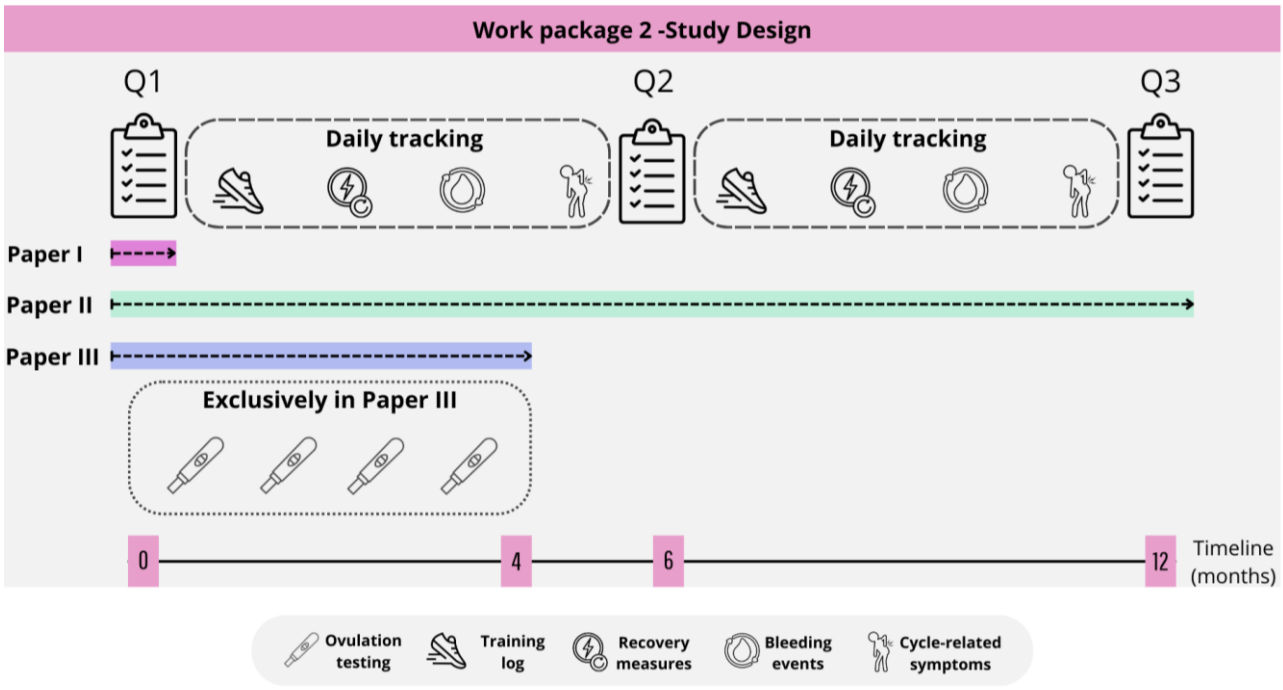

Figure 3. Illustration of work package 2 study design. Athletes enrolled into the project by replying to the first questionnaire (*Paper I*). Thereafter, athletes provided daily reports on training sessions, different recovery measures, menstruation/withdrawal bleeding and related symptoms for either 4 months (*Paper III*) or 12 months (*Paper II*). For *Paper II*, athletes completed follow-up questionnaires both after 6 and 12 months. For *Paper III* athletes used urinary ovulation tests from day 8 until ovulation was detected in each menstrual cycle.

Study design paper II and III

An overview of how the different phases/days in the cycle were defined in *Paper II* and *Paper III* is presented in **Figure 4**.

Paper II: As both HC users and non-HC users were included in this study, it was decided to focus on days related to bleeding, as well as cycle-related symptoms. The last four days before bleeding, as well as bleeding days, were also when most athletes have found to perceive a negative influence on physical fitness and performance, as noted

by Solli and colleagues.[90] Therefore, the conceptualization of days investigated where divided into pre-bleeding (last four days before menstruation/withdrawal bleeding), bleeding (menstruation/withdrawal bleeding days), and non-bleeding (all other days in the cycle).

Paper III: In *Paper III*, only naturally menstruating athletes were included, and four distinct phases were determined [35] using the calendar-based counting method and urinary ovulation prediction tests.

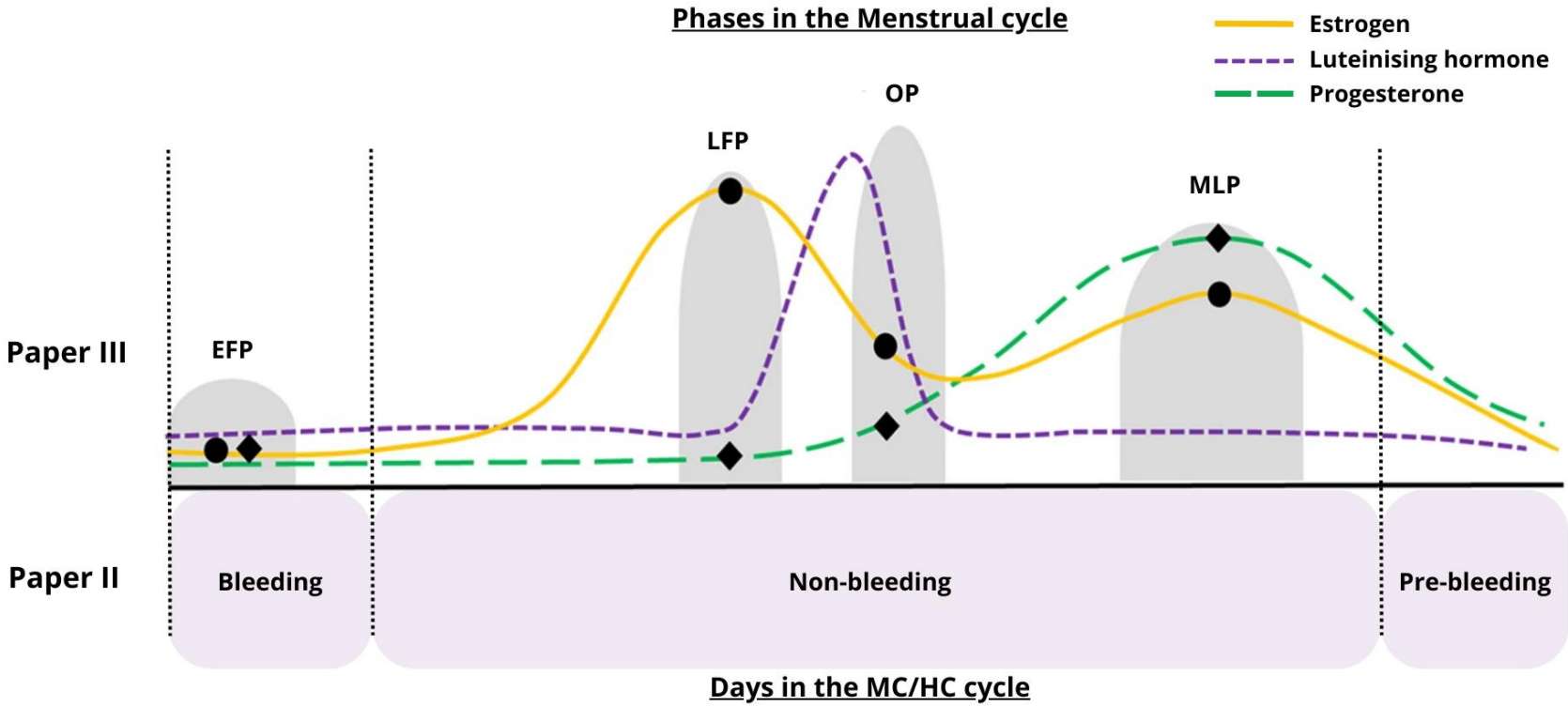

Figure 4. Overview of how days and phases are defined in *Paper II* and *III*, respectively. In *Paper II* days were defined as bleeding (all days with menstruation/withdrawal bleeding), non-bleeding days (all other days), and pre-bleeding (the four last days before bleeding). MC, menstrual cycle; HC, hormonal contraceptive. In *Paper III*, phases were determined based on calendar-based counting and a positive ovulation test: EFP, early follicular phase (the first three days of the MC); LFP, late follicular phase (the day before and the day with a positive ovulation test); OP ovulatory phase (the two following days after a positive ovulation test); MLP, mid-luteal phase (days 7 to 9 following the positive ovulation test). Black dots represent mean estrogen concentration in different phases. Black diamonds represent mean progesterone concentration in different phases. The figure is adapted and modified with permission [37] from Elliott-Sale et al. 2021 [35].

4.2.3 The recruitment process

The recruitment process started with collaboration meetings involving the Norwegian Ski- and the Norwegian Biathlon Federation, which further invited coaches and athletes to information meeting about the research project. Athletes expressing interest in participation in the research received an e-mail with more in-depth information about the project, along with a link to the initial Q1. The next step in the recruitment process went through text exchanges via e-mail and social media, where interested athletes received additional information through a phone meeting, followed by the same details and an invitation e-mail for participation. Some athletes exclusively wished to only participate in *Paper I,* which resulted in the larger sample size. For *Paper III,* athletes who were naturally menstruating and already part of the *Paper II* project were invited to participate in both studies. Other athletes were recruited through advertisements on social media, and athletes who were interested then received similar follow-up and information prior to participation.

4.2.4 Participants

For this PhD-project, female endurance athletes at different competition levels were recruited in collaboration with coaches and staff members of the Norwegian Ski Federation and the Norwegian Biathlon Federation. Overall, 166 athletes enrolled in the entire project between May 2020 and September 2020, where several athletes participated in more than one project. The data collection was conducted between 1st May 2020 and 30th September 2021. A brief overview of the three studies' recruitment process is presented in **Figure 5**. An overview of the study participants is presented in **Table 1**.

Table 1. Characteristics of study participants

	n	**Age (years)**	**Body height (cm)**	**Body mass (kg)**	**Tier**
Paper I	113	21.4 ± 3.2	168.7 ± 5.3	61.8 ± 4.8	3 to 5
Paper II	58	21.0 ± 2.8	169.6 ± 5.7	62.9 ± 4.6	3 to 5
Paper III	41	26.7 ± 8.2	168.7 ± 6.7	60.8 ± 5.9	2 to 4

Participant characteristics are presented as mean ± SD
Tiers refers to performance level based on McKay et al. [142]; tier 2 (trained/developmental), tier 3 (highly trained /national); tier 4 (elite/international); tier 5 (world class)

Paper I

A total of 115 athletes completed Q1. Two athletes were excluded due to missing consent forms and age (<18 years), thus, 113 cross-country skiers (*n* = 63) and biathletes (*n* = 50), were included in the final analysis. The athletes' performance level was classified based on McKay et al., [142] ranging from tier 3, highly trained/national (*n* = 83) to tier 4/5, elite/international/world class (*n* = 30).

Paper II

Of the 113 athletes that participated in *Paper I*, 89 volunteered for the one-year follow-up study. Of these athletes, 31 were excluded due to insufficient diary logging (*n* = 9) and changes in HC status (22 athletes changed, stopped, or started HC usage) during the study period. Thus, a total of 58 athletes were included in the analyses, with 43 classified as tier 3 (highly trained/national) and 15 as tier 4/5(elite/international/world class).[142]

Paper III

In *Paper III*, 51 endurance-trained athletes were exclusively recruited, while 10 non-HC using athletes from *Paper II* volunteered to participate. A total of 49 athletes completed the study while eight athletes were retrospectively excluded due to menstrual disturbances. The athletes were classified as tier 2, trained/developmental (*n* = 16), tier 3 highly trained/national (*n* = 18), and tier 4, elite/international (*n* = 7).[142]

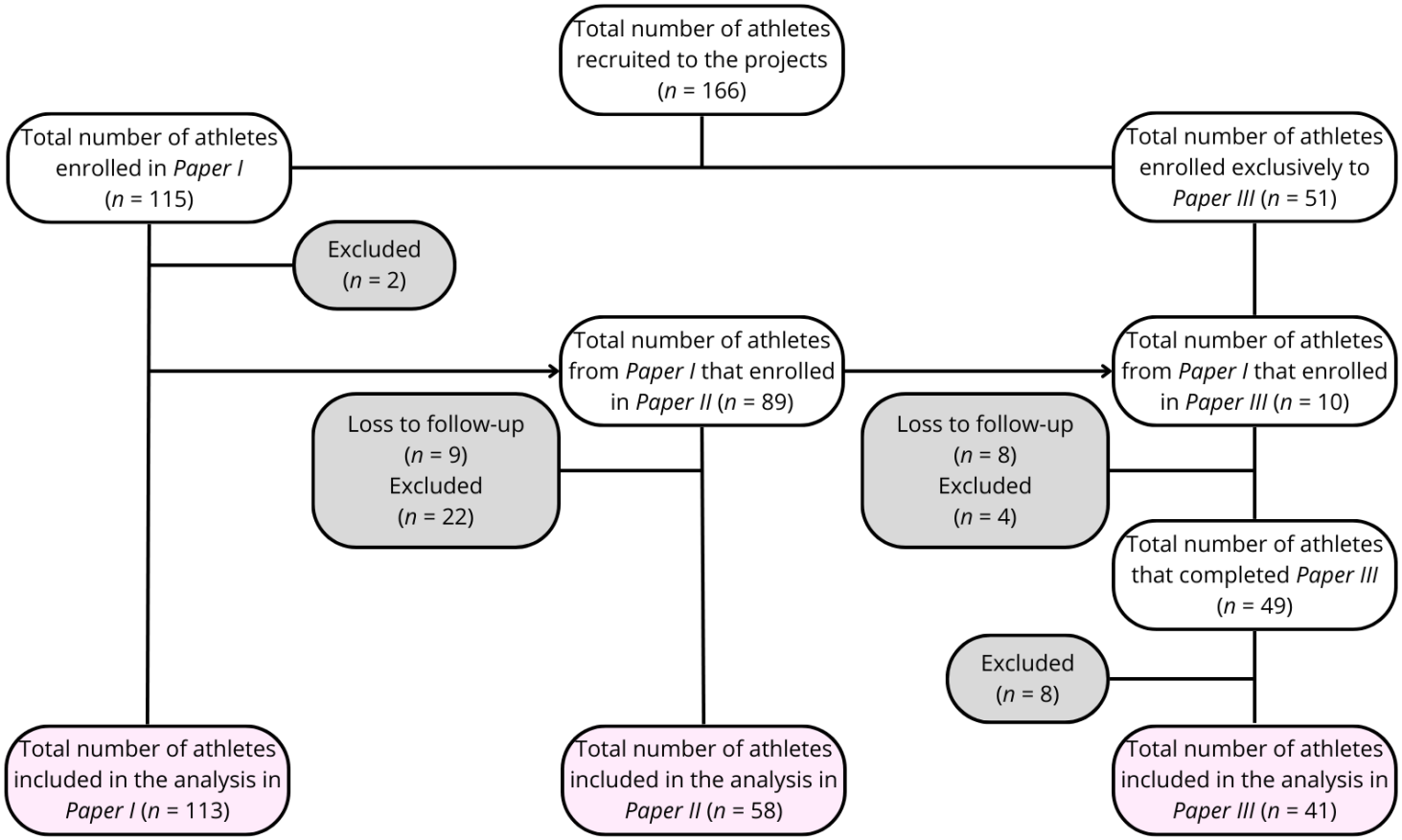

Figure 5. Overview of the overall recruitment process. More detailed description of the different papers' recruitment processes is provided in the specific papers.

4.2.5 Questionnaires

The three questionnaires (Q1, Q2 and Q3) were hosted on Nettskjema, an online survey platform provided by the University of Oslo (nettskjema.no). All questionnaires were based on the questionnaire used in the study by Solli et al. [90] and further developed in consultation with coaches, former athletes, physiologists, medical experts, and gynecologists.

The questionnaires were constructed and tested in Norwegian using a 5-step strategy inspired by Lankreijer et al.[143] First, the items were generated based on Solli et al., [90] as well as supplemented with new themes and items based on the aims of the PhD project. The development of the questionnaires involved collaboration with former athletes, coaches and staff members of the Norwegian Biathlon Federation, the Norwegian Ski Federation, and the Norwegian Top Sport Centre (Olympiatoppen). Second, prototypes were created, establishing themes and sections relevant to the different groups and research question. The questionnaires comprised sections on: 1) demographic information, 2) HC use/MC and perceived influence on training and performance (current HC users and non-HC users replied to different portions of this section), 3) tracking of training, recovery and MC/HC cycle information, and 4) communication. In Q2 and Q3, athletes answered additional questions about their current HC status, if they had skipped their withdrawal bleeding or taken medication to postpone their menstruation, and the influence of project participation on their relationship and communication with their coaches. Furthermore, discussions and adjustments were carried out in the research group to ensure the feasibility of the questionnaires and that important questions were addressed (validity). Third, the questionnaires were pre-tested on a sub-group of athletes, as well as the research group. Fourth, based on the feedback from test participants and further research group discussions, adjustments were made to the questionnaires (i.e., items were removed, replaced, or added) to enhance feasibility and validity. Fifth, the final questionnaires were created and pre-tested on the same sub-group and research group before implementation in the project. Based on this process we concluded that the questionnaires had sufficient validity for their purpose.

4.2.6 Training sessions and measures of health and recovery

The athletes used either the Norwegian Top Sport Centre (Olympiatoppen) or the Bestr (Oslo, Norway) digital training diaries to report their daily training sessions, health- and recovery measures. The different parameters were identical in both diaries and were presented using visual

analogue scales (VAS) with integer options ranging from 1 to 10, or binary "yes/no" options. Each VAS measure was presented with distinct anchors in Norwegian.

Training session information included session duration; training form (i.e., strength, endurance, speed, power and flexibility); endurance training intensity (categorized using a 5-zone model [144,145]); modality (e.g., on snow or roller skiing [classic or skating], cycling, running and other); daily fitness, ranging from 1 "bad" to 10 "great"; and perceived exertion using the Borg CR10 scale,[146] ranging from 1 "extremely easy" to 10 "maximum intensity".

Health and recovery measures included ratings of "yes/no" about menstruation/withdrawal bleeding, sickness, injury and if they had a day off from training. Athletes reported the severity of all types (physical and emotional) of cycle-related symptoms on a single scale ranging from 1 "no symptoms" to 10 "severe symptoms". Sleep quality was assessed on a scale from 1 "low sleep quality" to 10 "high sleep quality", while physical and mental readiness to train, ranged from 1 "not ready" to 10 "very ready". In addition, resting HR was measured using a standardized procedure upon awakening, or an overnight-monitoring watch (see *Paper II* and *Paper III* for a more detailed description).

4.3 Ethical approvals

The PhD-project resulting in *Papers I–III* were approved by the Norwegian Social Science Data Service (NSD/ Sikt; Project ID: 409326) and evaluated by the Regional Committee for Medical and Health Research Ethics (Project ID: 135555). All participants were given oral and written information about the project before providing their written informed consent.

4.4 Statistical analysis

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS 26, IMB Corp, Armonk, NY, USA) for *Paper I*, and R (R Core Team 2021) for *Papers II* and *III*. Descriptive data are presented as mean (standard deviation), frequencies, or prevalence, with the alpha level set at 0.05.

4.4.1 Paper I

Responses to the open-ended questions were analyzed by the content comparative methods of analysis.[136] By employing an abductive analysis approach, these questions were coded and

categorized by two authors of the current study (Tina Pettersen Engseth and Guro Strøm Solli), and disagreements were further discussed until a consensus was reached. Frequency analyses from the open-ended questions on symptoms and reasons for HC use were completed by counting codes in the different categories. A selection of responses, representing each category from the open-ended questions about "reasons for HC use" and "self-perceived influence of HC use on training/performance," are provided as examples of the interpretation of the responses to the various open-ended questions (see *Paper I*, Table 3 and 5 [**Table 2** in this thesis]).

The athletes were categorized based on HC use vs. non-HC use, as well as the type of HC (progestin-only vs. combined). We also stratified athletes based on age (senior vs. junior) and national team athletes (tier 4 and 5) vs. non-national team athletes (tier 3). Data were examined for normality distribution before analysis using a Shapiro–Wilk test and visual inspection of Q–Q plots and histograms. Independent sample t-tests and Mann-Whitney U-tests were used to examine between-group differences, with the latter test being used for data that were considered as non-normally distributed. The relationship between categorical variables was examined with Pearson's chi-square analysis, with Fisher's exact tests being used when any expected cell counts were <5, i.e., using a conservative approach.[147]

4.4.2 Paper II

A manual inspection and interpretation of the data set was carried out to ensure that the coding of the various days (pre-bleeding, bleeding, non-bleeding) was as reliable as possible. Five IUS users, two POC users, and one implant user, reported one occasion with spotting (i.e., only one day of bleeding that did not occur in connection with the bleeding days) and thus these events were excluded from the analyses. For three IUS users and three implant users, short cessations between bleeding days (i.e., up-to six days between two bleedings) were excluded. In three non-HC users, one occasion with spotting was excluded.

Mean missing data was 4.5%, ranging from 0% to 24.8% (resting HR), with data assumed to be completely missing at random. Ordinal dependent variables (i.e., sleep quality, physical readiness to train, mental readiness to train, rating of cycle-related symptoms) were modelled using cumulative link mixed regression with logit link fitted by Laplace approximation (clmm function from the ordinal package [148]). Resting HR was modelled with linear mixed effects regression (lme4 package). Models included days (levels: pre-bleeding, bleeding, non-bleeding), group (levels: COC, implant, IUS, POC, non-HC), and their interaction (days by group), as fixed factors. A potential

mediating factor, symptom severity, was included in all ordinal models. The association between cycle-related symptom severity and sleep quality, physical readiness, and mental readiness to train were, as described above, adjusted for potential confounding factors (i.e., days, group, and days by group). For this analysis, the severity of cycle-related symptoms was aggregated into four distinct ordinal categories: 1 was defined as 'no symptoms', 2–4 as "mild symptoms", 5–7 as "moderate symptoms", and 8–10 as "severe symptoms". All models included a random intercept, with days nested within athlete. Models were checked for convergence, and residuals checked using the DHARMa package.[149] Post-hoc testing was completed using the emmeans package,[150] with 'multivariate t' correction for multiple comparisons. Statistical significance was assumed to be α = 5%. For ordinal data modelled using cumulative link mixed regression, a rating of '7' was identified as a common breakpoint, and therefore the cumulative probability of a rating ≤7 was used for between-group comparisons. Data are provided as modelled marginal means and cumulative probability estimates, unless otherwise noted.

4.4.2.1 Additional analysis, Bleeding patterns in non-HC users and HC users

In *Paper II*, an overview of the athletes' individual bleeding patterns was presented to demonstrate the number of cycles included in the analyses for both HC users and non-HC users. This overview visualized athletes' individual cycle durations and bleeding frequencies (bleeding pattern). For non-HC users, this visualization revealed that many had cycle lengths variations outside the eumenorrheic criteria.[35] Based on these observations, an additional analysis to describe the non-HC users individual bleeding patterns is included in the thesis. As large variations in bleeding patterns are expected in HC users due to side-effects, their individual bleeding patterns will be briefly presented and described.

4.4.3 Paper III

Daily datapoints were averaged to obtain a single datapoint for each MC phase. Data were analyzed by performing linear mixed-effects model analysis. Random intercept models were built considering a two-level structure with MCs clustered within participants (random effect) and the relationship between MC phase (main determinant) and recovery measures (outcome) was investigated. The effect of the MC phase was corrected for potential confounders and/or effect modifiers, i.e., MC-related symptoms, daily training load (session rating of perceived exertion), monotony, and strain as described by Twisk.[151] EFP was defined as the reference phase for comparisons and the alpha level was set at < 0.05. The other phases were set as reference for

comparisons between each phase. Visual inspection of residuals did not reveal obvious deviations from normality or homoscedasticity, and assumptions were met. Effect sizes were calculated based on Nakagawa and Schielzeth [152] as marginal R^2 (variance explained by fixed effect only) and conditional R^2 (variance explained by fixed and random effects) and interpreted according to Cohen.[153] All statistical analyses were performed using the packages "lme4" (version 1.1-29) and "multilevelTools" (version 0.1.1); the figures were generated using the package "ggplot2" (version 3.3.6).

5 Results – summary of papers

5.1 Paper I:

Prevalence and self-perceived experiences with the use of hormonal contraceptives among competitive female cross-country skiers and biathletes in Norway: The FENDURA project [154]

The aims of the current study were to: (1) investigate the prevalence of different types of HC (progestin-only vs. combined HCs) used by female cross-country skiers and biathletes competing at a national and/or international level; (2) explore the athletes' reasons for HC use; (3) compare negative symptoms related to the MC/HC cycle experienced by HC users and non-HC users; and (4) characterize the self-perceived influence of HC use on training and performance.

HC use

Overall, 68% of all the athletes used HCs, with 64% and 36% of them using a progestin-only and combined type HC, respectively. We found no differences in the prevalence or type of HC being used when stratifying the athletes between juniors (born ≥2000, age ranging from 18 to 20) and seniors (born ≤1999, age ranging from 20 to 32) or between national team (tier 4 and 5 [142]) and non-national team (tier 3 [142]) athletes.

Reasons for HC use and cycle-related symptoms

Non-contraceptive reasons for HC use were reported by 51% of the progestin-only HC users vs. 75% of the combined HC users (p=.039). Cycle-related symptoms was the most common reason (63%) for HC usage, while practical reasons were reported by 46%. However, analyses of the open-ended questions about reasons for HC use revealed that many athletes (28%) reported compound reasons (i.e., symptoms influencing performance and/or for avoiding symptoms during competitions). Of the athletes reporting regular withdrawal bleedings in connection to HC use, 80% of the progestin-only and 86% of combined HC users experienced negative cycle-related symptoms, which was comparable to the non-HC group (86%).

Self-perceived influence of HC use on training and performance

The majority (81%) of HC users experienced solely positive, or no influence, of HC use on training and performance, with no differences between progestin-only and combined HC users (p=.942). A selection of responses of how HCs influence training and performance are presented in **Table 2**.

Table 2. Selection of responses: How hormonal contraception influence training and performance

Participants' experiences about how hormonal contraception influence training and/or performance
Perceived a solely positive influence
Influence on training: "I do not have as much pain and heavy bleeding anymore. What's more, I have not been as exhausted or tired as before I started on COC, therefore I feel better when training" **Influence on performance:** "I have no pain and I'm not nauseous on competitions days anymore, feelings that I used to have before"
Influence on performance: "Not directly on performance, but due to my previous menstrual problems, hormonal contraception has made it easier for me because I can avoid the negative menstrual symptoms"
Influence on training: "I do not have as much menstrual pain with HC, which makes it easier to train and compete" **Influence on performance:** "HC causes less bleeding and less pain during menstruation, which has a positive effect related to my performance. It is easier to give maximum at competitions when I do not have severe pain. I do not have to take paracetamol before competitions."
Influence on training: "To a positive degree, so that I could postpone menstruation until after a competition or reduce pain to perform better without too many distractions" **Influence on performance:** "I avoid pain, performs better. No need to think about changing sanitary pads/tampons or about bleeding through them"
Influence on training: "[I have] slightly less pain than I had without contraception. This makes it easier to complete workouts. In addition, I bleed less. When I used COC, I had no pain or bleeding, but was often in a bad mood"
Influence on training: "[I] struggled a lot with menstrual pain before, but after I started on the implant, this has decreased. This means that I am not knocked out when I have my menses and can train as normal"
Perceived a mixed influence
Positive influence on training: "I avoid menstruation, as well as menstrual pain" **Positive influence on performance:** "To avoid the MC which can affect the hormone balance in the body. For example, it prevents me feeling very emotional for some menses, etc., which I can imagine could affect both training and performance" **Negative influence on performance:** "I do not get the natural answer that my body functions properly as it should during a normal MC"
Positive influence on training: "Higher iron levels, more stable body and fewer mood swings" **Negative influence on training:** "Easier to get nauseous"
Positive influence on training/performance: "Predictable menstruation and the possibility to postpone it if it does not fit with competitions" **Negative influence on training/performance:** "Weight gain and irregular bleeding the first couple of months"

Table 2 continues on the next page.

Perceived a mixed influence

Negative influence on training: "I can experience menstrual symptoms of pain and intermittent bleeding to varying degrees"
Positive influence on performance: "In the period after menstruation, I feel stronger and fresher"

Positive influence on training: "I got less bleeding and pain during menstruation when I first started on COC. In recent years no bleeding"
Negative influence on training: "No bleeding in recent years has been practical in terms of training and competition performance. However, without (regular) menses, it is more difficult to confirm that I am not pregnant and that I have an adequate energy intake"

Positive influence on performance: "No bleeding is practical"

Perceived a solely negative influence

Influence on training: "Somewhat more pain during menstruation"

Influence on training: "I have negative experiences with POC, but now when I use an implant, I have some intermittent bleeding and sometimes pain. When I get menstrual cramps, I think it is extra difficult to exercise and I am not always in shape to train"
Influence on performance: "The days I have menstrual pain or heavy bleeding are much harder and makes it more difficult to perform optimally"

Influence on training: "Irregular menstruation due to IUS. When I used COC, it was regular. What's more, stronger menstrual pain now than with using COC"
Influence on performance: "When I used COC, I skipped menstruation a few times to avoid menstruation around important competitions. I cannot control this with IUS, so I think that is a negative point. At the same time, it is now very unpredictable when I will get my menses"

Influence on training: "Lethargic, and physically heavy. Harder to train. I lose the feeling of being 'light' in my body"
Influence on performance: "Loses the feeling of being in shape, strong/fast and 'light' in my body"

COC, combined oral contraceptive; HC, hormonal contraceptive; MC, menstrual cycle; Implant, subdermal hormonal implant; IUS, intrauterine system; POC, progestin-only oral contraceptive.
Retrieved from Paper I (Table 5).

5.2 Paper II:

Influence of menstrual/withdrawal bleeding on self-reported symptoms and recovery during an annual cycle in endurance athletes: The FENDURA project **(submitted/in review)**

This longitudinal study investigated 1) differences in self-reported symptoms severity and recovery measures between pre-bleeding, bleeding, and non-bleeding days in HC users and non-HC users; 2) associations between symptom severity and recovery.

Cycle-related symptoms

All groups reported higher symptom severity during bleeding compared to pre-bleeding and non-bleeding days (both $p<.001$), as well as during pre-bleeding compared to non-bleeding days ($p<.001$). Implant users reported significant lower symptom ratings than both IUS ($p<.001$) and non-HC users ($p=.008$).

Recovery measures

Sleep quality was worse during pre-bleeding compared to bleeding days for all groups ($p<.001$), while IUS users reported greater sleep quality than both POC users ($p=.040$) and non-HC users ($p=.039$). Additionally, IUS users reported higher physical readiness-to-train compared to non-HC users ($p=.010$). Regarding resting HR, we found an interaction between days and groups, with a significantly higher resting HR during pre-bleeding compared to bleeding for all groups (+1 to +1.6 beats·min^{-1}; $p<.001$ to $p=.036$) apart from implant users ($p=.440$). An overview of the main findings is presented in **Figure 6**.

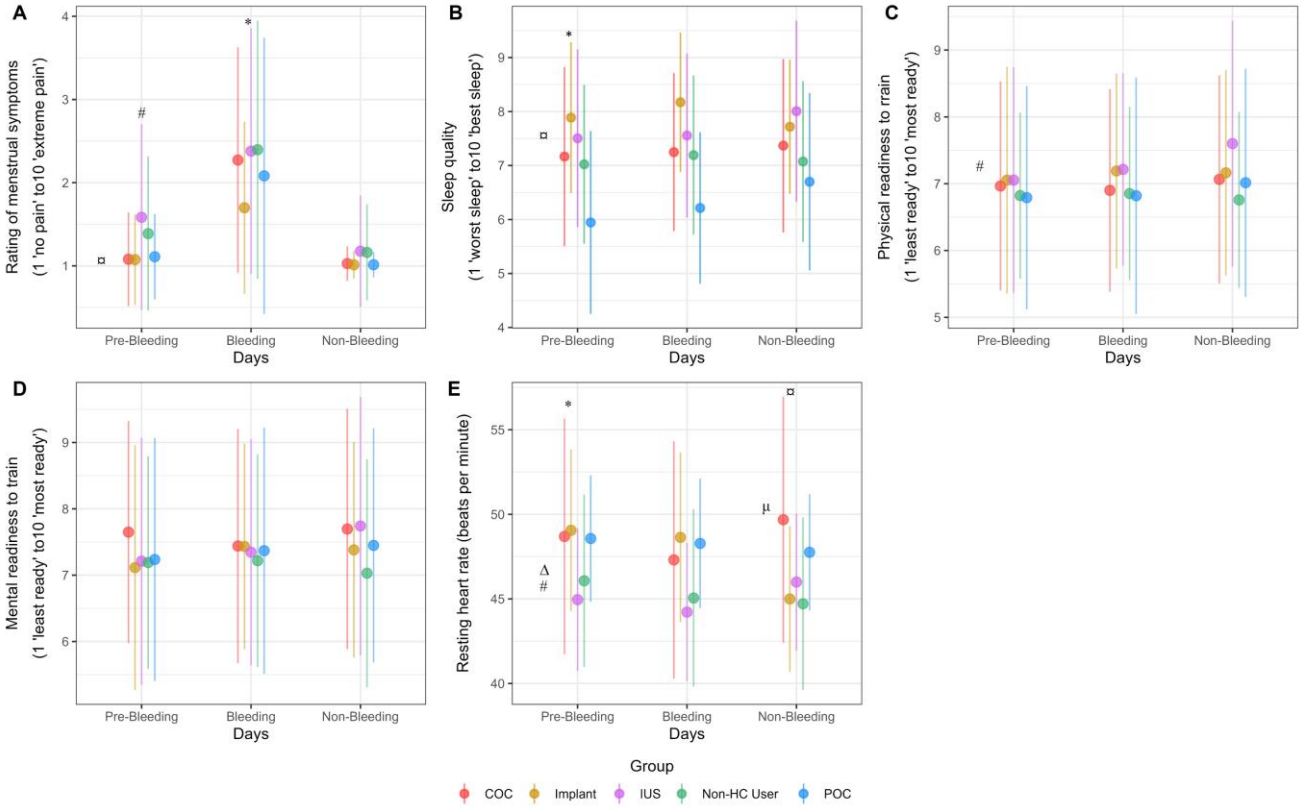

Figure 6. Days and group differences in recovery measures. Data are means and standard deviations.
A) * Significant more severe symptoms compared to pre-bleeding and non-bleeding days. # Significant more severe symptoms compared to non-bleeding. ¤ Significant lower symptom ratings for Implant (subdermal hormonal implant) users compared to IUS (Intrauterine system) and non-HC users. **B)** * Significant worse sleep quality compared to bleeding. ¤ Significant better sleep quality for IUS users compared to POC (progestin-only oral contraceptive) and non-HC users. **C)** # Significant higher ratings of physical readiness to train during pre-bleeding, bleeding and non-bleeding days for IUS users compared to non-HC users. **E)** * Significant higher resting HR (heart rate) compared to bleeding and non-bleeding. ¤ Significant higher resting HR compared to bleeding. # Significant higher resting HR compared to bleeding for POC, IUS, non-HC users and COC (combined oral contraceptive). Δ Significant higher resting HR compared to non-bleeding for implant and non-HC users. µ Significant higher resting HR compared to bleeding for COC. All $p<.05$.

Association between severity of cycle-related symptoms and recovery measures

Symptom severity was negatively associated with sleep quality and physical readiness-to-train (both $p<.050$). An overview of the associations is presented in **Figure 7**.

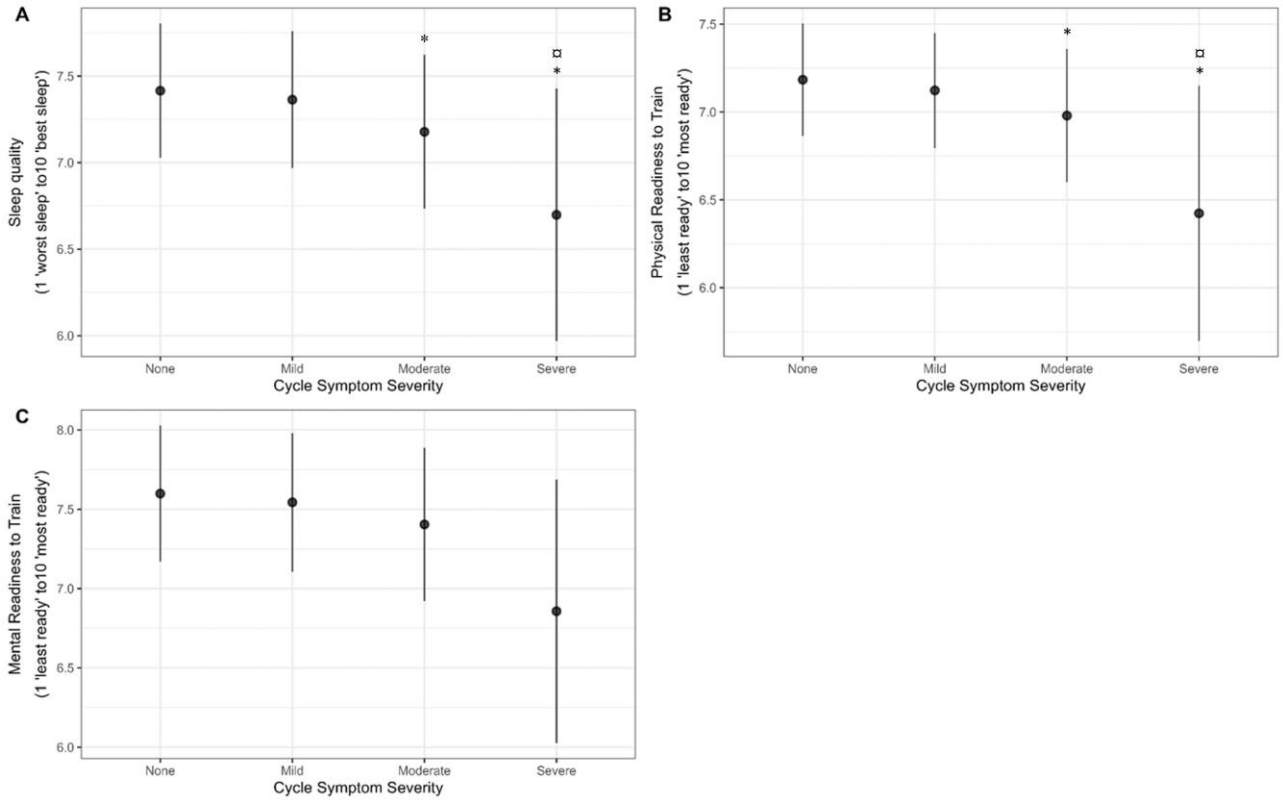

Figure 7. Overview of the association between severity of cycle-related symptoms (none, mild, moderate, severe) and; A) sleep quality; B) physical readiness to train; and C) mental readiness to train. Data are estimated marginal means (black circles) and 95% CI (black lines). Symbols indicate * significantly different ($p<.05$) to symptom severity of "none"; ¤ significantly different ($p<.05$) to symptom severity of "mild".

5.2.1 Additional analysis: Bleeding pattern in non-HC users and HC users

Based on data presented in the methods in *Paper II*, the aim of this *supplementary analysis* was to characterize individual bleeding patterns in non-HC users and HC users.

Overall, 207 cycles were observed in the non-HC group ($n=22$), of which 61 (29.5%) were of abnormal length. Three (14%) athletes out of 22 had exclusively 21–35 days cycles, while 19 (86%) athletes had one or more cycle with an abnormal length. This included three (14%) athletes with absence of bleeding for ≥12 weeks. The non-HC users body mass index (BMI) ranged from 18.7 to

25.9, with a mean BMI of 22.0. An overview of the non-HC users individual bleeding pattern during the study period is presented in **Figure 8**.

For HC users, substantial variations in bleeding patterns were observed, both between and within groups, as well as within each individual. For an overview of the HC users individual bleeding pattern, see **Figure 9**.

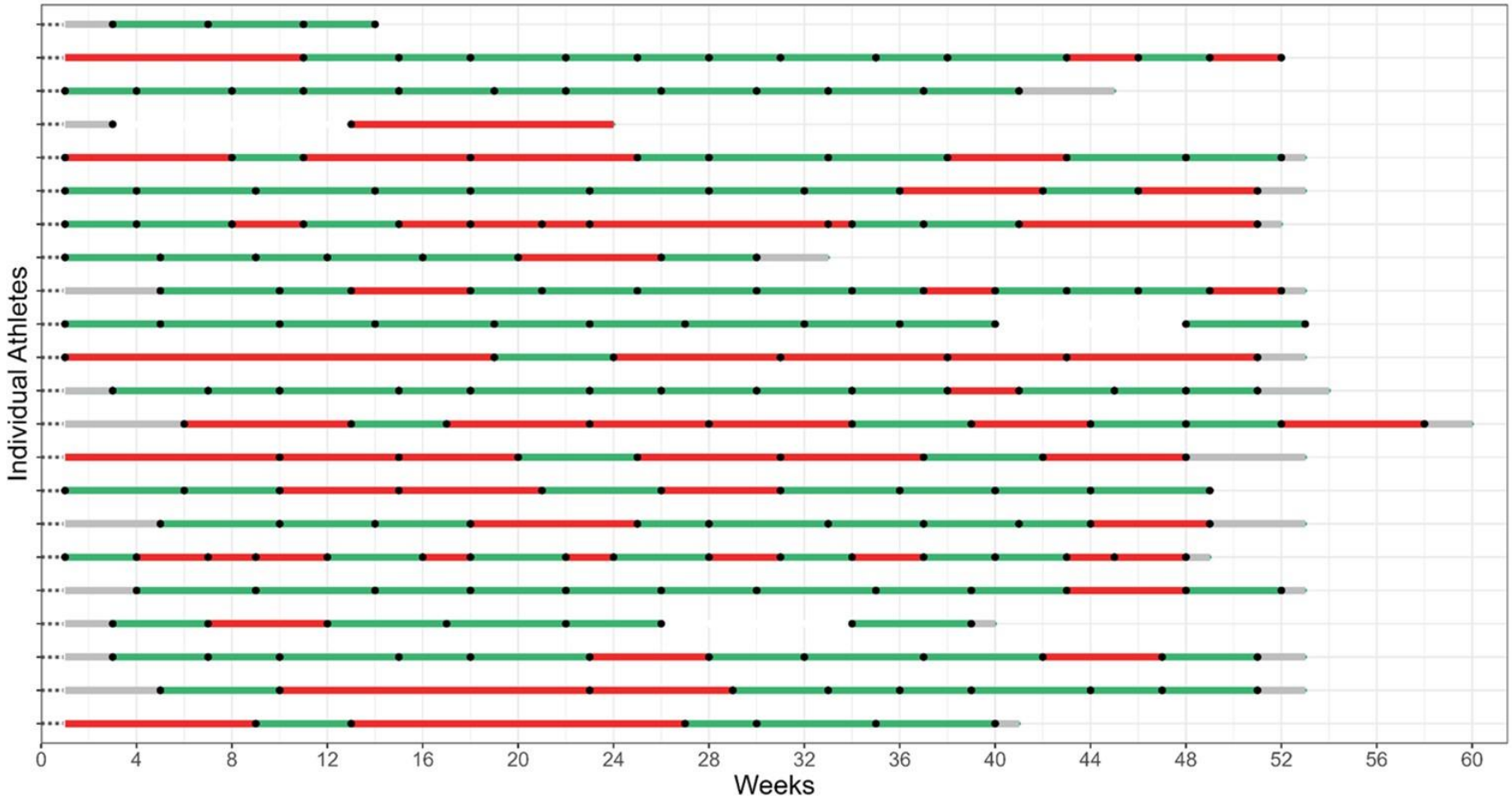

Figure 8. Overview of the non-hormonal contraceptive users individual bleeding pattern. Retrieved from *Paper II.*

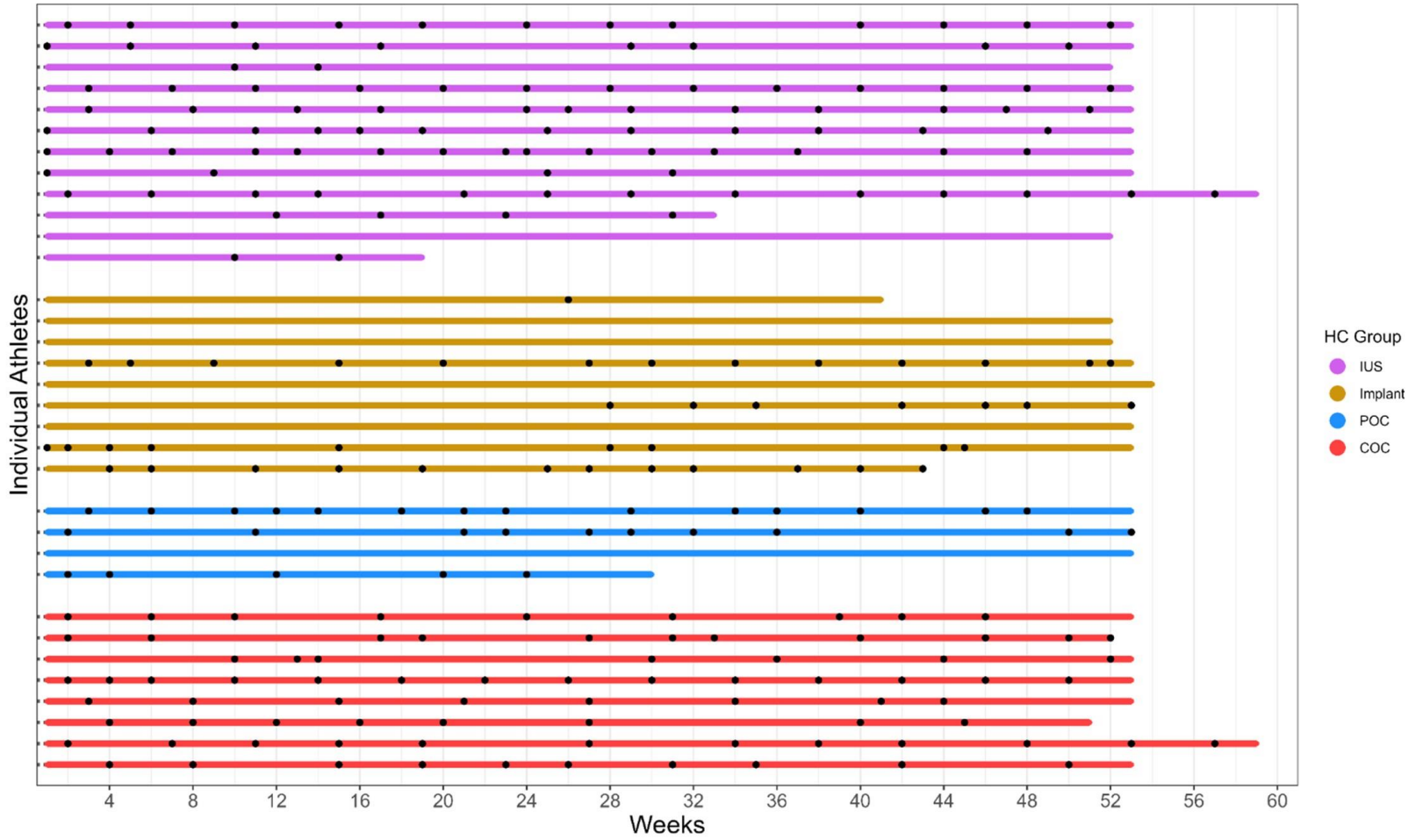

Figure 9. Overview of the HC users individual bleeding patterns. Retrieved from *Paper II.* COC, combined oral contraceptive; Implant, subdermal hormonal implant; IUS, intrauterine system; POC, progestin-only oral contraceptive.

5.3 Paper III:

The influence of menstrual cycle phase on measures of recovery status in endurance athletes, The FENDURA project [155]

The aim of this study was to investigate the influence of MC phase on measures of recovery status, such as resting HR, perceived sleep quality, and physical and mental readiness to train among female endurance athletes.

Overall, resting HR was significantly elevated in MLP compared to EFP by 1.7 beats per minute (p=.006), without significant differences observed among the other MC phases. Perceived sleep quality was impaired in MLP compared to LFP (-0.3, p=.035). Physical readiness to train was lower in both OP (-0.6, p=.015) and MLP (-0.5, p=.026) when compared to EFP. Conversely, mental readiness to train did not show any significant differences between MC phases (p>0.05). However, a significant interaction surfaced between MC phase and cycle-related symptoms(p=.010), indicating a diminishing impact of MC phase on mental readiness to train with an escalation in the severity of cycle-related symptoms. The variance explained by fixed effects was negligible for resting HR and small for perceived sleep quality, physical and mental readiness to train.

A summary of the main findings in *Paper III* in comparison with main findings of *Paper II* is presented in **Figure 10**.

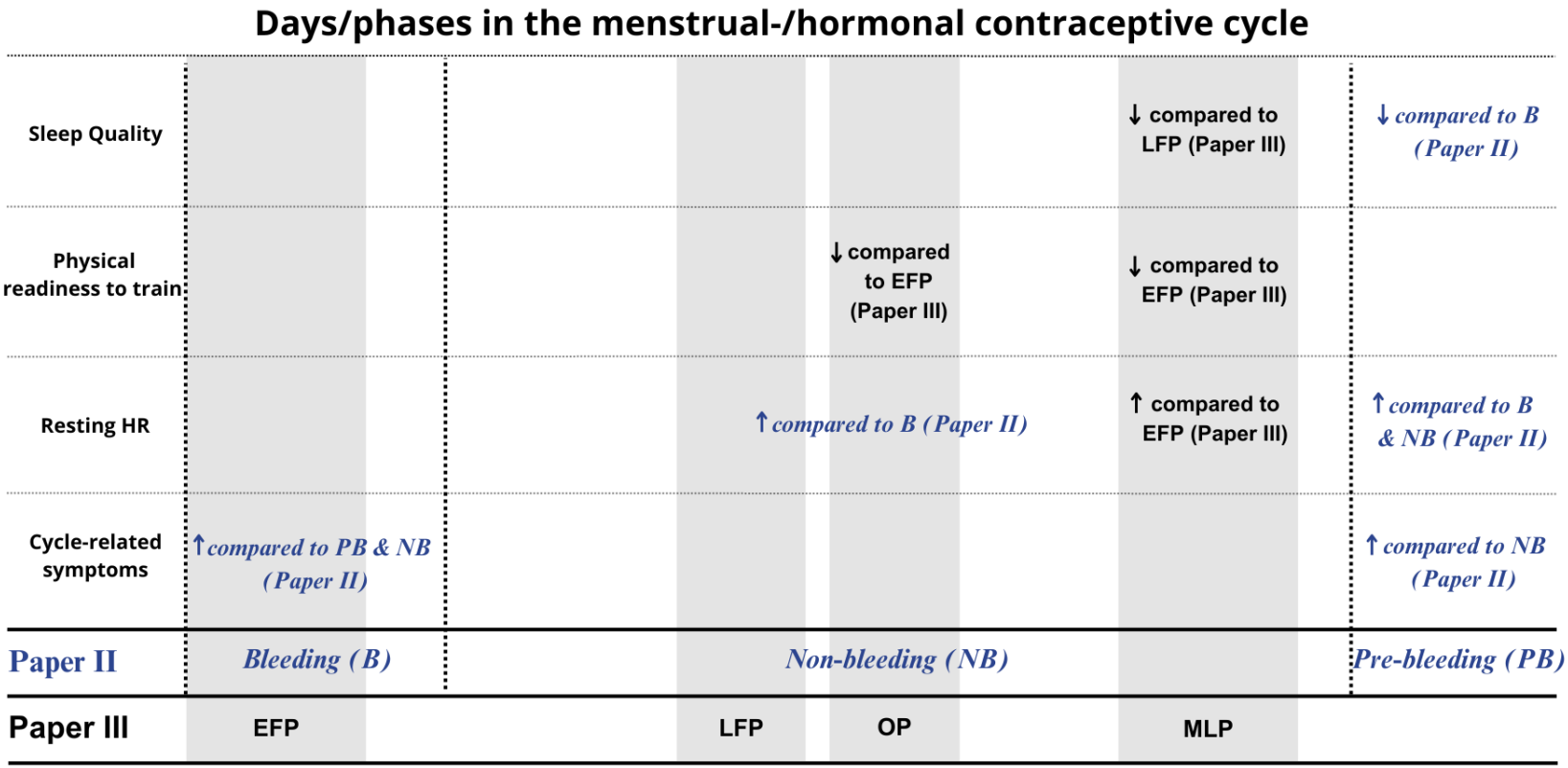

Figure 10. Overview of the main findings in *Paper II* and *III*. In *Paper II* both hormonal contraceptive- and non-hormonal contraceptive users were included. In *Paper III* only naturally menstruating athletes were included and the menstrual cycle phases were divided into: EFP, early follicular phase; LFP, late follicular phase; OP, ovulatory phase; MLP, mid-luteal phase. HR, heart rate.

6 Discussion of methodology

To conduct female specific research, recent reviews recommend a three-step method including the calendar-based counting, urinary ovulation prediction tests, and serum hormone verification, to control for MC phases.[35,38,82] However, researching high-level athletes poses challenges due to time constraints, which are often incompatible with their training schedules.[156] Therefore, it was crucial for this thesis to design a project that was time-efficient, simple, and feasible within the athletes' training schedule. As such, the collective findings of the present thesis contribute to the field's body of knowledge by offering insight into the perceived influence of the MC, HC use, and cycle-related symptoms on recovery, training, and performance in female endurance athletes. Based on the methods applied, the findings should, however, be interpreted in light of the different strengths and limitations of the project. Therefore, before proceeding to the discussion of the results, a discussion of methodological considerations and validity of the project is warranted.

6.1 Study design

In *Paper I,* a cross-sectional study design used a retrospective questionnaire, while *Paper II* and *III* adopted a prospective cohort study design with daily self-reported measures. To interpret the findings of these papers, different concerns associated with both study designs should be addressed. Furthermore, the quality of this project should be discussed concerning the validity, evaluating the studies generalizability and freedom from bias.[157]

6.1.1 Cross-sectional studies

In *Paper I,* the aims were to assess the prevalence of different types of HC used, exploring the reasons for usage, comparing negative cycle-related symptoms in HC users and non-HC users, and characterizing the HC users' perceptions of its influence on training and/or performance. As the aims included to explore the prevalence of HC type used by endurance athletes, as well as to compare different groups (i.e., HC vs. non-HC, progestin-only vs. combined HC), it was assumed that the questionnaire method would facilitate a comprehensive sample collection.[158] To achieve a more in-depth understanding of athletes' reasons and perceptions regarding HC use, analysis of open-ended questions was also conducted.

Regarding the use of questionnaires in the PhD project, *Paper I* was based exclusively on Q1, while *Papers II* and *III* used Q1 only for collecting athlete characteristics. In addition, *Paper II* relied on

Q2 and Q3 for updated information on athletes' HC status throughout the project period. As questionnaire data (Q1) forms the basis for the results only in *Paper 1*, the discussion below will focus on the structure of Q1 and the findings of *Paper I*.

As described in the methods, athletes who enrolled in *Paper I*, volunteered to participate based on their interest in the topic. In addition to information meeting, athletes were approached using social media. Of all athletes contacted via social media, all who noticed their invitation and were still active in their sport consented to participate and replied to Q1. As the study population was specified to competitive endurance athletes (tier 3–5 [142]), the sample population was also quite limited. Despite the limited numbers of potential respondents, the response rate was still relatively high.

In *Paper I*, several findings were based on open-ended questions. This is not the most common type of questions in questionnaires studies, as closed-ended options provide standardized information.[159] Using open-ended questions was decided based on the aims of *Paper I*. As previous studies have reported that many athletes use HC to control and manipulate their MC,[64,90,104] and/or to manage symptoms,[62,64] we wished to provide athletes with the opportunity to freely respond without the restrictions associated with close-ended questions. This also applied when we explored which cycle-related symptoms the athletes experienced during their cycle, as well as how the athletes perceived HCs to influence training and performance. Although the use of qualitative data limits the generalizability, this dissertation aims to highlight the athletes' own experiences, providing deeper understanding of the many perspectives that female athletes encounter regarding MC/HC cycle issues. In this context, the use of content comparative methods of analysis is arguably suitable, as this method has an abductive approach, that explores new perspectives while building on previous research.[136]

6.1.2 Prospective cohort studies

Using a prospective cohort design can be advantageous as it can detect patterns over a time period,[158] such as variations in different recovery measures across MC phases. The disadvantages are often related to expensiveness,[158] as well as selection and non-response bias, because large number of subjects often are required and long follow-up duration might result in withdrawals.[160] In order to retain athletes throughout the project period, it was important to engage the athletes early in the process.[161] As the current project aimed to recruit national and international level athletes, the data collection also had to be both feasible and undemanding, resulting in an applied approach

using athletes' own training diaries to collect data in *Paper II* and *III*. This, along with a research topic that actively engaged the athletes, might have been one of the reasons why we managed to recruit such a large number of subjects for our project. However, it is important to acknowledge that although the design allows for data collection using a tool the athletes already have implemented as part of their training and development process, namely their training diary, it does not automatically mean that the athletes are willing to share this information.[162] As such, designing a project that is relevant and important to the athletes most likely had a large positive effect on the participation rate.

Maintaining engagement and response rates over time is a unique challenge in prospective cohort studies.[162] In this dissertation, the exclusion criteria are described in detail in related papers, however, it is worth noting that only seven athletes withdrew from the project (*Paper III*) and ten athletes (*Paper II*, n=9; *Paper III*, n=1) were lost to follow-up due to insufficient logging. Other reasons for exclusion were related to change in HC status (*Paper II*) and detection of menstrual disturbances (*Paper III*), demonstrating that the athletes had continued engagement regarding sharing their data throughout the project period.

Another challenge with prospective cohort studies is the requirement for large samples.[158,160] This is especially an issue concerning *Paper II*, where some of the sub-groups were relatively small, which potentially might have masked true differences as type II error.[163] However, as our aim was to explore, rather than generalize, stratification of the HC users according to the HC type and delivery method used was conducted to reduce heterogeneity within the groups.[35] Additionally, previous research has found some differences between types and delivery methods regarding side-effects, resting HR and HR variability, and subjective sleep quality,[64,125,132] and such, argued for this division.

6.2 Validity

As self-report studies are prone to different bias,[164,165] which threatens internal and external validity, the potential bias in the current dissertation should be acknowledged and discussed thoroughly.

6.2.1 Selection bias

Selection bias occurs through errors related to the methods chosen to select participants, as well as other factors that might affect the study population.[157] As such, one question is whether the

experiences and the perceived influence of the MC/HC cycle and related symptoms on measures of recovery, training and performance differ between the athletes that participated in the study and the population of interest (external validity). For all papers included in this thesis, clear inclusion criteria were set before recruitment, reflecting the specific characteristics of the population of interest. Furthermore, athletes were recruited in collaboration with coaches and staff members of the Norwegian Biathlon Federation and Norwegian Ski Federation through information meetings, and by contacting them directly through social media. For *Paper III* we additionally used information posters on social media to recruit participants. By using this approach, we increased the probability of reaching all athletes that were registered in the federations, and thus all active athletes in Norway. This also reduces the likelihood of selection bias due to how the study population was found.[166] However, in *Paper III* we had to conduct an additional recruitment through information posters on social media, which might have excluded potential participants (e.g., those without access to social media), as our resources for widespread in other forms were limited.

Another factor affecting selection bias is the voluntariness of participation. Although we depended on volunteers, it is important to recognize that those who sign-up for projects tend to differ from those who do not (non-response bias [166]) regarding attitudes, behaviors, and health.[166] For the current project, however, the study population as considered to be both healthy and interested in the project, as it dealt with a topic that participants could immediately benefit from, as systematic tracking of MC/HC cycle is recommended by sports scientists. Nevertheless, we must acknowledge that the majority of participants (*Paper I-III)* were tier 2–3 [142] athletes, which does challenge our findings regarding the generalizability to other performance levels. Although it would have arguably improved the external validity, involving tier 4–5 [142] athletes in projects is known to be challenging due to their training schedules, as well as the constant study participation requests that such athletes often receive.[166] However, it is worth noting that negative cycle-related symptoms appears to be experienced by athletes at all performance levels, and by both HC users and non-HC users. These symptoms appear to be negatively associated with performance,[63,95,99] which is comparable to findings in our papers. As such, it is likely that selection bias is a minor concern in this dissertation.

Attrition bias, or loss to follow-up, is also considered a threat to the internal validity in prospective cohort studies.[157,160] Reasons for attrition bias can be related to such as dropouts, missing contacts, and protocol deviations, where loss to follow-up rate over 20% should raise concerns.[157,160] As

Paper II and *III* are based on a prospective cohort design, they are both prone to attrition bias and in **Figure 5** an overview of participants lost to follow-up is presented. In addition, **Figure 8** and **Figure 9**, presents *Paper II* athletes' individual bleeding patterns, and thereby also their participation period. In *Paper II,* we lost 9 athletes (10.1%) due to insufficient logging, while in *Paper III,* 8 out of 61 athletes (13.1%) did not complete the study. To minimize loss to follow-up in our project, we collected athletes' contact information, and sent push notifications to remind athletes to log their diary if they had forgotten. We also maintained periodic contact via e-mails and texts messages, answered questions that the athletes had about topics related to their MC/HC cycle, as well as held information meetings about related topics during the study period (*Paper II*). The reasons why some athletes chose to withdraw from the project are difficult to explain. However, illness, injuries, or that they can have ended their career during the project might be possible explanations. Nevertheless, if we follow the 20% "concern criteria" about loss to follow-up as suggested by Song and Chung,[160] attrition bias has not raised substantial worry in this project.

6.2.2 Information and self-reporting bias

Recall bias is a type of error that occurs when participants do not remember previous events, and thus give inaccurate responses [157,165]. This is particularly an issue in retrospective studies where methods such as self-administered questionnaires are utilized [165]. Thus, due to the retrospective method used in *Paper I*, this paper is possibly more threatened by recall bias compared to *Paper II* and *III*, as the latter were prospective cohort studies using day-to-day reporting. The topics investigated in *Paper I*, however, are issues that the athletes have a long experience with, hence there is good reasons to believe that their recall is sufficient. Nevertheless, it is important to acknowledge that the specific phase of the MC/HC cycle in which athletes were when replying to the questionnaire (*Paper I*), as well as their beliefs about what is expected to be perceived in different phases of the MC or with HC use might have influenced their responses [93,140].

Another concern relevant in self-reported studies, especially in those that investigate personal and sensitive topics, is the social desirability bias. This bias occurs if participants intentionally under- or overreport their responses due to a desire for social approval, and is especially a threat if confidentiality and anonymity cannot be guaranteed.[165] All athletes that enrolled into the current project received both written and oral information about how data were handled, and as MC and HC topics are often considered somewhat taboo in the athlete community,[137] it was important to specify how privacy was ensured. Based on the various statements from the athletes presented in *Paper I*, it

can be argued that they gave honest and personal responses. In *Paper II* and *III*, athletes daily reported measures related to their MC/HC cycle, as well as different recovery and wellness measures. Although there is a potential for athletes withholding honest answers due to fear of appearing 'unprofessional',[167] all measures in the current project were well-known to the athletes and already implemented in their diaries. These measures can help assess athletes' training, health status and recovery needs, as they appear to predict overreaching, and might also trump objective measures in evaluating training response.[117,118] As such, the athletes have been used to logging most of the measures in advance of the current project and are dependent on giving honest answers in order to follow and evaluate their process.

Notably, there will always be a possibility that interpretations of data differ between researchers, and interpretations of subjective data will thus be particularly susceptible to variability. Hence, observer bias can influence different parts of a study, such as evaluation, analysis, and reporting.[157] As a female researcher, it is important to be aware of how one's own experiences and perceptions related to the MC and with HC use might influence the project. However, to overcome this bias, we always made sure that several researchers worked together: from designing the project, to the recruitment and data collection, as well as the analyses and reporting. For instance, at least two researchers interpreted and analyzed the data before discussing our findings with the whole research group, which also has been suggested as an approach overcoming observer bias.[165] Additionally, all aims and research questions were set before inspection of the data, which hopefully has resulted in a more objective view of the data, as we did not search for suitable evidence, and thus being open for all findings.[165] Interestingly, the recent study by Cowley et al. [168] shows that being a female researcher investigating women-specific topics is not necessarily a disadvantage, as their findings suggest that studies led by women often are of higher quality, which might indicate that female researchers have a better understanding of women-specific factors.

6.2.3 Confounding

In observational studies, there can be numerous potential confounders, and therefore it is impossible to control for all of them.[151,166] However, to reduce the impact of confounders, stratification and multivariate adjustments of the analysis are considered possible strategies.[151,166,169] Although we have employed these strategies to reduce possible confounders, we cannot completely rule out residual confounding in any of the papers, as there are several factors that can influence athletes' perception of the MC and HC use, as well as measures of recovery.[46,116,122,140] Importantly, we must

acknowledge that the COVID-19 pandemic during our data collection period (May 2020–September 2021) might have had an impact on our findings, as lifestyle changes during the pandemic and lockdown, COVID-19 sickness and vaccines potentially can influence training/competition routines and menstrual health.[170-174] Hence, these factors should be considered when interpreting our results.

7 Discussion of results

This PhD thesis provides new insight into the prevalence of HC use among female endurance athletes in Norway, as well as their perception of how the MC and HC use, together with cycle-related symptoms, influence training, performance, and recovery using different approaches and methods. The main findings were as follows:

- In *Paper I* we found a higher prevalence of HC use (68.1%) and an increase in usage of progestin-only HCs (64%) compared to previous reports among Norwegian endurance athletes.[90] Of all HC users, 60% reported non-contraceptive reasons for HC use, with cycle-related symptoms being the main reason. The majority perceived a neutral or solely positive influence (81%) of HC usage on training and performance. For those HC users who reported a mixed or solely negative influence of HC use, the reasons where often related to different side-effects.
- Pre-bleeding days (*Paper II*) and MLP (*Paper III*) appear to be the time points with the most significant negative impact on self-reported measures of recovery in both HC users and non-HC users.
- We found cycle-related symptoms severity to be negatively associated with self-reported sleep quality and physical readiness to train (*Paper II*). Additionally, an interaction between MC phases and cycle-related symptoms was found in *Paper III*, where the influence of MC phase on mental readiness to train diminished with escalation in the severity of cycle-related symptoms.

The main findings related to each of the sub aims of the thesis are discussed in their respective papers, while this discussion aims to summarize these outcomes to address the overall objective.

7.1 Hormonal contraception use

In *Paper I*, the prevalence of HC use among Norwegian endurance athletes was found to be 68%, of which 64% of these athletes employed a progestin-only type. Although this prevalence is higher than what previous studies have found in the same population,[90,94] this aligns closely with the 69% prevalence reported among Norwegian women aged 20–24 in 2018, where also the use of progestin-only HC has increased especially after 2014.[72] Likewise, a recent study by Ekenros and colleagues [95] found the same trend among Scandinavian athletes from different sports, with 63%

HC usage and 52% of these employed a progestin-only type. The increased use of especially implant and IUSs is discussed in *Paper I,* attributed to their ease of use and the authorization for public health nurses and midwives to prescribe HCs. In addition, since 2016, the Norwegian Medicines Agency has recommended IUSs and implant, especially for younger women starting to use HC, due to their enhanced efficacy in preventing unwanted pregnancies and absence of risk of venous thromboembolism.[72] With recent research indicating a strong increase of progestin-only HC use among athletes in Scandinavia,[95] future studies should seek to investigate the effects of these long-acting HCs on sports specific and health-related parameters to deepen our understanding of the advantages and disadvantages associated with these contraceptives, ensuring the safeguarding of athletes' health and performance development.

7.2 Self-perceived influence of the menstrual cycle and hormonal contraception on recovery, training, and performance

In *Paper I,* almost half of the HC users experienced a solely positive influence of HC use on training and/or performance. The main findings from *Paper II*, including Implant, IUS, COC, POC and non-HC users, were that perceived sleep quality was worse during pre-bleeding compared to bleeding days, while resting HR was higher during pre-bleeding days compared to all other days in the cycle for all groups. In *Paper III*, including naturally menstruating athletes, MLP showed a negative effect on physical readiness to train and sleep quality compared to EFP and LFP, respectively. Additionally, physical readiness to train was also impaired during the OP compared to EFP, and resting HR was higher during MLP compared to EFP.

Whilst the effect of the MC phases and COC use on objective measures of exercise performance and recovery might not be detectable,[19,31,175,176] the perception of recovery can influence the recovery time course.[109] Overall, our findings from *Paper II* and *III* indicate that athletes perceive their MC or HC cycle to influence various aspects of recovery. Particularly in MLP, when examining the effects of different MC phases (*Paper III*), as well as pre-bleeding days (*Paper II*), athletes seem to perceive the most negative impact. This supports previous studies that have used retrospective questionnaires [90,95,99] and prospective self-reported [96,97,176] data. As discussed by Bruinvels and colleagues,[34] there is a higher probability of prolonged recovery time during the pre-bleeding days (late luteal phase) and bleeding days (EFP). Although our findings indicate that athletes might be more sensitive for recovery issues during the MLP (naturally menstruating

athletes, *Paper III*) and in the pre-bleeding days (all athletes, *Paper II*), it is important to acknowledge that the MC/HC cycle and related symptoms are some of many different stressors that might have an impact on these recovery measures.[46,116,122,140]

Considering that athletes', both HC users and non-HC users, report a negative influence on recovery measures during pre-bleeding days, it would have been interesting to include these days as part of the test-design when phases related to the MC is investigated. This has previously been discussed by Bruinvels and colleagues.[34] They suggest that it is not only the four distinct hormonal phases that should be investigated, as the transition in hormones between these MC phases can be rapid and significant. Moreover, they highlight that the progesterone withdrawal in the late luteal phase, the occurrence of cycle-related symptoms, and high training load (or stress), could potentially lead to fatigue and under-performance.

Interestingly, in *Paper I*, many HC users reported using HC to reduce negative cycle-related symptoms, perceiving these symptoms as interfering with their training and performance. In fact, almost 50% of the HC users perceived a solely positive influence on training and/or performance through HC use, often attributing it to the reduction of negative symptoms. However, nearly 20% experienced a mixed or solely negative influence, with the negative perception mostly related to various side-effects. As described in the introduction, HCs can cause different side-effects. In the study by Martin and colleagues [64] athletes reported both positive and negative effects. Positive effects were mainly related to better control and fewer/lighter bleeding events, and reduced pain/cramps, while negative effects were related to weight gain, irregular bleedings, and mood changes.[64] Some athletes also reported a negative effect on performance, as well as feelings of tiredness/fatigue, with progestin-only HC users more frequently reporting negative effects.[64] In *Paper I*, there was no difference between combined- and progestin-only HC users in the self-perceived influence of HC use on training and/or performance, nor where there any differences in reported cycle-related symptoms. This emphasizes how positive and negative side-effects can be individually perceived. Therefore, it is very important that athletes make independent and well-considered choices, in consultation with their medical experts, when considering different HC options.

7.3 The influence of cycle-related symptoms

In *Paper I,* the main reason for HC usage was reported to be cycle-related symptoms, and many HC users expressed that they wanted to manipulate their MC due to cycle-related symptoms interfering with training and/or performance. Reduction in cycle-related symptoms was frequently reported when HC users highlighted the positive influence of HC usage on training and/or performance. In *Paper II,* moderate and severe cycle-related symptoms were associated with reduced perceived sleep quality and readiness to train.

Previous studies have reported that athletes perceive cycle-related symptoms to interfere with training and performance, similar to the findings of *Paper II,* however, most previous research has been based on retrospective questionnaires, [90,91,95,99,102] similar to *Paper I.* Furthermore, the negative influence of cycle-related symptoms is further strengthened in studies using prospective data, although most of these studies have a relatively short timeframe.[63,97,156] In this way, *Paper II* contributes valuable data to these previous findings by following a cohort of endurance athletes for 12 months. Notably, the findings in *Paper II* indicate that no specific group (i.e., HC users [implant, IUS, COC, POC] and non-HC users) is more affected than any other, as all groups perceived cycle-related symptoms during pre-bleeding and bleeding days. Rather, it appears that those who experienced more severe symptoms were those who were most affected, as we found cycle-related symptom severity to be negatively associated with physical readiness to train and perceived sleep quality. This association is consistent with previous findings.[49,63,91,99,101] Therefore, it is important to take cycle-related symptoms into account when conducting female athlete research, as these symptoms might influence study outcomes. This finding further highlights the need to conduct studies where groups are distinguished between those experiencing severe cycle-related symptoms and those who are not. As shown in *Paper I,* there were no differences between HC users (progestin-only and combined) and non-HC users in reported cycle-related symptom severity, while in *Paper II,* implant users reported significantly lower cycle-related symptom severity compared to both IUS users and non-HC users. Despite these differences in cycle-related symptom severity among groups, all groups did experience more severe symptoms during pre-bleeding and bleeding days compared to non-bleeding days. Moreover, the range of reported cycle-related symptom severity was extensive even among implant users, indicating that the perception and experiences with symptoms are highly individual.

In *Paper I*, nearly 60% of the HC users reported that they used HCs for reasons other than contraception, with cycle-related symptoms being the primary reason. However, no difference was found between HC users and non-HC users when examining the prevalence of symptoms experienced, which is consistent with other studies.[62,63] As many HC users use hormonal contraception as symptom management, the lack of differences between groups are difficult to interpret. Therefore, it would be interesting to examine HC users' perceptions of cycle-related symptoms prior to HC usage, and how these symptoms affected their training, performance, and recovery. As hormonal contraception has the potential to mask menstrual disturbances,[44] a crucial indicator of REDs,[46,112] understanding athletes' reasons for choosing HCs, and whether HC use might enhance athletes' perception of training quality, recovery and performance is essential.

7.4 Bleeding patterns in non-HC users and HC users

Among non-HC users in *Paper II*, 86% reported abnormal cycle lengths during the study period. Additionally, 3 out of 22 (14%) athletes reported an absence of bleeding for ≥12 weeks. These findings align with the prevalence of secondary amenorrhea (absence of bleeding for ≥3 consecutive MC) found in endurance athletes, which ranges from 15–35%, as reported in a recent systematic review by Taim et al.[43] Menstrual cycle disorders, such as secondary amenorrhea, may be caused by continued ovarian suppression which could be due to low energy availability.[43] The development of MC disorders in endurance athletes may be attributed to the high volumes and intense endurance training, which may lead to REDs.[45] Notably, 12 of the 22 athletes with abnormal cycle lengths had three or more consecutive cycles within the 21–35 days range before experiencing an abnormal cycle length (**Figure 8**). It is also important to recognize that variations in cycle length are natural and common in healthy and fertile women,[39] and Li et al. [177] highlights that younger women (age <24 years) or women that are underweight (BMI <18.5 kg·m^2) are more likely to experience longer cycles than older women (35–39 years) and/or with a healthy BMI (18.5–25 kg·m^2). As all athletes in the present study were defined with a healthy BMI it is possible that the large percentages of abnormal cycle lengths may reflect the athletes age group or are related to their training.

The valuable insights into the large inter- and intra-individual variation in bleeding patterns among endurance athletes due to the use of long-term systematic data highlight the difficulty in engaging MC phase based training,[42] as there may also be large intra-individual variations to take into

account. Moreover, it is surprising to see such large variations in cycle length throughout a year. Whether the athletes themselves are aware of these variations is uncertain, but previous findings may indicate that many athletes have a lack of knowledge about menstrual function and disturbances, as well as little medical support.[178] Although cycles shorter than 21 days or longer than 35 days may simply be a result of expected variation, they may also indicate an underlying MC disorder, which further may be an indication of REDs and should, therefore, be examined and evaluated by medical experts to ensure athletes´ health and well-being.

For the HC users in *Paper II,* findings indicated substantial variations in bleeding patterns both between and within groups, as well as within each individual. As these findings are in line with expected side-effects related to various HCs, no further discussion on this group will be prioritized.

8 Conclusion

Overall, our papers provide insight into Norwegian female endurance athletes' experiences and perceptions of how the MC, HC use, and related symptoms influence training, performance, and recovery measures. Our findings indicate a higher prevalence of total HC use and an increased proportion in usage of progestin-only HC compared to previous studies. The most common reason for HC use was related to cycle-related symptoms, with the majority of HC users perceiving a neutral or solely positive influence of HC use on training and performance. The positive influence was often related to the reduction of cycle-related symptoms while the negative influence was related to different side-effects. Furthermore, MLP, pre-bleeding days, and cycle-related symptoms severity appear to negatively influence self-reported measures of recovery in HC users and non-HC users. However, it is important to consider the presence of other possible stressors, as the MC/HC cycle and related symptoms are just one of many factors that can potentially influence recovery.

9 Practical applications and future research

9.1 Practical applications

Based on our findings in *Paper II* and *III*, it appears that both HC and non-HC users might be more sensitive to recovery issues in the days prior to bleeding, with the severity of cycle-related symptoms being a possible contributor. Self-reported readiness to train, sleep quality and resting HR can interfere with the overall recovery process and thereby potentially affect training quality, physiological adaptations, and performance. Therefore, we recommend that athletes and coaches should focus on symptom management and MC/HC cycle monitoring and make individual adjustments to the training plan if necessary. Notably, as we detected large variations in bleeding patterns of non-HC users (*Paper II*), which potentially could indicate underlying MC disorders. Therefore, the detecting of such bleeding irregularities should also be considered an important reason for monitoring the MC among non-HC users.

In *Paper* I, many athletes reported that negative cycle-related symptoms interfered with training and performance and used HCs to reduce these symptoms. When hormonal contraception is considered, it is important to be aware of its potential to mask menstrual disturbances, a crucial indicator of REDs.[46] Moreover, although the majority of athletes perceived a positive or no influence of HC usage on training and performance, nearly 20% of the athletes reported having mixed or negative experiences, which mainly were related to different side-effects. This emphasizes the importance for athletes to make independent and well-considered HC choices, in consultation with their medical experts, when evaluating different HC options.

9.2 Future research

Many athletes experience an influence of the MC, HC use, and related symptoms on aspects related to training, performance, and recovery. Nevertheless, it is challenging to investigate these factors, as athlete perceptions appear to be highly individual. In this dissertation, the days prior to bleeding, together with cycle-related symptoms, stand out as important factors, which have also been emphasized in previous research.[31,34,63,90,91,99,102] Therefore, it would be interesting to include these days as part of the experimental design when phases related to the MC is investigated. Additionally, consideration for cycle-related symptoms is crucially important for improving the quality of female athlete research, as these symptoms might influence study outcomes. Hence, stratifying athletes

differently than previously recommended, such as distinguishing between those experiencing severe cycle-related symptoms and those who are not, might be an interesting and important option.

With over half of the athlete population in Scandinavia using HCs, as well as an increase in the use of progestin-only HC, more attention is required towards the different delivery methods and their influence on aspects regarding athletes' health, training, performance, and recovery. This, along with research exploring how HC use influences symptomology, should be prioritized. Moreover, it is necessary to obtain a more nuanced understanding of the different positive and negative side-effects with HC use, as well as to develop strategies to safeguard athletes' health and performance development.

Considering that we found different self-reported recovery measures to differ across the MC/HC cycle, it would be useful to further examine the association between objective and subjective measures of recovery in this regard. Moreover, as urinary ovulation testing does not detect all menstrual disturbances, future research should include serum hormone measurements when investigating the influence of MC phases on recovery measures.

Lastly, as many of the non-HC users had menstrual irregularities (*Paper II*), future research should seek to improve menstrual health literacy for coaches and athletes by addressing the recommendations by McGawley et al. [44] to safeguard athletes' health and well-being.

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Paper I

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Prevalence and Self-Perceived Experiences With the Use of Hormonal Contraceptives Among Competitive Female Cross-Country Skiers and Biathletes in Norway: The FENDURA Project

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Purpose: To investigate the prevalence of hormonal contraceptive (HC) use by female cross-country (XC) skiers and biathletes competing at a national and/or international level, their reasons for HC use, and to compare negative symptoms related to the HC-/menstrual cycle in HC users and non-HC users. Additionally, to characterize the self-perceived influence of HC use on training and performance.

Methods: A total of 113 Norwegian competitive XC skiers and biathletes completed an online questionnaire including both closed and open-ended questions. The questions were designed to assess the type of HC, reasons for use, self-reported negative symptoms related to HC-/menstrual cycle, as well as athletes' experiences regarding how HC use affects training and performance.

Results: In total, 68% of all the athletes used HC, with 64 and 36% of them using a progestin-only and combined type HC, respectively. Non-contraceptive reasons for HC use were reported by 51% of the progestin-only HC users vs. 75% of the combined HC users ($P = 0.039$), with reduction of negative menstrual-related symptoms as the most common reason. Of the athletes reporting regular withdrawal bleedings in connection to HC use, 80% of the progestin-only and 86% of combined HC users experienced negative menstrual-related symptoms, which was comparable to the non-HC group (86%). The majority (81%) of HC users experienced solely positive, or no effect, of HC use on training and performance, with no differences between progestin-only and combined HC users ($P = 0.942$).

Conclusions: In total, 68% of the XC skiers and biathletes used HC, with the highest proportion (64%) using a progestin-only HC. Many athletes used HC to manipulate their menstrual cycle due to perceived negative menstrual-related symptoms that interfered with their training sessions and/or competitions.

Keywords: combined hormonal contraceptives, endurance, female athletes, hormonal contraceptives, progestin-only hormonal contraceptives

INTRODUCTION

Hormonal contraceptives (HCs) are exogenous hormones used to alter endogenous sex hormone concentrations to prevent pregnancy or for medical and/or health-related purposes (Davis and Westhoff, 2001; Bitzer and Simon, 2011; Burke, 2011; Shulman, 2011). HCs can be classified into two main types, progestin-only or combined, based on their concentration of synthetic estrogen and progestin (Burke, 2011; Shulman, 2011). Progestin-only HCs include oral contraceptives (OCs; mini pills), implants, injections, and intrauterine systems (IUSs) (Burke, 2011), while combined HCs contain both synthetic estrogen and progestin and include OCs, transdermal patches, and vaginal rings as delivery methods (Shulman, 2011).

Approximately 40% of women (15–49 years) in the general Nordic population have been reported to use HCs, with the most common delivery method being combined OCs (Lindh et al., 2017). However, recent data from the Norwegian Prescription Database shows a rapid increase in the use of long-acting progestin-only HCs (i.e., implants and IUS) during the past 3 years (Furu et al., 2021). In the athlete population, approximately half of the respondents from various sports in the United Kingdom, Ireland, Denmark, and Norway reported hormonal contraceptive (HC) use (Martin et al., 2018; Oxfeldt et al., 2020; Solli et al., 2020; Nolan et al., 2022), with athletes in technical sports (e.g., golf, table tennis etc.) showing a higher proportion of HC use (80%) compared to athletes competing in endurance sports (50%) (Oxfeldt et al., 2020). Overall, combined HCs were more commonly used than progestin-only HCs (Martin et al., 2018; Oxfeldt et al., 2020; Solli et al., 2020). Although these studies were recently published, it is unclear if the rapid shift toward the use of long-acting progestin-only HCs, as reported by Furu et al. (2021), is also present in the athletic population.

Although HCs are mainly used to prevent pregnancy, both types of HCs are also used for other medical or health-related purposes, such as reducing premenstrual syndrome, premenstrual dysphoric disorder, anemia, mild-to-moderate acne, and other negative menstrual-related symptoms (Burke, 2011; Shulman, 2011). In addition, hormonal contraceptives are widely used to manipulate menstruation in recreationally active and competitive women (Schaumberg et al., 2018). In athletes, the consensus from previous research is that prediction and manipulation of menstruation are the most common non-contraceptive reasons, and positive side-effects, for using HCs (Martin et al., 2018; Armour et al., 2020; Elliott-Sale et al., 2020; Oxfeldt et al., 2020; Clarke et al., 2021), even though a meta-analysis showed that OC use results in a slightly lower performance compared to a natural menstrual cycle (Elliott-Sale et al., 2020). When Armour et al. (2020) investigated why Australian team-sports athletes chose to manipulate their menstruation, "convenience" and "reducing the impact on sporting events" were the main reasons. Furthermore, athletes from various sports reported that a reduction in negative menstrual-related symptoms is a positive side-effect of using HC (Martin et al., 2018; Clarke et al., 2021). However, negative side-effects such as weight gain, irregular periods, and mood swings are also reported with HC use and are mentioned as reasons for disuse of HCs (Martin et al., 2018; Clarke et al., 2021). Although the above-mentioned studies provide initial insights into the self-reported reasons and side-effects experienced by athletes using HCs, information about the self-perceived influence of HC use on endurance training among athletes of different age groups and performance levels, and whether their experiences differ from non-HC users, is lacking.

In the previous study by Solli et al. (2020), 17% of HC using athletes reported HCs to have a positive effect on their physical fitness or performance, while only 5% experienced negative effects. Since this study provided limited insights into differences between types of HC preparations, reasons for HC use, and how the HC affected training and performance, the present study aimed to build upon the work of Solli et al. (2020), by investigating HC users in more detail. Therefore, the aims of the current study were to: (1) investigate the prevalence of different types of HC (progestin-only vs. combined HCs) used by female cross-country (XC) skiers and biathletes competing at a national and/or international level; (2) explore the athletes' reasons for HC use; (3) compare negative symptoms related to the HC-/menstrual cycle experienced by HC users and non-HC users; and (4) characterize the self-perceived influence of HC use on training and performance.

MATERIALS AND METHODS

The current study is part of The Female Endurance Athlete (FENDURA) project, which is led by the School of Sport Sciences at UiT The Arctic University of Norway, in collaboration with the Norwegian University of Science and Technology, the Norwegian Olympic Committee (Olympiatoppen), the Norwegian Ski Federation, and the Norwegian Biathlon Federation. The overall aim of the FENDURA project is to increase the knowledge on how female-specific aspects, such as the menstrual cycle and HC use, influence training and performance among female endurance athletes.

Participants

From May 2020 to September 2020, 221 Norwegian competitive female XC skiers and biathletes were invited to complete a questionnaire about their menstrual cycle and HC use. The recruitment process was performed in collaboration with coaches and staff members of the Norwegian Ski Federation and the Norwegian Biathlon Federation, and by approaching athletes directly. The inclusion criteria were as follows: (1) competing at a national or international level; (2) above 18 years of age; (3) training systematically in their sport for at least 3 years. Of the athletes invited, 115 athletes completed the questionnaire. Of these, one athlete was excluded from the analysis due to missing consent form and one athlete was excluded due to low age (<18 years). Thus, 113 responses were included in the analysis; of these, 50 athletes were biathletes and 63 were XC skiers. Overall, the total sample included 51 juniors (born ≥2000) with an average age of 19 (range from 18 to 20) years and 62 seniors (born ≤1999) with an average age of 24 (range from 20 to 32) years. Based on the framework by McKay et al. (2022),

TABLE 1 | Participant characteristics stratified by type of hormonal contraceptive (HC), and by use and non-use of HC (mean and SD).

Characteristics information	Progestin-only HC users ($n = 49$)	Combined HC users ($n = 28$)	All HC users ($n = 77$)	Non-HC users ($n = 36$)	Seniors ($n = 62$)	Juniors ($n = 51$)	National team athletes ($n = 30$)	Non-national team athletes ($n = 83$)
Age (y)	21.3 (2.7)	22.2 (4.0)	21.6 (3.2)	20.8 (3.1)	23.5 (2.9)**	18.8 (0.7)	23.2 (3.9)**	20.7 (2.6)
Body height (cm)	168.6 (5.0)	168.1 (4.3)	168.4 (4.7)	169.3 (6.4)	168.4 (5.3)	169.0 (5.4)	169.8 (4.9)	168.3 (5.4)
Body mass (kg)	61.5 (5.3)	60.3 (3.3)	61.1 (4.7)**	63.5 (4.7)	61.2 (4.6)	62.6 (4.9)	63.2 (5.0)	61.4 (4.7)
Annual training volume (hr/year)	611.5 (113.1)*	667.8 (124.8)	632.2 (119.8)	644.7 (122.4)	679.3 (122.5)**	582.8 (93.9)	725.9 (120.6)*	603.4 (102.7)

*Significant differences between groups (*P <0.05 and **P <0.01).*

30 athletes (10 juniors and 20 seniors) belonging to a national team (recruit, junior, elite) were classified as Tier 4 and 5, while 83 athletes were classified as national level athletes (Tier 3) based on their training volume being within 20% of the international athletes (**Table 1**). The study was evaluated by the Regional Committees for Medical and Health Research Ethics (REK) and approved by the Norwegian Social Science Data Services (NSD). All participants were given oral and written information about the study, before providing their written informed consent to participate.

Questionnaire

The questionnaire used in the current study was based on the previously published questionnaire by Solli et al. (2020) but modified based on consultations with an expert panel, including former athletes, physiologists, medical experts, a gynecologist, and coaches. The current questionnaire was validated in Norwegian for use among Norwegian athletes (**Supplementary Table 1**) and contained several questions, both closed- and open-ended, about HC use, reasons for use, and how HCs influence self-perceived training quality and performance. The questionnaire was designed to take ∼15–30 min to complete. All participants reported age, body height, body mass, and total training volume over the preceding season (May 1st 2019, to April 30th 2020) (**Table 1**). Additionally, HC users reported information about which HC delivery method and brand they used (**Figure 1**). Athletes were grouped as either "current HC users" or "non-HC users," and each group completed different sections of the questionnaire. Current HC users reported if they used HC for non-contraceptive reasons, and athletes who used HC for non-contraceptive reasons were also asked to state these reasons by answering an open-ended question. HC users were asked to report if they experienced any positive and/or negative influence of HC use on training and performance. All HC users who experienced a positive or negative influence on training/performance were then asked to specify these experiences through answering open-ended questions. Both HC users and non-HC users were asked if they had regular withdrawal bleedings/menstruation. Athletes with regular bleedings were asked if they had any negative menstrual-related symptoms (i.e., experienced negative symptoms in relation to their HC-/menstrual cycle), and to specify these symptoms by answering an open-ended question.

Data Analysis

Responses to the open-ended questions were analyzed by the content comparative methods of analysis (Postholm, 2019). By employing an abductive analysis approach, these questions were coded and categorized by two authors of the current study (TE and GS), which were further discussed until a consensus was reached. Frequency analyses from the open-ended questions on symptoms and reasons for HC use were completed by counting codes in the different categories. A selection of responses, representing each category from the open-ended questions about "reasons for HC use" and "self-perceived influence of HC use on training/performance," are provided as examples of the interpretation of the responses to the various open-ended questions (**Tables 3**, **5**). Quantitative data are presented as mean (SD), frequencies, or prevalence, and the statistical significance level was set at $P < 0.05$. The athletes were categorized based on HC use vs. non-HC use, as well as the type of HC (progestin-only vs. combined). We also stratified athletes based on age (senior vs. junior) and national team athletes (Tier 4 and 5) vs. non-national team athletes (Tier 3). Categorical and numerical data were analyzed using the Statistical Package for the Social Sciences (SPSS 26, IMB Corp, Armonk, NY, USA). Data were examined for normality distribution before analysis using a Shapiro–Wilk test and visual inspection of Q–Q plots and histograms. Independent sample *t*-tests and Mann-Whitney *U*-tests were used to examine between-group differences, with the latter test being used for data that were considered as non-normally distributed. The relationship between categorical variables was examined with Pearson's chi-square analysis, with Fisher's exact tests being used when any expected cell counts were <5, i.e., using a conservative approach (Field, 2013).

RESULTS

Detailed information about the athletes' characteristics are presented in **Table 1**.

HC Use

Of all participants, 68.1% were currently using HC, of whom 63.6% used a progestin-only HC (IUS: 51%; implants: 28.6%; mini-pills: 20.4%), while 36.4% used combined HC (combined-OC: 96.4%; one patch-user). A lower proportion of progestin-only vs. combined users (30.6 vs. 75.0%, $P < 0.001$) reported having a regular withdrawal bleeding in connection with their

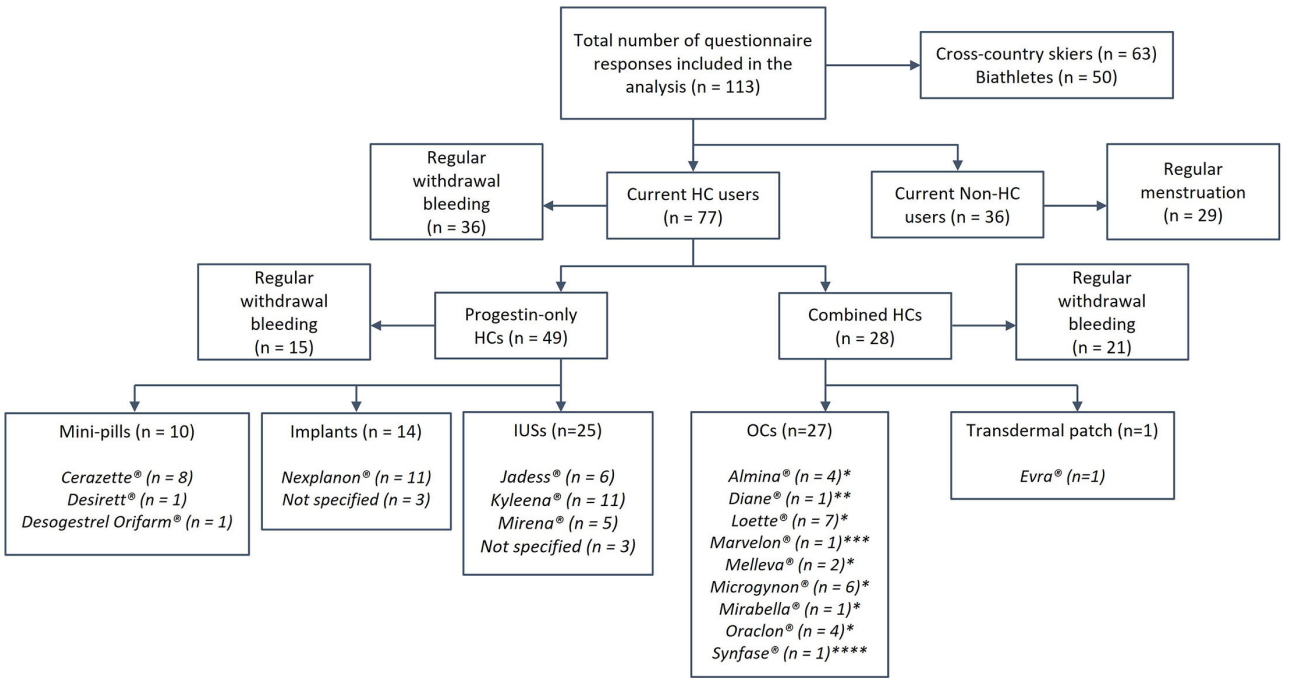

FIGURE 1 | The prevalence of type, delivery methods, and preparations of hormonal contraceptives (HCs) used. Concentration of synthetic hormones in the different delivery methods: Mini-pills, 75 μg Desogestrel; Implants, ∼40 μg Etonogestrel in 24 h over 3 y; Intrauterine devices (IUSs), 6–15 μg Levonorgestrel in 24 h over 3–6 y; Oral contraceptives (OCs), * 20–30 μg Ethinyl estradiol (EE) and 100–150 μg Levonorgestrel, **35 μg EE and 2,000 μg Cyproterone acetate, ***30 μg EE and 150 μg Desogestrel, ****35 μg EE and 500–1,000 μg Noretisterone; Transdermal patch, 33.9 μg EE and 203 μg Norelgestromin in 24 h.

HC use. Furthermore, 19.5% of the HC users had previously stopped using another HC due to experiencing a negative influence on physical fitness and/or performance. No difference in the prevalence of HC use or the type of HC were found between junior and senior athletes (HC use: $P = 0.054$; Type of HC: $P = 0.596$) or between national and non-national team athletes (HC use: $P = 0.799$; Type of HC: $P = 0.074$, for details see **Supplementary Table 2**).

Reasons for HC Use

Detailed information about reasons for HC use is presented in **Table 2** and a selection of statements is presented in **Table 3**. For detailed information about the juniors vs. seniors and national- vs. non-national team athletes see **Supplementary Table 3**). Among the 77 HC users, 59.7% reported that they used HC for non-contraceptive reasons, including 51% of the progestin-only HC users vs. 75% of the combined HC users ($P = 0.039$). For these athletes, menstrual symptoms were the most common reason (60% of the progestin-only HC users vs. 67% of the combined HC users, $P = 0.762$), while practical reasons were reported by 40% of the progestin-only HC users vs. 52% of the combined HC users ($P = 0.553$). Furthermore, 16% of the progestin-only HC users vs. 43% of the combined HC users ($P = 0.056$) reported compound reasons (i.e., symptoms influencing performance and/or for avoiding symptoms during competitions). Health-related reasons were reported by 8% of the progestin-only HC users vs. 19% of the combined HC users. When stratified based on age and performance level, non-contraceptive reasons for HC use were reported by 76.7% of the juniors vs. 48.9% of the seniors ($P = 0.016$), and by 61.9% of the national and by 58.9% of the non-national team athletes ($P = 0.813$). No differences were detected between junior vs. senior and between national vs. non-national team athletes when comparing the different non-contraceptive reasons for using HCs.

Symptoms Related to HC- and Menstrual Cycle

A detailed overview of the athletes' self-reported menstrual-related symptoms is presented in **Table 4**. Of the HC users with regular withdrawal bleeding, 80 and 85.7% of the respective progestin-only and combined HC users reported having menstrual-related symptoms. By comparison, 86.2% of the non-HC users who reported regular menstruation experienced menstrual symptoms. There were no significant differences between progestin-only and combined HC users or between all HC users and non-HC users (**Supplementary Table 4**).

HC Use and Self-Perceived Influence on Training and Performance

Detailed information about HC use and self-perceived influence on training and performance is presented in **Supplementary Table 3**. Of all HC users, 49.4% experienced a solely positive influence on training and/or performance, including 51% of the progestin-only HC users and 46.4%

TABLE 2 | Frequency and prevalence for hormonal contraceptive (HC) use.

Reported reasons for HC use	Progestin-only HC users ($n = 25$)		Combined HC users ($n = 21$)		All HC users ($n = 46$)	
	Frequency (*n*)	Prevalence, %	Frequency (*n*)	Prevalence, %	Frequency (*n*)	Prevalence, %
Menstrual symptoms	15	60	14	67	29	63
Unspecified pain	11	44	13	62	24	52
Heavy bleeding	7	28	2	10	9	20
Reduced physical fitness/emotional feelings	3	12	0	0	3	7
Practical	10	40	11	52	21	46
Avoid menstruation during competitions	6	24	9	43	15	33
Cessation of menstruation	4	16	0	0	4	9
Control of the cycle	2	8	3	14	5	11
Regular menstrual cycle	0	0	1	5	1	2
Compound reasons	4	16	9	43	13	28
Symptoms influence performance	4	16	4	19	8	17
Avoid symptoms during competitions/training camps	2	8	5	24	7	15
Health-related reasons*	2	8	4	19	6	13

**No detailed information due to low n.*

No significant differences progestin-only HC users and combined HC users when comparing reasons (symptoms: $P = 0.762$, Cramer's $V = 0.069$; practical: $P = 0.553$, Cramer's $V = 0.124$; compound reasons: $P = 0.056$, Cramer's $V = 0.297$).

No significant differences between juniors and seniors when comparing reasons (symptoms: $P = 0.760$, Cramer's $V = 0.045$; practical: $P = 0.139$, Cramer's $V = 0.218$; compound reasons: $P = 0.743$, Cramer's $V = 0.048$).

No significant differences between national and non-national team athletes when comparing reasons (symptoms: $P = 0.739$, Cramer's $V = 0.080$; practical: $P = 0.203$, Cramer's $V = 0.188$; compound reasons: $P = 0.469$, Cramer's $V = 0.142$).

TABLE 3 | Selection of responses: reasons for hormonal contraceptive (HC) use.

Participants' reasons for using HC			
Symptoms	**Practical**	**Compound reasons**	**Health-related**
"I use it to reduce severe menstrual cramps" "I suffered from prolonged, heavy, frequent bleeding that disturbed my everyday life. It became easier to handle with combined oral contraceptives. My menses became lighter, and my bleedings shorter with longer duration between each bleeding" "To reduce the amount of bleeding, pain and a consistent bad feeling" "Heavy bleedings, and some menstrual cramps" "Severe menstrual cramps" "Bloating, ailments, and abdominal pain" "To reduce menstrual pain"	"To get continuity in my menstruation, the ability to skip menstruation and as contraception" "To avoid menstruation at competitions/training camps etc." "Have control/avoid menstruation during training and competition" "Loss of menstruation" "Can postpone my period when I am competing or at training camps" "The possibility to skip menstruation, but the main reason is contraception" "To prevent menstruation and therefore make it more convenient, such that I do not need to think about it"	"To regulate when I have menstruation because I get painful cramps that I feel reduce my performance. Because of this, I can avoid having my period during important competitions" "To avoid bleeding at training camps and during training as it is both annoying and painful. The intrauterine system reduces my menstrual pains" "… Also had very strong menstrual cramps, and needed to be able to control my menstruation in relation to competitions etc…" "To avoid menstrual cramps during important competitions" "Severe and unpredictable menstrual cramps especially the first four days, which reduce my performance extremely" "[I] had so much menstrual pain before I started on combined oral contraceptives that I could not train" "Abdominal pain. I have struggled a lot with stomach cramps due to menstruation, which sometimes affected my performance"	"Both for contraception and due to low production of estrogen" "… polycystic ovary syndrome. I had a too low estrogen level" "Iron deficiency"

of the combined HC users. In total, 31.2% of the HC users experienced neither a positive nor a negative influence (i.e., "neutral") on training and/or performance, while 14.3 and 5.2% experienced a mixed and a solely negative influence, respectively. There were no significant differences between progestin-only and combined HC users when investigating

TABLE 4 | Prevalence of reported menstrual symptoms for progestin-only and combined hormonal contraceptive (HC) users, and for all HC users and non-HC users.

Symptoms	Progestin-only HC users ($n = 12$)		Combined HC users ($n = 18$)		All HC users ($n = 30$)		Non-HC users ($n = 25$)	
	Frequency (*n*)	Prevalence, %	Frequency (*n*)	Prevalence, %	Frequency (*n*)	Prevalence, %	Frequency (*n*)	Prevalence, %
Physical								
Stomach cramps/abdominal pain	6	50	16	89	22	73	13	52
Back pain	4	33	5	28	9	30	11	44
Heavy bleeding	4	33	4	22	8	27	4	16
Tiredness/fatigue/lethargy	2	17	1	6	3	10	4	16
Nausea/sickness/vomiting	0	0	2	11	2	7	4	16
Unspecified pain/cramps	2	17	0	0	2	7	3	12
Bloating/Other stomach problems	2	17	0	0	2	7	3	12
Reduced physical fitness	0	0	0	0	0	0	2	8
Muscle- and/or joint ache	2	17	2	11	4	13	2	8
Sweating/hot flushes	0	0	1	6	1	3	1	4
Hunger/increased appetite	1	8	0	0	1	3	1	4
Sore breasts	1	8	0	0	1	3	1	4
Headache	1	8	1	6	2	7	0	0
Emotional								
Mood changes/swings	4	33	3	17	7	23	9	36
Demotivated/sad/depressed	1	8	1	6	2	7	2	8
Flustered/Unfocused	0	0	0	0	0	0	2	8

the self-perceived influence on training and performance ($P = 0.942$). No differences were detected between junior vs. senior ($P = 0.788$) and national vs. non-national team athletes ($P = 0.379$) when investigating the athletes' perception of how HCs influenced training and performance.

DISCUSSION

The current study explored the prevalence and self-perceived experiences with the use of hormonal contraceptives in Norwegian competitive endurance athletes. Our main findings were as follows: (1) 68% of the examined athletes used HC, with 64% of these using a progestin-only type; (2) 60% of the HC users reported non-contraceptive reasons for HC use, with menstrual symptoms as the main reason (i.e., 60% of the progestin-only HC users and 67% of the combined users; non-significant difference); (3) of the HC users with regular withdrawal bleeding, 80% of the progestin-only and 86% of the combined HC users experienced negative menstrual-related symptoms (non-significant difference), which was similar to the non-HC users (non-significant); (4) there were no significant differences in how the use of HC was perceived to influence training and/or performance between progestin-only and combined HC users, and the majority (81%) of all HC users experienced a solely positive or no influence, of using HC on training and/or performance.

HC Use

The 68% prevalence of HC use in this study is higher than the ∼50% prevalence reported in earlier studies on athletes from various sports (Martin et al., 2018; Oxfeldt et al., 2020; Solli et al., 2020; Clarke et al., 2021; Nolan et al., 2022). Furthermore, over 60% of HC users in the current study employed a progestin-only type of HC, which differs from previous studies where most (61–74%) athletes used a combined type (Martin et al., 2018; Oxfeldt et al., 2020; Solli et al., 2020). This prevalence of progestin-only HC use (64%) was substantially higher than the 38% reported in Solli et al. (2020), who investigated the same population of Norwegian XC skiers and biathletes. The reason for this difference could be the general increase in long-acting contraceptives, including implants and IUS, found in the general Norwegian population (Furu et al., 2021). Based on the Norwegian Prescription Database, the investigation by Furu et al. (2021) showed an increase in the use of implants and IUS from 8 to 26% from 2015 to 2020 in women aged 20–24 years. The reason for this increase may be that public health nurses and midwives were authorized to prescribe all hormonal contraceptives for women 16 years and older from 2016, including implants and IUS. Furthermore, the reason for the higher prevalence of progestin-only HC could be the ease of use, which is reported as the most common reason for athletes' choice of type/delivery method in the study by Martin et al. (2018). Accordingly, long-acting HCs as implants and IUS, have been preferred because of their high efficacy and ease of use (Burke, 2011). However, there is limited research examining how different types of HC, especially progestin-only types, affect athletic performance (Martin and Elliott-Sale, 2016; Clarke et al., 2021). The rapid increase in the use of progestin-only HCs, particularly long-acting HCs, in endurance athletes is interesting since a significantly higher incidence of negative side-effects has

been reported in progestin-only compared to combined HCs (Martin et al., 2018). However, the positive effects of long-acting HCs on athletes' training quality and performance may potentially outweigh any negative side-effects. Future studies should seek to answer this question, in addition to directing more attention to the effects of long-acting HCs on training and performance.

Reasons for HC Use

Sixty percent of the HC users reported that they used HCs for non-contraceptive reasons. Interestingly, this included a significantly higher proportion of combined HC users (75%) compared to progestin-only HC users (51%). The reason for the disagreement is unclear since no differences were detected in the reported reasons for HC use between the two groups. Reduction in negative menstrual-related symptoms was the main reason for HC use in both groups, with athletes stating (**Table 3**) to use HC "*To reduce the amount of bleeding, pain and a consistent bad feeling*," and to reduce "*Bloating, ailments, and abdominal pain*." Such reduction of menstrual symptoms, as well as "practical reasons" such as the ability to predict and/or change the HC-/menstrual cycle, and cessation of menstruation are all positive effects of HC use reported in previous studies (Martin et al., 2018; Oxfeldt et al., 2020; Clarke et al., 2021). However, these latter studies have mainly reported practical reasons as the most common non-contraceptive reason for HC use. Our findings of athletes reporting compound reasons (**Table 3**), highlight that some athletes use HC to reduce or avoid negative menstrual-related symptoms because they perceive this to interfere negatively with their training and performance.

Symptoms Related to HC- and Menstrual Cycle

In the current study, only HC users with regular withdrawal bleeding were asked about having negative menstrual-related symptoms, which excluded nearly 70% of the progestin-only HC users. Our findings indicate that a large portion of the progestin-only HC users experiences irregular or cessation of bleeding, which is a known reported side-effect of using progestin-only HC (Burke, 2011). Of the athletes with regular withdrawal bleeding, negative menstrual-related symptoms similar to the experiences of non-HC users, occurred in both progestin-only and combined HC users (with no differences between groups), which is in line with previous studies (Solli et al., 2020; Clarke et al., 2021). However, Clarke et al. (2021) speculated that although HC users experience negative menstrual-related symptoms, they may experience decreased duration or severity of symptoms. In addition, Findlay et al. (2020) highlighted that some athletes in their study used HCs to manage their negative menstrual-related symptoms. In the current study, HC users were not asked if they had fewer/lighter menstrual symptoms compared to before they started using HC. However, responses such as "*[I] had so much menstrual pain before I started on combined oral contraceptives that I could not train*" (**Table 3**), "*[I have] slightly less pain than I had without contraception. This makes it easier to complete workouts…*" (**Table 5**) suggest that athletes' negative menstrual-related symptoms may have reduced in severity as a result of HC use.

HC Use and Self-Perceived Influence on Training and Performance

No differences between progestin-only and combined HC users were detected when we examined the self-perceived influence of HC use on training and performance. Furthermore, nearly half of the athletes (51% of the progestin-only HC users and 46% of the combined users) experienced only a positive influence of HC use on training and/or performance. This is much higher than the 17% reported in Solli et al. (2020). While Solli et al. (2020) did not provide any further explanations for these positive effects, several of the athletes in our study stated that their perceived positive influence on training and/or performance was due to lighter, or absence, of negative menstrual-related symptoms (**Table 5**), e.g., "*I do not have as much menstrual pain with HC, which makes it easier to train and compete*" and "*[I] struggled a lot with menstrual pain before, but after I started on the implant, this has decreased. This means that I am not knocked out when I have my period and can train as normal.*" Based on the athletes' experiences in this study, it appears that a reduction of menstrual-related symptoms increases the perceived training quality, which might be an important positive effect from HC use in many athletes. Still, ∼30% of the athletes did not experience any influence (i.e., "neutral") of HC use on training and performance, while 14% experienced a mixed (i.e., both positive and negative) influence by using HC. In addition, 5% had solely negative experiences, which is in line with Solli et al. (2020). The negative influence reported by athletes in the current study were mostly related to perceived side-effects such as irregular bleeding or stronger negative menstrual-related symptoms.

Overall, the findings in this study emphasize that athletes use HC to improve their perceived training quality due to complex negative menstrual-related symptoms. Furthermore, our findings indicate large individual variations in response to HC use, probably due to the athletes' unique hormonal profile and their reaction to the composition of synthetic hormones in different types and brands of HCs (Elliott-Sale et al., 2021). The individual response to HC use also highlights the importance of proper communication between coaches, athletes, and medical staff, as well as the need to monitor health and performance when starting on a new HC to detect potential changes (Findlay et al., 2020; Solli et al., 2020; Höök et al., 2021).

Strengths and Limitations

A strength of the current study is the inclusion of national team athletes, which in XC skiing and biathlon includes athletes of world-class level. The high athletic level of these participants is valuable for generalization of the findings across different groups of elite endurance athletes. No differences were found between the national and non-national team athletes, suggesting that these results are representative of competitive endurance athletes of different

TABLE 5 | Selection of responses: how hormonal contraceptives (HCs) influence training and/or performance.

Participants' experiences about how HCs influence training and/or performance		
Perceived a solely positive influence	**Perceived a mixed influence**	**Perceived a solely negative influence**
Influence on training: "I do not have as much pain and heavy bleeding anymore. What's more, I have not been as exhausted or tired as before I started on combined OC, therefore I feel better when training"	**Positive influence on training:** "I avoid menstruation, as well as menstrual pain"	**Influence on training:** "Somewhat more pain during menstruation"
Influence on performance: "I have no pain and I'm not nauseous on competitions days anymore, feelings that I used to have before"	**Positive influence on performance:** "To avoid the menstrual cycle which can affect the hormone balance in the body. For example, it prevents me feeling very emotional for some periods, etc., which I can imagine could affect both training and performance"	**Influence on training:** "I have negative experiences with mini-pills, but now when I use an implant, I have some intermittent bleeding and sometimes pain. When I get menstrual cramps, I think it is extra difficult to exercise and I am not always in shape to train"
Influence on performance: "Not directly on performance, but due to my previous menstrual problems, hormonal contraception has made it easier for me because I can avoid the negative menstrual symptoms"	**Negative influence on performance:** "I do not get the natural answer that my body functions properly as it should during a normal menstrual cycle"	**Influence on performance:** "The days I have menstrual pain or heavy bleeding are much harder and makes it more difficult to perform optimally"
Influence on training: "I do not have as much menstrual pain with HC, which makes it easier to train and compete"	**Positive influence on training:** "Higher iron levels, more stable body and fewer mood swings"	**Influence on training:** "Irregular menstruation due to IUS. When I used OC, it was regular. What's more, stronger menstrual pain now than with using OC"
Influence on performance: "HC causes less bleeding and less pain during menstruation, which has a positive effect related to my performance. It is easier to give maximum at competitions when I do not have severe pain. I do not have to take paracetamol before competitions"	**Negative influence on training:** "Easier to get nauseous"	**Influence on performance:** "When I used OC, I skipped menstruation a few times to avoid menstruation around important competitions. I cannot control this with IUS, so I think that is a negative point. At the same time, it is now very unpredictable when I will get my period"
Influence on training: "To a positive degree, so that I could postpone menstruation until after a competition or reduce pain to perform better without too many distractions"	**Positive influence on training/performance:** "Predictable menstruation and the possibility to postpone it if it does not fit with competitions"	**Influence on training:** "Lethargic, and physically heavy. Harder to train. I lose the feeling of being 'light' in my body"
Influence on performance: "I avoid pain, performs better. No need to think about changing sanitary pads/tampons or about bleeding through them"	**Negative influence on training/performance:** "Weight gain and irregular bleeding the first couple of months"	**Influence on performance:** "Loses the feeling of being in shape, strong/fast and 'light' in my body"
Influence on training: "[I have] slightly less pain than I had without contraception. This makes it easier to complete workouts. In addition, I bleed less. When I used OC, I had no pain or bleeding, but was often in a bad mood"	**Negative influence on training:** "I can experience menstrual symptoms of pain and intermittent bleeding to varying degrees"	
Influence on training: "[I] struggled a lot with menstrual pain before, but after I started on the implant, this has decreased. This means that I am not knocked out when I have my period and can train as normal"	**Positive influence on performance:** "In the period after menstruation, I feel stronger and fresher"	
	Positive influence on training: "I got less bleeding and pain during menstruation when I first started on OC. In recent years no bleeding"	
	Negative influence on training: "No bleeding in recent years has been practical in terms of training and competition performance. However, without (regular) menses, it is more difficult to confirm that I am not pregnant and that I have an adequate energy intake"	
	Positive influence on performance: "No bleeding is practical"	

levels. However, the sole focus on only biathletes and XC skiers might limit the generalizability of these findings to women competing in other endurance sports. Furthermore, the analysis of the open-ended questions provides complementary qualitative insight when analyzing reasons for HC use and the athletes' perception of how HCs may influence their training and performance.

There are also some limitations of this study. First, only current HC users were asked about previous HC use and the perceived influence of HCs on training and performance. This may have excluded important information about non-HC users' previous experiences of HC use and reasons for discontinuation. Second, HC users were not asked about perceived side-effects related to HC use, which reduces the possibility to understand the relationship between a specific type of HC and perceived side-effects. Third, the questionnaire was originally designed for two main groups (HC users and non-HC users) where only athletes with regular menstruation (and withdrawal bleedings) were asked about negative menstrual-related symptoms. Optimally, all athletes should have been asked to state if they have symptoms. In addition, associations between the duration of HC use and negative menstrual-related symptoms experienced could not be conducted with our dataset. However, since this would have been interesting information in the discussion on how HC use influence negative menstrual-related symptoms, we recommend future studies to investigate this. Forth, it is a possibility that the lack of significant differences found in this study could be caused

by the low proportion of combined HC users or athletes at an international level (Tier 4–5). Thus, further studies should aim to include even more athletes in their sample. Similar to the data presented in the current study, most of the results from previous studies are limited by the descriptive and comparative analyses.

CONCLUSIONS

This study provides new insight into the prevalence and reasons for using HCs among Norwegian female endurance athletes, with in-depth knowledge on athletes' perceptions of how different types of HC influence their training and performance. Overall, we found 68% HC use in XC skiers and biathletes, which is a higher proportion then reported previously in other athlete populations. The highest proportion (64%) of athletes in the current study used a progestin-only HC, which follows the increasing trend in the general Norwegian female population. The most common non-contraceptive reason for using HC was to reduce negative menstrual-related symptoms. This substantiates the fact that many athletes use HC to avoid menstrual-related negative symptoms interfering with their training and/or competitions. These perspectives, alongside the observation of the high proportion of progestin-only HC users, provide important information for the development of specific guidelines and the direction for future research in this area.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the dataset generated for this study is not publicly available due to privacy concerns. Requests for assessing the dataset should be directed to the corresponding author. Requests to access the datasets should be directed to TE, tina.engseth@uit.no.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by REK, Regionale komiteer for medisinsk og helsefaglig forskningsetikk (Project ID: 135555). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

TE, GS, BM, TT, DN, ØS, and BW designed the study whereas TE collected data. TE, EA, GS, and BW performed the data and statistical analyses, and interpreted the results. TE wrote the first draft of the manuscript. All authors jointly revised the manuscript and approved the final version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fspor.2022.873222/full#supplementary-material

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Paper II

Engseth TP, Osborne J, Solli GS, Morseth B, Andersson EP, Topranin VDM, Taylor M, Noordhof DA, Sandbakk Ø, & Welde B.

Influence of menstrual/withdrawal bleeding on self-reported symptoms and recovery during an annual cycle in endurance athletes: The FENDURA project.

(*Submitted/in review*)

Paper III

Topranin VDM, Engseth TP, Hrozanova M, Taylor M, Sandbakk Ø, & Noordhof DA.

The influence of menstrual cycle phase on measures of recovery status in endurance athletes: The FENDURA project.

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Human Kinetics
ORIGINAL INVESTIGATION

The Influence of Menstrual-Cycle Phase on Measures of Recovery Status in Endurance Athletes: The Female Endurance Athlete Project

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Purpose: To investigate the influence of menstrual-cycle (MC) phase on measures of recovery status, that is, resting heart rate, perceived sleep quality, and physical and mental readiness to train, among female endurance athletes. ***Methods:*** Daily data were recorded during 1 to 4 MCs (ie, duration ≥21 and ≤35 d, ovulatory, luteal phase ≥10 d) of 41 trained-to-elite-level female endurance athletes (mean [SD]: age 27 [8] y, weekly training: 9 [3] h). Resting heart rate was assessed daily using a standardized protocol, while perceived sleep quality and physical and mental readiness to train were assessed using a visual analog scale (1–10). Four MC phases (early follicular phase [EFP], late follicular phase, ovulatory phase, and midluteal phase [MLP]) were determined using the calendar-based counting method and urinary ovulation-prediction test. Data were analyzed using linear mixed-effects models. ***Results:*** Resting heart rate was significantly higher in MLP (1.7 beats·min^{-1}, $P = .006$) compared with EFP without significant differences between the other MC phases. Perceived sleep quality was impaired in MLP compared with late follicular phase (–0.3, $P = .035$). Physical readiness to train was lower both in ovulatory phase (–0.6, $P = .015$) and MLP (–0.5, $P = .026$) compared with EFP. Mental readiness to train did not show any significant differences between MC phases ($P > .05$). ***Conclusions:*** Although significant, the findings had negligible to small effect sizes, indicating that MC phase is likely not the main determinant of changes in measures of recovery status but, rather, one of the many possible stressors.

Keywords: follicular phase, ovulatory phase, luteal phase, hormonal fluctuations, sleep quality, resting heart rate, readiness to train

Training adaptations in sports are regulated through an intricate balance between training stimulus and recovery.[1] Recovery status is defined as a state of biopsychosocial balance[2] and is influenced by several factors, such as nutrition, sleep,[1] and potentially the menstrual cycle (MC). The endogenous female sex hormones fluctuate cyclically over a 21- to 35-day period in an eumenorrheic MC.[3] Four phases are commonly identified based on their different concentrations of estrogen and progesterone: the early follicular phase (EFP), the late follicular phase (LFP), the ovulatory phase (OP), and the mid-luteal phase (MLP).[3] Sex hormone fluctuations associated with the MC might influence both training tolerance and the rate of recovery through several pathways.[4,5] However, there are insufficient published original investigations with proper MC phase verification to draw any conclusions. An improved understanding of the influence of MC phase on the recovery status of athletes would help female athletes and their support personnel to adjust training load and/or the subsequent recovery to optimize training adaptations.

Athletes, coaches, and researchers have used a variety of objective and subjective variables to monitor recovery status. A commonly used objective marker of recovery status is resting heart rate (HR). Measuring resting HR has the potential to detect training-induced changes in the autonomic nervous system, which has a crucial role in stress tolerance.[6] Although there is some recent evidence of increased resting HR in the MLP compared with the EFP,[7–9] high-quality studies on exercise-trained women or athletes are missing. Only one of the aforementioned studies[8] focused on an exercise-trained population; however, this study exclusively employed the calendar-based counting method for MC phase determination. Exercising women and athletes often exhibit subtle menstrual disturbances,[10] such as anovulatory MCs and luteal phase deficiency, which present with altered hormonal fluctuations compared with eumenorrheic MCs and could possibly influence the recovery patterns. These subtle menstrual disturbances are not detectable when only using the calendar-based counting method,[11] and the inclusion of additional methods for the determination of MC phases (eg, ovulation prediction test) would make the findings more reliable.

In addition to objective measures, subjective indicators, such as perceived fatigue and readiness to train, are commonly used to assess recovery status[1] and are able to identify nonfunctional states.[12] Subjective measures appear to be more sensitive and consistent than objective markers for monitoring the training-induced changes in athletes well-being.[13] However, there is limited research on the influence of the MC on subjective recovery measures in athletes. Cook et al[14] showed significant variations in motivation to train across the MC among athletes involved in a range of different sports, but this study only employed the calendar-based

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counting method for determination of MC phases. Perceived sleep quality is another subjective measure with the potential to provide useful indications about recovery status. Although perceived sleep quality has been shown to be impaired in the days preceding the bleeding phase (ie, late luteal phase) and during the bleeding phase (ie, EFP) in healthy women,[15,16] there are currently no robust findings about the influence of the MC on perceived sleep among female athletes.

A combination of objective and subjective measures of recovery status that is time-efficient, easy-to-collect, and noninvasive is widely used by athletes and their support staff. Knowledge about the influence of MC phase on such recovery measures could be important for interpreting recovery status in female athletes. Altogether, the aim of this study was to investigate the influence of MC phase on measures of recovery status, such as resting HR, perceived sleep quality, and physical and mental readiness to train among female endurance athletes.

Methods

Study Design

The present study was part of the Female Endurance Athlete (FENDURA) project, which investigates the influence of female-specific aspects on training and performance among female endurance athletes. The study was preapproved by the Norwegian Social Science Data Services (409326). All participants were given written information about the study, and they provided their written informed consent before participation.

Participants

Participants were invited to enroll in the project if they (1) were 18 years old or older, (2) were naturally menstruating, (3) reported to have a regular menstrual bleeding, (4) were exercising at least 6 times per week, and (5) were a recreational or professional athlete within an endurance sport (see Figure 1; team sports excluded). Participants could not take part in the study if they (1) were amenorrheic, (2) were using hormonal contraceptives at the time of recruitment, (3) reported having a menstrual disturbance at the time of enrollment, and (4) reported having sleep disorders or severe medical conditions. Of the 61 athletes who consented to participate, 49 completed the study (see Figure 1). Eight participants were retrospectively excluded because all their MCs during the study period presented with a menstrual disturbance, such as (1) absence of a positive ovulation test (anovulatory cycles), (2) luteal phase shorter than 10 days,[17] and/or (3) MC duration shorter than 21 or longer than 35 days[3] (Figure 1). Participants were included in the analysis when they had at least one MC without menstrual disturbances. Considering the self-reported history of regular menstrual bleeding and the fact that exercising women are likely to have menstrual disturbances,[10] this was regarded as a sufficient criterion for including MCs in the analysis. Details about prevalence of menstrual disturbances within each participant during the study period are reported in Supplementary Table S6 [available online]). Thus, 1 to 4 MCs (n = 107) per participant (n = 41) were included in the final analysis. Their characteristics were collected via an enrolment questionnaire (see Table 1). Participants were classified based on their training volume and

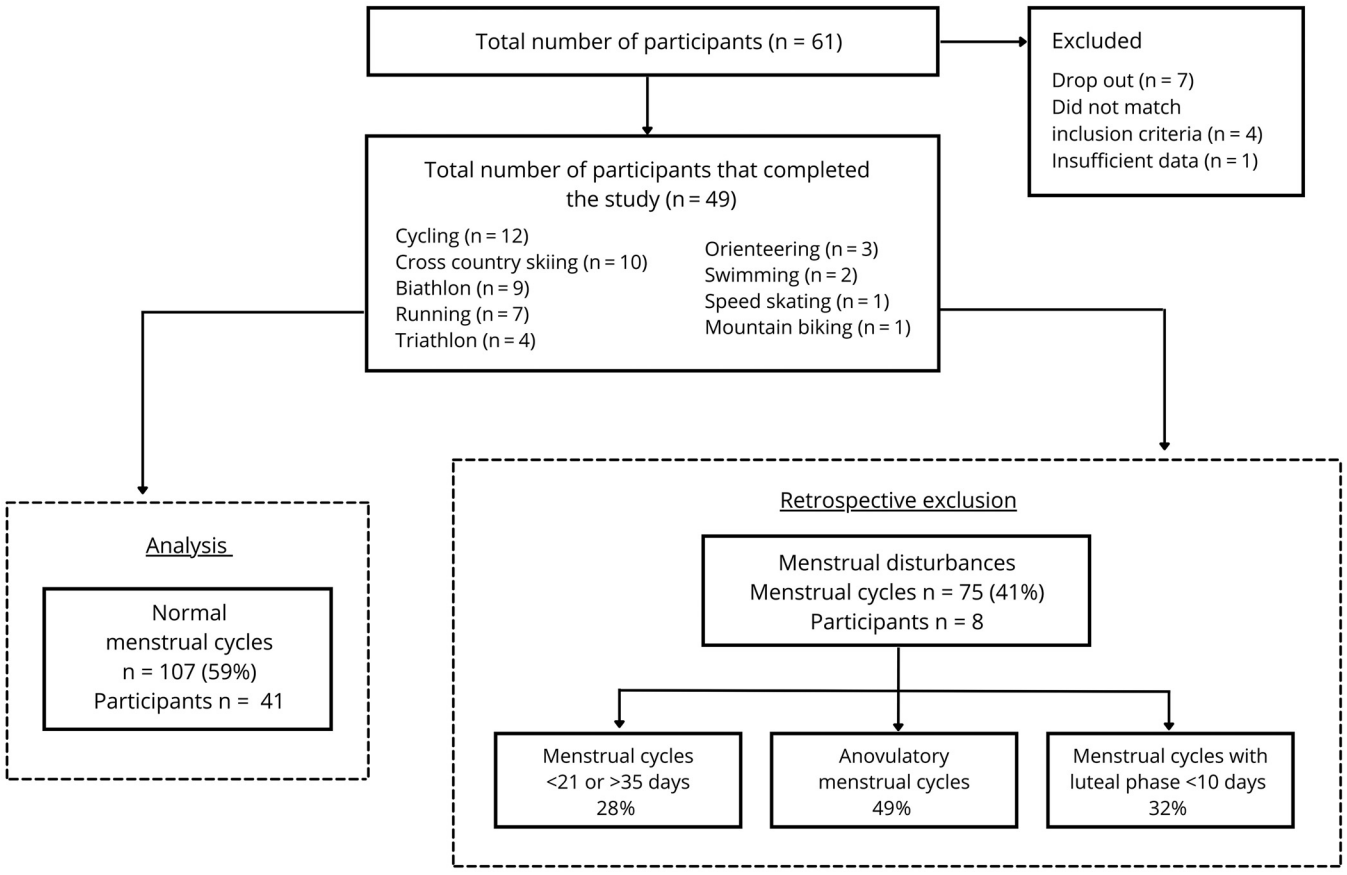

Figure 1 — Flowchart showing the inclusion procedure and the classification of menstrual cycles.

performance level[18] in (1) tier 2, trained/developmental (n = 16); (2) tier 3, highly trained/national level (n = 18); and (3) tier 4, elite/international level (n = 7).

MC-Phase Determination

MC phases were determined using the calendar-based counting method and a urinary ovulation prediction test. The first day of menstrual bleeding was identified as day 1, and MC length was defined as the number of days from day 1 up to and including the day before day 1 of the following MC.

The participants were provided with Clearblue digital ovulation test kits (Clearblue, SPD Swiss Precision Diagnostics GmbH) and instructed to start using these on day 8 of the MC, and to perform the test at approximately the same time each day (±1 h) and in standardized conditions (not having urinated for at least 4 h before testing and to avoid excessive fluid intake before testing). The test was performed every day until a positive result occurred or until the first day of menstrual bleeding in the following MC. Participants were required to send a photograph of the test strip to the primary investigator for visual confirmation of a positive test. Four MC phases were determined based on the first day of menstrual bleeding and the day of a positive ovulation test: EFP (day 1 to day 3 of the MC), LFP (the day before and the day of a positive ovulation test), OP (the 2 d following a positive ovulation test), MLP (7–9 d following the positive ovulation test).[3] Figure 2 provides a graphical visualization of the MC phases.

Table 1 Participant Characteristics

	Mean	SD
Age, y	26.7	8.2
Body height, cm	168.7	6.7
Body mass, kg	60.8	5.9
Weekly training volume, h:min	09:07	03:17

Note: Weekly training volume refers to the study period.

Training Parameters

Participants self-recorded their training sessions using one of 2 online platforms: "Olympiatoppens Treningsdagbok," the Norwegian Top Sports Center (Olympiatoppen) training diary, or BESTR training diary (BESTR). Both the training and recovery parameters that participants recorded daily were identical in the 2 training diaries. Training load was calculated by multiplying total duration of the training session in minutes by the session rating of perceived exertion as described in Foster et al.[19] In case of multiple training sessions on one day, the training load of those sessions was summated to obtain one training load score per day. Both endurance and strength sessions were considered for the quantification of training load, including warm-up, cooldown, and recovery intervals. Mobility and stretching sessions were excluded. Monotony was quantified as the mean of the daily training load during a given MC phase divided by its SD; strain was determined as the product of training load during a given MC phase and monotony[20] (both variables were calculated for each MC phase). To account for the different length of MC phases, the mean training load was used rather than the sum.[21]

Recovery Measures

Participants were asked to report their objective and subjective measures of recovery status in their online training diary daily. Resting HR was assessed using an overnight-monitoring watch (mean value throughout the night). Participants who did not have such equipment used a standardized procedure upon awakening, that is, go to the bathroom, lie back in bed in supine position and calm down, relax for 5 minutes, and count the HR during the last minute. Participants were instructed to measure resting HR using

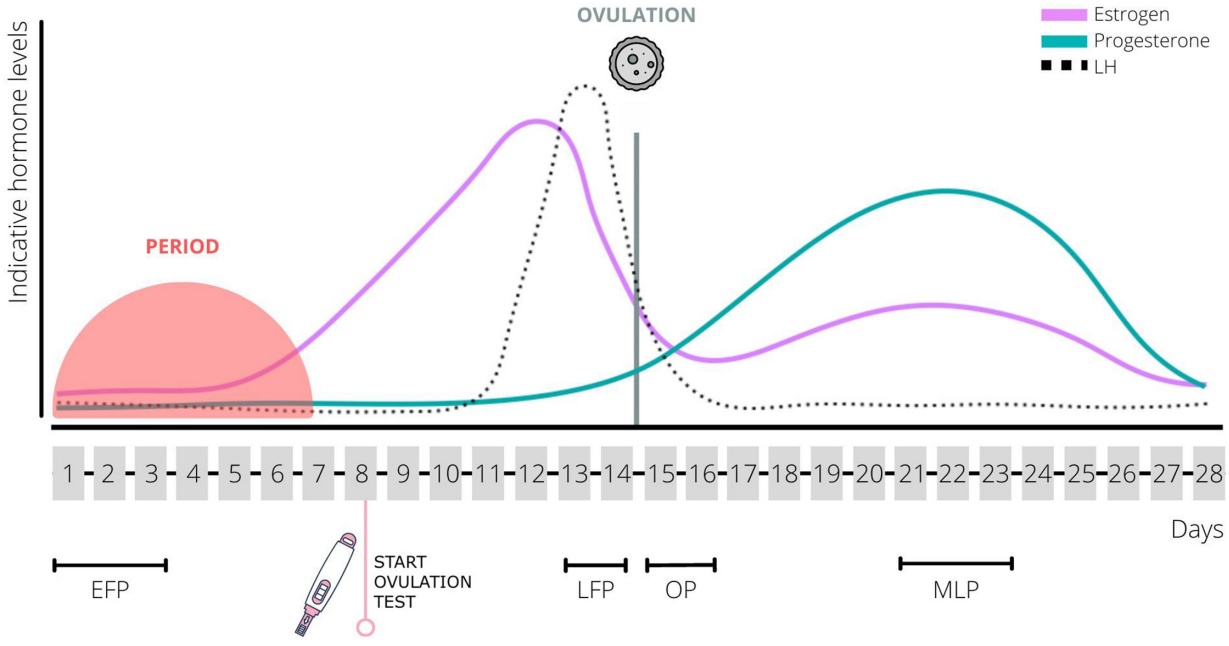

Figure 2 — Graphical visualization of the determination of menstrual-cycle phases over an idealized 28-day menstrual cycle. EFP indicates early follicular phase; LFP, late follicular phase; LH, luteinizing hormone; MLP, midluteal phase; OP, ovulatory phase.

the same method throughout the whole study period. Perceived sleep quality, perceived physical readiness to train, and mental readiness to train were assessed using a visual analog scale from 1 to 10 (only whole numbers).[12] Each scale included specific verbal anchors provided in the participants native language (Norwegian): for perceived sleep quality, 1 referred to "low sleep quality" and 10 to "high sleep quality." Physical and mental readiness to train were defined as the degree of how ready the athlete felt physically and mentally to complete training or competition and had to be filled out on days off as well. Participants could rate their feeling from 1 = "not ready" to 10 = "very ready." The analyses were performed using resting HR, perceived sleep quality, and physical and mental readiness to train data reported on the following day respective to the MC phase day. Additionally, participants were asked to record the degree of negative MC-related symptoms (eg, headache, bloating, severe bleeding, back/abdominal pain) every day on a 1 to 10 visual analog scale: 1 was equal to "no symptoms" and 10 to "severe symptoms."

Statistical Analysis

Daily data points were averaged to obtain a single data point for each MC phase. Data were analyzed by performing linear mixed-effects model analysis. Random intercept models were built considering a 2-level structure with MCs clustered within participants (random effect), and the relationship between MC phase (main determinant) and recovery measures (outcome) was investigated. The effect of the MC phase was adjusted for potential confounders and/or effect modifiers, that is, MC-related symptoms, daily training load (session rating of perceived exertion), monotony, and strain as described by Twisk.[22] EFP was defined as the reference phase for comparisons and the alpha level was set at <.05. The other phases were set as reference for comparisons between each phase. Visual inspection of residuals did not reveal obvious deviations from normality or homoscedasticity, and assumptions were met. Effect sizes were calculated based on Nakagawa and Schielzeth[23] as marginal R^2 (variance explained by fixed effect only) and conditional R^2 (variance explained by fixed and random effects) and interpreted according to Cohen.[24] Descriptive data are presented as mean (SD). All statistical analyses were performed using R[25] with the packages "lme4" (version 1.1-29) and "multilevelTools" (version 0.1.1); the figures were generated using the package "ggplot2" (version 3.3.6).

Results

Weekly training volume (in hours:minutes) in each tier during the study period was as follows: 07:24 (02:47) hours per week in tier 2, 09:24 (03:05) hours per week in tier 3, whereas athletes in tier 4 trained 11:27 (02:35) hours per week.

Figure 3 illustrates the change in recovery measures between MC phases (estimates based on the adjusted models). Results of the association model for each recovery variable are reported in Table 2; complete results of the association analyses and comparisons between MC phases can be found in Supplementary Tables S1–S5 (available online). Resting HR was significantly higher in MLP compared with EFP ($P = .006$), without significant differences between the other MC phases. The average perceived sleep quality was 7.1 in EFP. Perceived sleep quality differed significantly between LFP and MLP, with it being lower in MLP ($P = .035$). Physical readiness to train was significantly lower in both OP ($P = .015$) and MLP ($P = .026$) compared with EFP. Mental readiness to train did not show a significant difference between MC phases, but a significant interaction was found between MC phase and MC-related symptoms ($P = .010$). The influence of MC phase on mental readiness to train was weaker with increasing values of MC-related symptoms. For resting HR, the variance explained by fixed effects was 1.3% (negligible effect size), while 82.4% (large effect size) was explained by both fixed and random effects. Fixed effects explained 2.0%, 4.6%, and 6.6% (small effect sizes) of the variance in perceived sleep quality, physical readiness, and mental readiness to train, respectively, while fixed and random effects taken together accounted for 54.9%, 56.5%, and 54.0% (large effect sizes) of the variance.

Discussion

This study investigated the influence of MC phase on objective and subjective measures of recovery status among endurance-trained female athletes. The main finding was that resting HR, perceived sleep quality, and physical readiness to train were all significantly influenced by MC phase, with the following differences between phases: Resting HR was significantly higher in MLP compared with EFP, perceived sleep quality was significantly decreased in MLP compared with LFP, and physical readiness to train was significantly lower in OP and MLP compared with EFP. In contrast, mental readiness to train did not show a significant difference between MC phases.

Resting HR

Resting HR was higher in MLP compared with EFP. This increase in resting HR in MLP may be explained by several physiological changes, such as increased cardiovascular strain, altered fluid regulation, reduced vagal activity, or alternatively by a shift in thermoregulatory control, which results in an increased basal body temperature.[26] The pattern found in resting HR throughout the MC identified in competitive women in this study was comparable to the pattern found in nonathletic participants,[7,9] as well as in exercising women.[8,27] However, the absolute increase in resting HR in MLP found in our study was smaller compared with previous findings. The discrepancies in absolute increases in HR between studies are most likely due to methodological differences (eg, MC phase determination and statistical analyses) as well as differences in the training status of the participants (eg, lower resting HR in endurance-trained participants). However, when considering the percentage change (3.4%), the current study is in line with previous findings that employed a similar methodological approach for determining MC phases.[7,9] An increase of approximately 2 beats per minute might not constitute a meaningful change for well-trained women and athletes, as the day-to-day variation in submaximal HR may be up to 6.5%.[28] Thus, an increase of 3.4% due to MC phase could be easily masked by the influence of other stressors. Moreover, the low effect size (marginal R^2) highlights a limited practical relevance of this finding on a group level.

Perceived Sleep Quality

Perceived sleep quality was significantly decreased in MLP compared with LFP, with no differences between other MC phases. In agreement with the present study, a recent review showed changes in sleep characteristics during the MC and an increased incidence of sleep disturbances in the luteal phase compared with the follicular phase.[29] The higher concentration of progesterone in the

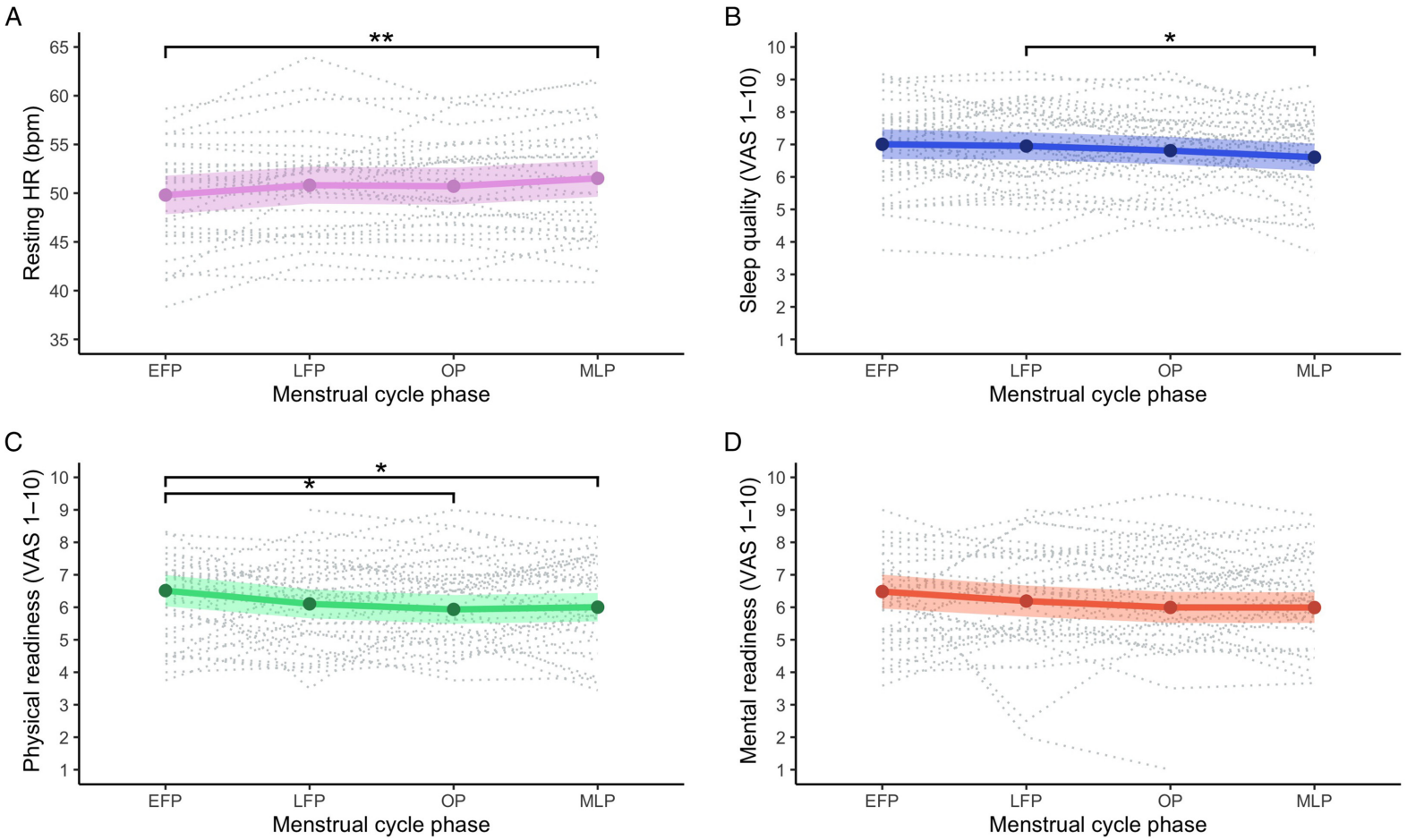

Figure 3 — Change in recovery measures across menstrual-cycle phases: (A) resting HR, (B) perceived sleep quality, (C) physical readiness to train, and (D) mental readiness to train. Dotted gray lines indicate individual data; solid bold line indicates estimates and 95% CI. Bpm indicates beats per minute; EFP, early follicular phase; HR, heart rate; LFP, late follicular phase; LH, luteinizing hormone; MLP, midluteal phase; OP, ovulatory phase; VAS, visual analog scale. Differences between menstrual cycle phases where $^{*}P < .05$ and $^{**}P < .01$.

Table 2 Association Between Menstrual-Cycle Phase and Recovery Measures

Predictor	Estimate	SE	95% CI	*P*
Resting heart rate				
(Intercept)	49.64	1.16	47.37 to 51.92	**<.001**
Late follicular phase	1.01	0.64	–0.25 to 2.26	.115
Ovulatory phase	0.9	0.65	–0.36 to 2.17	.163
Midluteal phase	1.71	0.62	0.50 to 2.91	**.006**
Perceived sleep quality				
(Intercept)	7.09	0.32	6.47 to 7.71	**<.001**
Late follicular phase	–0.06	0.22	–0.48 to 0.37	.8
Ovulatory phase	–0.2	0.22	–0.63 to 0.24	.376
Midluteal phase	–0.4	0.21	–0.82 to 0.02	.06
Physical readiness to train				
(Intercept)	6.7	0.34	6.04 to 7.37	**<.001**
Late follicular phase	–0.41	0.24	–0.87 to 0.05	.084
Ovulatory phase	–0.58	0.24	–1.05 to –0.11	**.015**
Midluteal phase	–0.51	0.23	–0.96 to –0.06	**.026**
Mental readiness to train				
(Intercept)	6.48	0.37	5.76 to 7.21	**<.001**
Late follicular phase	–0.29	0.26	–0.80 to 0.22	.26
Ovulatory phase	–0.49	0.26	–1.01– to 0.03	.064
Midluteal phase	–0.49	0.25	–0.99 to 0.01	.053

Note: Bold values indicate statistical significance at the <.05 level.

luteal phase compared with the follicular phase is associated with elevated core body temperature, which could interfere with sleep.[29] Self-reported sleep quality has previously been found to be poorer in the 3 days prior to the bleeding phase (ie, late luteal phase) and during the bleeding phase (ie, EFP) compared with the mid-follicular and early/MLP in young healthy nonathletic women,[15] which might be due to the higher incidence of MC-related symptoms during these days.[30] Since it is conceivable that MC-related symptoms occurring before and during the bleeding phase can disrupt sleep, the variable was controlled for in our analysis (ie, MC-related symptoms were added to the model as confounder). Moreover, our participants did not report severe symptoms (see Supplementary Figure S1 [available online]), which might explain why this study did not show a poorer sleep quality during the bleeding phase (ie, EFP). Baker and Driver[15] did, unlike our study, not find a lower perceived sleep quality in MLP compared with the follicular phase. This discrepancy between studies could also be due to sample characteristics. The participants in our study were trained individuals with likely good sleep hygiene (reasonable to assume based on the sleep quality scores) and, thus, different characteristics and sleeping routines compared with the previous studies.[15,16] A recent study showed altered sleep patterns across the MC among young endurance athletes[31] in which sleep efficiency measured objectively with an at-home sleep monitor was impaired in the follicular phase compared with the luteal phase.[31] This contrasts the finding of the present study; however, objectively measured sleep characteristics have previously been shown to poorly reflect perceived sleep quality,[32] and it has been shown that subjective measures trump objective ones as markers of training response.[13] Moreover, the study of Hrozanova et al[31] only employed the calendar-based counting method for determination of MC phases. In addition to the risk of overlooking possible menstrual disturbances, and thus abnormal hormonal concentrations, it is challenging to compare our findings to the ones of Hrozanova et al[31] since the identification of MC phases was performed using different methodologies.

Readiness to Train

Our study addressed the influence of MC phase on readiness to train, a widely used marker of recovery in sports practice. Physical readiness to train was significantly reduced in OP and MLP compared with EFP. Higher muscle damage, inflammatory response, as well as delayed recovery of muscle soreness have been associated with lower sex hormones concentrations.[4,33] Thus, a slower recovery process and, in turn, a decreased physical readiness to train could be expected when estrogen concentration is low. This would confirm the lower physical readiness to train found in OP in our study. However, EFP is also marked by a low concentration of female sex hormones, which makes this finding difficult to interpret. MLP is normally characterized by high concentrations of both estrogen and progesterone, and the protective effect of estrogen might be blunted by the increased concentration of progesterone. The antagonistic effect of progesterone promotes protein catabolism during exercise,[5] and it might explain the lower physical readiness to train found in MLP in the present study.

Mental readiness to train was not influenced by MC phase in our study, although mental readiness to train is expected to reflect the psychological recovery status as well as psychological changes induced by MC phase. A rise in serum progesterone during the luteal phase has previously been linked to negative mood symptoms[34]; increased negative mood preexercise has been found in MLP,[35] and motivation to train was decreased on day 21 of the MC (ie, supposedly MLP).[14] Moreover, a higher incidence of mood swings and irritability was found 1 to 4 days before and during

the bleeding phase (ie, late luteal phase and EFP).[36] The possible confounding effect of MC-related symptoms was corrected for in our analysis. This might explain the lack of MC-phase influence on mental readiness to train in the present study compared to previous evidence. Alternatively, this can be due to our sample characterized by no severe MC-related symptoms and/or differences in MC phase determination. The discrepancies between studies suggest that MC phase do not consistently influence readiness to train on a group level, but we cannot exclude meaningful individual effects.

Methodological Considerations

This study has several limitations that should be considered when interpreting the findings. First, isolating the effect of a single stressor (eg, MC phase) on recovery measures outside of a controlled laboratory environment is clearly challenging. We tried to mitigate this limitation by including several MCs for most of the participants to capture the acute response to the stressor over time. Second, most of the data are self-reported with measures such as perceived sleep quality, readiness to train, as well as session rating of perceived exertion that were all scored using the same scale. This could potentially result in participants answering in a default fashion (ie, common method bias). However, participants received a booklet containing an explanation and an anchor question for each recovery variable to make them aware of what a specific variable and scale meant. Third, serum hormone verification of MC phases would have improved the validity of the results, as we might have included MCs not showing appropriate hormonal concentrations. Indeed, the study might have failed to detect MCs presenting with subtle menstrual disturbances, such as luteal phase deficiency,[10] which should have been excluded from the analysis. However, the serum hormone verification of MC phases would probably have limited the generalizability of the findings since employing such methodology would have resulted in a dramatic reduction of sample size, both because the participants were located all over the country and because of the lower compliance with the busy and ever-changing schedule of athletes. Moreover, using 2 different measurement methods for resting HR may entail larger variability because one being dependent on the subject's accuracy in performing it. Finally, the inclusion of participants with a high prevalence of MCs presenting menstrual disturbances during the study period may have yielded biased results. However, we performed additional analyses excluding participants presenting ≥50% or >50% of disturbed MCs and showed that this did not substantially change the results (Supplementary Tables S7–S10 [available online]). On the other hand, the exclusion of many MCs because of subtle menstrual disturbances, as well as the a priori exclusion of athletes with severe menstrual disturbances, limits the generalizability of the findings to all non-hormonal-contraceptives-using female athletes of reproductive age. Since it has been shown that the prevalence of menstrual disturbances in exercising women and athletes is significantly higher than in the general population,[10] it is quite unrealistic to draw a sample from the female athletic population presenting with no menstrual disturbances. In this regard, a thorough tracking of the MC history prior to the initiation of the study would have helped identifying possible menstrual disturbances and making the inclusion/exclusion of participants more precise.

Future research should overcome the above-mentioned limitations by employing distinct item context and characteristics for each variable to minimize common method bias and by including serum hormone measurements for the verification of MC phases. Furthermore, it would be useful to investigate the association between objective and subjective measures of recovery status in relation to the MC.

Practical Applications

Although significant, the findings had negligible to small effect sizes and thus limited practical relevance on a group level. Thus, MC phase is likely not the main determinant of changes in resting HR, perceived sleep quality, and physical readiness to train, and it should rather be regarded as one of the many possible stressors. It is advisable to consider the influence of MC phase when anomalies in the measures of recovery status are found that cannot be explained by other stressors, as MC phase could represent one of the elements for the optimization of training at an individual level.

The findings might indicate a slower recovery capacity in the luteal phase. Athletes and their support staff should consider optimizing the recovery strategies in this phase to prevent nonfunctional states.

The design of the current study makes the findings highly relevant for athletes and coaches, as the variables used are commonly reported by athletes. The inclusion of at-home ovulation testing is also an efficient and feasible tool for athletes.

Conclusions

This study showed that menstrual-cycle (MC) phase significantly influenced several commonly used measures of recovery status, although the effects were all small. Since mental readiness to train did not significantly vary between MC phases, changes in mental readiness to train throughout the MC are most likely influenced by other factors than MC phase. The generalizability of these findings is limited to ovulatory MCs with a duration between 21 and 35 days and a luteal phase longer than 10 days.

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Appendices

Appendix A: Evaluation from the Regional Committee for Medical and Health Research Ethics (REK)

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Appendix A

Evaluation from the Regional Committee for Medical and Health Research Ethics (REK)

Alle skriftlige henvendelser om saken må sendes via REK-portalen
Du finner informasjon om REK på våre hjemmesider rekportalen.no

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK nord	Veronica Sørensen	77620758	17.04.2020	135555
			Deres referanse:	

Boye Welde

135555 Den kvinnelige skiløperen: Menstruasjonssyklusens påvirkning på treningskvalitet og fysisk yteevne

Forskningsansvarlig: UiT Norges arktiske universitet

Søker: Boye Welde

Søkers beskrivelse av formål:

I dette prosjektet vil gjennom observasjon undersøke hvordan ulike faser i menstruasjonssyklusen, samt bruk av hormonelle prevensjonsmidler, påvirker selvrapportert treningskvalitet, prestasjon, motivasjon og grad av menstruasjonsplager hos kvinnelige langrennsløpere og skiskyttere på regionalt-, nasjonalt- eller internasjonalt nivå. I studien inngår spørreskjema på tre ulike tidspunkt om trening og konkurranse i tilknytning til menstruasjonssyklusen, menstruasjonsplager, samt noen spørsmål om hormonelle prevensjonsmidler dersom du benytter dette. Videre vil vi samle inn data fra Olympiatoppens (OLT) treningsdagbok for å få daglige rapporteringer på syklusdag, ulike dagsparametere, type treningsøkt, puls, dagsform, belastning, bevegelsesform, intensitet, styrke og restitusjonstiltak.

REKs vurdering

Veiledning vedrørende framleggingsplikt

De prosjektene som skal framlegges for REK er prosjekt som dreier seg om *«medisinsk og helsefaglig forskning på mennesker, humant biologisk materiale eller helseopplysninger»*,

jf. helseforskningsloven § 2. *«Medisinsk og helsefaglig forskning»* er i § 4 a), definert som «*virksomhet som utføres med vitenskapelig metodikk for å skaffe til veie ny kunnskap om helse og sykdom»*. Det er altså formålet med studien som avgjør om et prosjekt skal anses som framleggelsespliktig for REK eller ikke.

Det fremgår av prosjektbeskrivelsen at formålet med prosjektet er å bidra til større forståelse for hvordan menstruasjonssyklus kan påvirke kvinnelige skiløpere under trening og konkurranse. Det beskrives at økt kunnskap rundt dette feltet er viktig for å tilrettelegge og optimalisere trening og prestasjonsutvikling hos kvinnelige skiløpere.

Det skal samles inn opplysninger på friske idrettsutøvere, det skal ikke gjøres noen intervensjon og det skal ikke spørres om helserelatert spørsmål.
Prosjektet skal således ikke vurderes etter helseforskningsloven.

Prosjekter som faller utenfor helseforskningslovens virkeområde kan gjennomføres uten godkjenning av REK. Det er institusjonens ansvar å sørge for at prosjektet gjennomføres på en forsvarlig måte med hensyn til for eksempel regler om taushetsplikt og personvern

Vedtak

Ikke fremleggspliktig

Etter søknaden fremstår prosjektet ikke som et medisinsk og helsefaglig forskningsprosjekt som faller innenfor helseforskningsloven. Prosjektet er ikke framleggingspliktig, jf. helseforskningsloven § 2.

Vi gjør oppmerksom på at etter personopplysningsloven må det foreligge et behandlingsgrunnlag etter personvernforordningen. Dette må forankres i egen institusjon.

MVH
May Britt Rossvoll
Sekretariatsleder
Veronica Sørensen
Seniorrådgiver

Appendix B

Approval from the Norwegian Social Science Data Services (NSD)

Det innsendte meldeskjemaet med referansekode 409326 er nå vurdert av NSD.

Følgende vurdering er gitt:

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet den 21.04.2020 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD VESENTLIGE ENDRINGER
Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde: nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle særlige kategorier av personopplysninger om helseopplysninger og alminnelige kategorier av personopplysninger frem til 30.06.2024.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 nr. 11 og art. 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse, som kan dokumenteres, og som den registrerte kan trekke tilbake.

Lovlig grunnlag for behandlingen vil dermed være den registrertes uttrykkelige samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a, jf. art. 9 nr. 2 bokstav a, jf. personopplysningsloven § 10, jf. § 9 (2).

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen

- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål

- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet

- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18),

underretning (art. 19), dataportabilitet (art. 20). NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

Nettskjema, TSD , Netlife og Seeds er databehandler i prosjektet. NSD legger til grunn at behandlingen oppfyller kravene til bruk av databehandler, jf. art 28 og 29.

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp underveis (hvert annet år) og ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet/pågår i tråd med den behandlingen som er dokumentert.

Lykke til med prosjektet!

Kontaktperson hos NSD: Mathilde Hansen

Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Appendix C

Consent form and the questionnaires 1–3

Forespørsel om deltakelse i forskningsprosjektet

Ønsker du å delta i studien, trenger vi ditt samtykke.

Merk: Det er frivillig å delta i studien. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta i studien.

Les hele samtykket digitalt var1

Ja 1

Vil du delta i forskningsprosjektet

" Den kvinnelige skiløperen: Menstruasjonssyklusens påvirkning på treningskvalitet og fysisk yteevne"

I dette doktorgradsprosjektet vil gjennom observasjon undersøke hvordan ulike faser i menstruasjonssyklusen, samt bruk av hormonelle prevensjonsmidler, påvirker selvrapportert treningskvalitet, prestasjon, motivasjon og grad av menstruasjonsplager hos kvinnelige langrennsløpere og skiskyttere (heretter kalt skiløpere).

Vi håper du vil stille opp som deltager i dette prosjektet og nedenfor gir vi deg informasjon om målene for prosjektet og hva en eventuell deltakelse vil innebære.

Formål

Vår overordnede målsetning er å øke kunnskapen om hvordan menstruasjonssyklusens faser, og eventuell bruk av hormonelle prevensjonsmidler, påvirker treningskvalitet, prestasjon, motivasjon og grad av menstruasjonsplager hos den kvinnelige skiløperen. Dette for å bidra til å optimalisere langsiktige treningsresponser og resultatutvikling, samt redusere helserelaterte problemer.

Hvem er ansvarlig for forskningsprosjektet?

UiT Norges Arktiske Universitet er ansvarlig for doktorgradsprosjektet som er del av et større forskningsprosjekt (The Female Endurance Athlete, FENDURA, oppstart 1.januar 2020) hvor Tromsø Forskningsstiftelse har bevilget forskningsmidler. Doktorgradsstipendiat Tina P. Engseth, vil gjennomføre dette doktorgradsprosjektet under veiledning av 1. amanuensis Boye Welde (UiT), 1. amanuensis Tor Oskar Thomassen (UiT) og professor Øyvind Sandbakk (NTNU).

Hvorfor får du spørsmål om å delta?

Som kvinnelig skiløper på regionalt-, nasjonalt- eller internasjonalt nivå ønsker vi å invitere deg til å delta i dette studiet. Med bakgrunn i at du er aktiv skiløper, samt i dialog med Norges Skiforbund og Norges Skiskytterforbund har vi definert deg til å være i den målgruppen som får tilbud om å delta i studien.

Hva innebærer det for deg å delta?

Informasjonen under beskriver hva studiet vil innebære for deg som deltaker.

Studiet har en varighet på 12 måneder (en sesong), med oppstart på innhenting av data fra og med 1. mai 2020. Innledningsvis ønsker vi at du svarer på et spørreskjema (20-30 minutter) som omhandler personalia, trening og konkurranse i tilknytning til menstruasjonssyklusen, menstruasjonsplager, samt noen spørsmål om hormonelle prevensjonsmidler dersom du benytter dette.

Videre vil vi med dette spørre deg om samtykke til å få tilgang til dine data fra Olympiatoppens (OLT) treningsdagbok (gjelder fra og med 1.mai 2020), hvor vi vil samle inn daglige opplysninger om syklusdag, ulike dagsparametere, type treningsøkt, puls, dagsform, belastning, bevegelsesform, intensitet, styrke, restitusjonstiltak og eventuelle kommentarer.

Vi vil trenge ditt mobilnummer slik at en ansvarlig i forskningsgruppa, som har ansvar for å følge opp at data blir registrert daglig, får mulighet til å sende deg push-varsel dersom du skulle glemme å registrere data. Ditt mobilnummer vil ikke bli brukt i annen sammenheng eller til annet formål enn å sende eventuelle push-varsler.

Etter 6 måneder (halvveis) svarer du på et nytt spørreskjema (knyttet til de samme temaene som ved oppstart). Studiet fortsetter å samle inn data i 6 måneder til og etter 12 måneder vil dette studiet avsluttes ved at du svarer på et siste spørreskjema (ca 15-20 minutter) knyttet til de samme temaene.

Alle opplysninger vi innhenter fra deg vil bli lagret elektronisk og kodet slik at disse avidentifiseres.

Noen av deltagerne vil blir spurt om å delta i en oppfølgingsstudie med målinger av prestasjon, fysiologiske variabler og hormonell profil i ulike faser av syklusen i etterkant av dette studiet. Vi vil komme tilbake med ny forespørsel om dette.

Fordeler og ulemper for deg som utøver

Ved å delta i studien, kan du som utøver være med å bidra til større forståelse for hvordan menstruasjonssyklus kan påvirke kvinnelige skiløpere under trening og konkurranse. Økt kunnskap rundt dette feltet er viktig for å tilrettelegge og optimalisere trening og prestasjonsutvikling hos kvinnelige skiløpere. I denne sammenhengen håper vi studiet vil gi deg mulighet til å øke din egen bevissthet om hvordan din kropp responderer på trening og konkurranser i forbindelse med de ulike fasene av menstruasjonssyklusen.

Det følger ingen ulempe eller ubehag ved å delta i studien da vi kun vil innhente daglige data fra din treningsdagbok som du allerede benytter, i tillegg til at du skal svare på de 3 spørreskjemaene som er fordelt gjennom studien.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta vil alle opplysningene om deg bli avidentifisert og du kan når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

> Doktorgradsstipendiat Tina P. Engseth, veilederne Boye Welde, Øyvind Sandbakk, Tor Oskar Thomassen, samt 1. amanuensis Bente Morseth, 1. amanuensis Dionne Noordhof og forsker/doktorgradsstipendiat Guro Strøm Solli vil ha tilgang til de data som samles inn.
>
> Ditt navn og dine kontaktopplysninger vil bli erstattet med en kode som lagres på egen navneliste adskilt fra øvrige data. Datamaterialet vil lagres på en datamaskin tilhørende behandlingsansvarlig institusjon. Denne datamaskinen er innelåst og beskyttet med passord og brukernavn.

Deltakere i dette prosjektet vil ikke kunne gjenkjennes i en publikasjon eller avhandling. Alle analyser som utføres vil bli gjort på gruppenivå, og det vil ikke være mulig å identifisere enkeltindivid.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?

Prosjektet skal etter planen avsluttes 30.06.2024. Personopplysninger vil etter prosjektslutt bli anonymisert, ved at koder/koblingsnøkler blir slettet.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

> innsyn i hvilke personopplysninger som er registrert om deg,
> å få rettet personopplysninger om deg,
> få slettet personopplysninger om deg,
> få utlevert en kopi av dine personopplysninger (dataportabilitet), og
> å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra UiT Norges Arktiske Universitet har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?

Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

> Norges Arktiske Universitet ved Tina P. Engseth (doktorgradsstipendiat, tlf.: 99518687, e-post: tina.engseth@uit.no) eller 1. amanuensis Boye Welde (veileder, tlf.: 99357696, e-post: boye.welde@uit.no).
>
> Vårt personvernombud ved UiT: Seniorrådgiver Joakim Bakkevold (tlf: 77646322/97691578, e-post: joakim.bakkevold@uit.no).
>
> NSD – Norsk senter for forskningsdata AS, på e-post (personverntjenester@nsd.no) eller telefon: 55 58 21 17.

Med vennlig hilsen

Tina Engseth (Stipendiat)

Boye Welde (Prosjektansvarlig/Veileder)

Jeg har mottatt og forstått informasjon om prosjektet «Den kvinnelige skiløperen: Menstruasjonssyklusens påvirkning på treningskvalitet og fysisk yteevne», og har fått anledning til å stille spørsmå

var2

Jeg samtykker til å delta i dette forskningsprosjektet, samt at mine opplysninger behandles frem til prosjektet er avsluttet, 30.06.24.

Ved å samtykke til deltakelse gir jeg også tilgang til min OLT-dagbok.

Ja, jeg samtykker til deltakelse som beskrevet over 1

Nei, jeg ønsker ikke å delta 2

Side 2

Sideskift

Hva heter du (fornavn og etternavn)? var3

Hva er din fødselsdato? var4

Hva er ditt telefonnummer? var5

For å kunne sende push-varsler ang. OLT-treningsdagboken trenger vi ditt mobilnummer.
Ditt mobilnummer vil ikke bli brukt i annen sammenheng eller til annet formål enn å sende eventuelle push-varsler.

Hva er din e-postadresse? var6

Hvor høy er du? var7

(cm)

Hvor mye veier du? var8

(kg)

Hvilken idrett driver du med? var9

Hvilken klubb hører du til? var10

Hvor mange timer i gjennomsnitt trente du foregående sesong? var11

(antall timer)

Side 3

Sideskift

Ca hvor gammel var du da du fikk din første menstruasjonsblødning?

var12

Husker ikke 1

Før jeg fylte 9 år 2

9 - 10 år 3

11 - 12 år 4

13 - 14 år 5

15 - 16 år 6

17 - 18 år 7

Etter jeg fylte 18 år 8

Jeg har aldri hatt en menstruasjonsblødning 9

Side 4

Sideskift

Bruker du noen form for hormonelt prevensjonsmiddel? var13

Ja 1

Nei 2

Side 5

Sideskift

Hvilken form for hormonelt prevensjonsmiddel benytter du? var14

P-piller 1

Mini-piller 2

P-ring 3

P-sprøyte 4

P-plaster 5

P-stav 6

Hormonspiral 7

Annet 8

Dersom annet, hva bruker du? var15

Hva heter produktet du benytter? var16

Side 6

Sideskift

Hvor lenge har du brukt hormonelle prevensjonsmidler? var17

Antall måneder

Hvor lenge har du brukt det hormonelle prevensjonsmidlet du benytter i dag? var18

Antall måneder

Side 7

Sideskift

Bruker du hormonelt prevensjonsmiddel av andre grunner enn som prevensjon?

var19

Ja 1

Nei 2

Hvis ja, kan du spesifisere hvilke andre årsaker? var20

Side 8

Sideskift

Har du opplevd at hormonelt prevensjonsmiddel påvirker din fysiske form eller prestasjon?

var21

Ja 1

Nei 2

Vet ikke 3

Dersom ja, hvordan har hormonelt prevensjonsmiddel påvirket din fysiske form eller prestasjon?

var22

Side 9

Sideskift

Har du sluttet med et hormonelt prevensjonsmiddel fordi det påvirket din fysiske form eller prestasjon negativt?

var23

Ja 1

Nei 2

Dersom ja, kan du spesifisere hvorfor? var24

Side 10

Sideskift

Opplever du noen positive effekter knyttet til trening ved å benytte hormonelt prevensjonsmiddel?

var25

Ja 1

Nei 2

Dersom ja, kan du spesifisere hvilke? var26

Side 11

Sideskift

var27

Opplever du noen negative effekter knyttet til trening ved å benytte hormonelt prevensjonsmiddel?

Ja 1

Nei 2

Dersom ja, kan du spesifisere hvilke? var28

Side 12

Sideskift

Opplever du noen positive effekter knyttet til prestasjon ved å benytte hormonelt prevensjonsmiddel?

var29

Ja 1

Nei 2

Dersom ja, kan du spesifisere hvilke? var30

Side 13

Sideskift

Opplever du noen negative effekter knyttet til prestasjon ved å benytte hormonelt prevensjonsmiddel?

var31

Ja 1

Nei 2

Dersom ja, kan du spesifisere hvilke? var32

Side 14

Sideskift

Har du regelmessig menstruasjon? var33

Ja 1

Nei 2

Ja, men går på hormonelt prevensjonsmiddel 3

Nei, men går på hormonelt prevensjonsmiddel 4

Hvor mange mensturasjonsblødninger har du hatt i løpet av de siste 12 månedene?

var34

Skriv inn antallet som hele tall

Har du hatt menstruasjonssblødning i løpet av den siste måneden?

var35

Ja 1

Nei 2

Dersom nei, når hadde du sist menstruasjonsblødning? var36

1 - 2 måneder 1

3 - 4 måneder 2

5 - 6 måneder 3

Over 6 måneder 4

Side 15

Sideskift

Illustrasjonsbilde av en menstruasjonssyklus (inkludert starten av ny syklus)

Bruk litt tid på å se over dette bildet som definerer de ulike fasene av en menstruasjonssyklus (inkludert starten på neste syklus). På de neste sidene vil du bli bedt om å svare på noen spørsmål knyttet til tidlig og sen follikulær fase, samt tidlig og sen luteal fase.

Side 16

Sideskift

Illustrasjonsbilde av menstruasjonssyklusen

Hvordan opplever du at den tidlige follikulære fasen (fasen med blødning) påvirker de ulike faktorene under?

Prestasjon var37

Fysisk form under trening var38

Søvnkvalitet var39

Hvor klar for trening/konkurranse du føler deg var40

Trening med lav intensitet var41

Trening med høy intensitet var42

Styrketrening var43

Svært negativt 1

Noe negativt 2

Hverken eller 3

Noe positivt 4

Svært positivt 5

Side 17

Sideskift

Illustrasjonsbilde av menstruasjonssyklusen

Hvordan opplever du at den sene follikulære fasen (fasen rundt en eventuell eggløsning) påvirker de ulike faktorene under?

Prestasjon var44

Fysisk form under trening var45

Søvnkvalitet var46

Hvor klar for trening/konkurranse du føler deg var47

Trening med lav intensitet var48

Trening med høy intensitet var49

Styrketrening var50

- Svært negativt 1
- Noe negativt 2
- Hverken eller 3
- Noe positivt 4
- Svært positivt 5

Sideskift

Illustrasjonsbilde av menstruasjonssyklusen

Hvordan opplever du at den tidlige luteale fasen (fasen etter eventuell eggløsning) påvirker de ulike faktorene under?

Prestasjon var51

Fysisk form under trening var52

Søvnkvalitet var53

Hvor klar for trening/konkurranse du føler deg var54

Trening med lav intensitet var55

Trening med høy intensitet var56

Styrketrening var57

- Svært negativt 1

Noe negativt 2

Hverken eller 3

Noe positivt 4

Svært positivt 5

Side 19

Sideskift

Illustrasjonsbilde av menstruasjonssyklusen

Hvordan opplever du at den sene luteale fasen (fasen før blødning) påvirker de ulike faktorene under?

Prestasjon var58

Fysisk form under trening var59

Søvnkvalitet var60

Hvor klar for trening/konkurranse du føler deg var61

Trening med lav intensitet var62

Trening med høy intensitet var63

Styrketrening var64

Svært negativt 1

Noe negativt 2

Hverken eller 3

Noe positivt 4

Svært positivt 5

Side 20

Sideskift

Illustrasjonsbilde av en menstruasjonssyklus (inkludert starten av ny syklus)

I hvilken fase(r) har du opplevd å ha dine beste prestasjoner? var65

Flere valg mulig

Tidlig follikulær fase 1

Sen follikulær fase 2

Tidlig luteal fase 3

Sen luteal fase 4

Har ikke opplevd noen forskjell 5

Vet ikke 6

I hvilken fase(r) har du opplevd å være i best fysisk form på trening?

var66

Flere valg mulig

Tidlig follikulær fase 1

Sen follikulær fase 2

Tidlig luteal fase 3

Sen luteal fase 4

Har ikke opplevd noen forskjell 5

Vet ikke 6

Side 21

Sideskift

Hvor lang er din menstruasjonssyklus i gjennomsnitt? var67

Antall dager fra første dag med menstruasjonsblødning til neste blødning starter

Side 22

Sideskift

Har du opplevd at menstruasjonsblødningen forsvinner i perioder med høyt treningsvolum?

var68

Ja 1

Nei 2

Vet ikke 3

Har du opplevd at menstruasjonsblødningen forsvinner i perioder hvor du utfører en stor mengde høyintensive økter?

var69

Ja 1

Nei 2

Vet ikke 3

Side 23

Sideskift

Opplever du noen plager i forbindelse med menstruasjonssyklusen?

var70

F.eks mage-/ryggsmerter, kraftig blødning, humørsvigninger eller annet

Ja 1

Nei 2

Vet ikke 3

Dersom ja, kan du spesifisere hvilke plager og når disse plagene oppstår i menstruasjonssyklusen (hvilke faser)?

var71

Side 24

Sideskift

Har du endret på treningen på grunn av plager i forbindelse med menstruasjonssyklusen?

var72

Ja 1

Nei 2

Side 25

Sideskift

Du svarte ja, hvorfor har du endret treningen? var73

Hvordan har du endret treningen? var74

Side 26

Sideskift

Planlegger du din trening med hensyn til menstruasjonssyklus?

var75

Ja 1

Nei 2

Side 27

Sideskift

Du svarte ja, hvordan planlegger du treningen i forhold til menstruasjonssyklusen?

var76

Trener du f.eks visse økter oftere/sjeldnere i ulike faser av syklus

Side 28

Sideskift

Loggfører du noe i treningsdagboken eller annet sted relatert til menstruasjonssyklusen din?

var77

F.eks blødningsdager, søvn, hvilepuls, menstruasjonsplager m.m.

Ja 1

Nei 2

Side 29

Sideskift

Du svarte ja, hva loggfører du i forbindelse med menstruasjonssyklusen?

var78

Hvor mange måneder har du loggført menstruasjonssyklusen din?

var79

Hvor loggfører du data som du knytter til menstruasjonssyklusen?

var80

Har du oppdaget noen mønstre gjennom syklusen? var81

Ja 1

Nei 2

Side 30

Sideskift

Du svarte ja, hvilke mønstre i menstruasjonssyklusen har du oppdaget?

var82

Side 31

Sideskift

Har du endret på treningen/gjort noe annerledes i forbindelse med konkurranse på bakgrunn av disse mønstrene?

var83

Ja 1

Nei 2

Dersom ja, hva har du endret på? var84

Side 32

Sideskift

Har du diskutert hvordan menstruasjonssyklus kan påvirke trening og prestasjon med andre?

var85

Ja 1

Nei 2

Side 33

Sideskift

Du svarte ja, hvem har du diskutert med? var86

På hvilken måte har du hatt nytte av å disse samtalene? var87

Side 34

Sideskift

Har du trener(e)? var88

Ja 1

Nei 2

Side 35

Sideskift

Hvilket kjønn er treneren(e)? var89

- Kvinne 1
- Mann 2
- Jeg har flere (kun kvinner) 3
- Jeg har flere (kun menn) 4
- Jeg har flere (begge kjønn) 5

Hvor ofte kommuniserer du med trener(e) angående temaer knyttet til menstruasjonssyklusen?

var90

- Aldri 1
- Sjelden 2
- Av og til 3
- Ofte 4

Side 36

Sideskift

Dersom du har både kvinnelige og mannlige trenere, hvilket kjønn er treneren(e) du kommuniserer med angående temaer knytte til menstruasjonssyklusen?

var91

- Kvinne/kvinner 1
- Mann/menn 2
- Begge kjønn 3

Side 37

Sideskift

Har du snakket med trener om menstruasjonsyklusen i forhold til trening/prestasjoner det siste året?

var92

- Ja 1
- Nei 2
- Vet ikke 3

Side 38

Sideskift

Hvordan opplever du samtalene om dette temaet med treneren din?

var93

- Naturlig 1
- Noe naturlig 2

Hverken eller 3

Noe ubehagelig 4

Ubehagelig 5

Dersom du synes dette er noe ubehagelig eller ubehagelig, kan du forklare hvorfor?

var94

Side 39

Sideskift

Ønsker du å snakke med din trener om menstruasjonssyklus i forhold til trening og prestasjon?

var95

Ja 1

Nei 2

Vet ikke 3

Hvordan opplever du kunnskapsnivået til treneren på dette temaet?

var96

Dårlig 1

Tilfredsstillende 2

Veldig bra 3

Vet ikke 4

Side 40

Sideskift

Tror du at du har nok kunnskap om hvordan menstruasjonssyklus kan påvirke trening og prestasjon?

var97

Ja 1

Nei 2

Vet ikke 3

Tusen takk for at du velger å delta i vårt forskningsprosjekt!

Nå gjenstår kun en siste autentisering for at ditt samtykke til å delta skal bli digitalt signert og formelt dokumentert.

Hva heter du (fornavn og etternavn)? var1

Hvor mye veier du? var2

(kg)

Side 2

Sideskift

Hormonelt prevensjonsmiddel

Bruker du noen form for hormonelt prevensjonsmiddel? var3

Ja 1

Nei 2

Har brukt tidligere, men har sluttet siden sist jeg svarte på spørreskjema 3

Har ikke brukt tidligere, men har begynt siden sist jeg svarte på spørreskjema 4

Side 3

Sideskift

Bruk av hormonelt prevensjonsmiddel

Ved forrige spørreskjema fikk du noen spørsmål om hormonelt prevensjonsmiddel. Noen av de samme spørsmålene vil dukke opp igjen nå, i tillegg til noen nye.

Side 4

Sideskift

Bruker du det samme hormonelle prevensjonsmiddelet som da du svarte på det første spørreskjemaet?

var4

Ja, jeg bruker fortsatt p-piller 1

Ja, jeg bruker fortsatt minipiller 2

Ja, jeg bruker fortsatt p-ring 3

Ja, jeg bruker fortsatt p-sprøyte 4

Ja, jeg bruker fortsatt p-plaster 5

Ja, jeg bruker fortsatt p-stav 6

Ja, jeg bruker fortsatt hormonspiral 7

Nei 8

Side 5

Sideskift

Bruker du fortsatt det samme merket? var5

Ja 1

Nei 2

Hva heter merket du benytter nå? var6

Side 6

Sideskift

Hvilken form for hormonelt prevensjonsmiddel har du byttet til?

var7

- P-piller 1
- Minipiller 2
- P-ring 3
- P-sprøyte 4
- P-plaster 5
- P-stav 6
- Hormonspiral 7
- Annet 8

Du svarte annet, hva har du byttet til?

var8

Side 7

Sideskift

Hvorfor har du valgt å bytte til et annet hormonelt prevensjonsmiddel?

var9

Flere valg mulig

- På grunn av bivirkninger 1
- Det gamle påvirket trening/prestasjon negativt 2
- Jeg har fått råd om å teste en annen form for hormonelt prevensjonsmiddel 3
- Jeg følte meg ikke tilfreds med det hormonelle prevensjonsmiddelet jeg brukte 4
- Andre trenings-/prestasjonsrelaterte grunner 5
- Annet 6

Du svarte at du har byttet til et annet hormonelt prevensjonsmiddel på grunn av bivirkninger, kan du fortelle hvilke bivirkninger?

var10

Flere valg mulig

- Hodepine 1
- Følte meg deprimert 2
- Hudproblemer 3
- Vektoppgang 4
- Kraftige blødninger 5

Humørsvingninger 6

Annet 7

Du svarte annet, kan du fortelle hvilke andre bivirkninger? var11

Du svarte at det var andre trenings-/prestasjonsrelaterte grunner til at du har byttet til et annet hormonelt prevensjonsmiddel, kan du fortelle hvilke?
var12

Hva heter produktet du benytter nå? var13

Side 8

Sideskift

Du svarte at du ved forrige spørreskjema brukte en form for hormonelt prevensjonsmiddel, men at du har sluttet. Kan du fortelle hvorfor?
var14

Flere valg mulig

Hormonelt prevensjonsmiddel påvirket trening/prestasjon negativt 1

På grunn av bivirkninger 2

Jeg har fått råd om å slutte på hormonelt prevensjonsmiddel 3

Andre trenings-/prestasjonsrelaterte grunner 4

Annet 5

Du svarte at du har sluttet med hormonelt prevensjonsmiddel på grunn av bivirkninger, kan du fortelle hvilke bivirkninger?
var15

Flere valg mulig

Hodepine 1

Følte meg deprimert 2

Hudproblemer 3

Vektoppgang 4

Kraftige blødninger 5

Humørsvingninger 6

Annet 7

Du svarte annet, kan du fortelle hvilke andre bivirkninger? var16

Du svarte at det var andre trenings-/prestasjonsrelaterte grunner til at du har sluttet med hormonelt prevensjonsmiddel, kan du fortelle hvilke grunner?

var17

Side 9

Sideskift

Du svarte at du har begynt på en form for hormonelt prevensjonsmiddel etter at du svarte på det forrige spørreskjemaet, hvilken form for hormonelt prevensjonsmiddel har du begynt å bruke?

var18

- P-piller 1
- Minipiller 2
- P-ring 3
- P-sprøyte 4
- P-plaster 5
- P-stav 6
- Hormonspiral 7
- Annet 8

Du svarte annet, hva bruker du? var19

Side 10

Sideskift

Hva heter produktet du benytter? var20

Bruker du hormonelt prevensjonsmiddel av andre grunner enn som prevensjon?

var21

- Ja 1
- Nei 2

Du svarte ja, kan du spesifisere hvilke andre årsaker? var22

Side 11

Sideskift

Bruk av hormonelt prevensjonsmiddel og effekt på trening og prestasjon

Opplever du noen positive effekter knyttet til trening ved å benytte hormonelt prevensjonsmiddel?

var23

- Ja 1
- Nei 2
- Vet ikke 3

Du svarte ja, kan du spesifisere hvilke positive effekter? var24

Opplever du noen negative effekter knyttet til trening ved å benytte hormonelt prevensjonsmiddel?

var25

Ja 1

Nei 2

Vet ikke 3

Du svarte ja, kan du spesifisere hvilke negative effekter? var26

Side 12

Sideskift

Opplever du noen positive effekter knyttet til prestasjon ved å benytte hormonelt prevensjonsmiddel?

var27

Ja 1

Nei 2

Vet ikke 3

Du svarte ja, kan du spesifisere hvilke positive effekter? var28

Opplever du noen negative effekter knyttet til prestasjon ved å benytte hormonelt prevensjonsmiddel?

var29

Ja 1

Nei 2

Vet ikke 3

Du svarte ja, kan du spesifisere hvilke negative effekter? var30

Side 13

Sideskift

Bruk av p-piller

Bruk av p-piller

Bruk av p-piller

P-piller tas enten
A) 28 dager kontinuerlig, hvorav 21 piller er aktive piller og 7 er placebopiller, eller
B) 21 dager med aktive piller + 7 dager opphold uten inntak av piller.

Den uka man tar placebopiller (A) eller har opphold (B), vil man få en blødning. De som derimot går rett på et nytt brett etter 21 piller uten å ta 7 placebopiller (A) eller velger å ikke ta 7 dagers opphold (B), vil ikke få

noen blødning.

P-piller tas enten
A) 28 dager kontinuerlig, hvorav 21 piller er aktive piller og 7 er placebopiller, eller
B) 21 dager med aktive piller + 7 dager opphold uten inntak av piller.

Den uka man tar placebopiller (A) eller har opphold (B), vil man få en blødning. De som derimot går rett på et nytt brett etter 21 piller uten å ta 7 placebopiller (A) eller velger å ikke ta 7 dagers opphold (B), vil ikke få noen blødning.

P-piller tas enten
A) 28 dager kontinuerlig, hvorav 21 piller er aktive piller og 7 er placebopiller, eller
B) 21 dager med aktive piller + 7 dager opphold uten inntak av piller.

Den uka man tar placebopiller (A) eller har opphold (B), vil man få en blødning. De som derimot går rett på et nytt brett etter 21 piller uten å ta 7 placebopiller (A) eller velger å ikke ta 7 dagers opphold (B), vil ikke få noen blødning.

De neste spørsmålene omhandler bruk av p-piller i perioden du har vært deltaker i forskningsprosjektet.

De neste spørsmålene omhandler bruk av p-piller i perioden du har vært deltaker i forskningsprosjektet.

De neste spørsmålene omhandler bruk av p-piller i perioden du har vært deltaker i forskningsprosjektet.

Side 14

Sideskift

Har du i perioden du har vært deltaker i forskningsprosjektet hoppet over den pillefrie-/placebopille uka?

var31

Altså gått rett på et nytt brett etter å ha fullført 21 dager med aktive piller

Ja 1

Nei 2

Har du i perioden du har vært deltaker i forskningsprosjektet hoppet over den pillefrie-/placebopille uka?

var32

Altså gått rett på et nytt brett etter å ha fullført 21 dager med aktive piller

Ja 1

Nei 2

Har du i perioden du har vært deltaker i forskningsprosjektet hoppet over den pillefrie-/placebopille uka?

var33

Altså gått rett på et nytt brett etter å ha fullført 21 dager med aktive piller

Ja 1

Nei 2

Du svarte ja, husker du når du har hoppet over uken med blødning?

var34

hvilken måned(er)

Du svarte ja, husker du når du har hoppet over uken med blødning?

var35

hvilken måned(er)

Du svarte ja, husker du når du har hoppet over uken med blødning?

var36

hvilken måned(er)

Hvorfor ønsket du å hoppe over uken med blødning (altså starte rett på neste brett etter å ha fullført 21 dager med aktive piller)?

var37

Flere valg mulig

- For å prestere bedre i konkurranse 1
- For å prestere bedre på en test 2
- For å trene mer effektivt 3
- Andre trenings-/prestasjonsrelaterte grunner 4
- For å slippe blødningsperioden 5
- Annet 6

Hvorfor ønsket du å hoppe over uken med blødning (altså starte rett på neste brett etter å ha fullført 21 dager med aktive piller)?

var38

Flere valg mulig

- For å prestere bedre i konkurranse 1
- For å prestere bedre på en test 2
- For å trene mer effektivt 3
- Andre trenings-/prestasjonsrelaterte grunner 4
- For å slippe blødningsperioden 5
- Annet 6

Hvorfor ønsket du å hoppe over uken med blødning (altså starte rett på neste brett etter å ha fullført 21 dager med aktive piller)?

var39

Flere valg mulig

For å prestere bedre i konkurranse 1

For å prestere bedre på en test 2

For å trene mer effektivt 3

Andre trenings-/prestasjonsrelaterte grunner 4

For å slippe blødningsperioden 5

Annet 6

Du svarte at du har hoppet over uken med blødning av andre trenings-/prestasjonsrelaterte grunner, kan du fortelle hvilke?

var40

Du svarte at du har hoppet over uken med blødning av andre trenings-/prestasjonsrelaterte grunner, kan du fortelle hvilke?

var41

Du svarte at du har hoppet over uken med blødning av andre trenings-/prestasjonsrelaterte grunner, kan du fortelle hvilke?

var42

Sideskift

Menstruasjonshistorikk

Har du regelmessig menstruasjon? var43

Ja 1

Nei 2

Ja, men går på hormonelt prevensjonsmiddel 3

Nei, men går på hormonelt prevensjonsmiddel 4

Ja, men kun dersom jeg bruker hormonelt prevensjonsmiddel 5

Under finner du flere utsagn, velg de som passer for din menstruasjonshistorikk.

var44

Flere valg mulig

Jeg har alltid hatt regelmessig menstruasjonssyklus 1

Jeg har stort sett hatt regelmessig menstruasjonssyklus 2

Jeg har hatt noen perioder med uregelmessig menstruasjonssyklus 3

Jeg har stort sett hatt uregelmessig menstruasjonssyklus 4

Jeg har alltid hatt ureglemessig menstruasjonssyklus 5

Jeg har begynt på hormonelt prevensjonsmiddel for å få regelmessig menstruasjonssyklus
6

Jeg har uregelmessig menstruasjonssyklus på grunn av hormonelt prevensjonsmiddel
7

Jeg har uregelmessig menstruasjonssyklus på grunn av hormonforstyrrelser dokumentert av lege
8

Jeg vet ikke hvorfor jeg har uregelmessig menstruasjonssyklus 9

Har du diskutert/fått råd om hormonelt prevensjonsmiddel med noen?

var45

Ja 1

Nei 2

Du svarte ja, hvem har du diskutert hormonelt prevensjonsmiddel med?

var46

Flere valg mulig

Lege (fastlege eller teamlege) 1

Gynekolog 2

Trener 3

OLT 4

Lagkamerater/andre utøvere 5

Familie/kjæreste 6

Andre 7

Du svarte andre, hvem har du diskutert hormonelt prevensjonsmiddel med?

var47

Hvilke råd har du fått? var48

Side 16

Sideskift

Menstruasjonssyklus og effekt på trening og prestasjon

Slik som sist ønsker vi at du bruker litt tid på å se over bildet som definerer de ulike fasene av en menstruasjonssyklus inkludert starten på en ny. På de neste bildene vil du bli bedt om å svare på noen spørsmål knyttet til de ulike fasene.

Tidlig follikulær fase

Side 17

Sideskift

Hvordan opplever du at den tidlige follikulære fasen (fasen med blødning) påvirker de ulike faktorene under?

Prestasjon var49

Fysisk form under trening var50

Søvnkvalitet var51

Hvor klar for trening/konkurranse du føler deg var52

Trening med lav intensitet var53

Trening med høy intensitet var54

Styrketrening var55

- Svært negativt 1
- Noe negativt 2
- Hverken eller 3
- Noe positivt 4
- Svært positivt 5
- Vet ikke 6

Sideskift Sen follikulær fase Side 18

Hvordan opplever du at den sene follikulære fasen (fasen rundt en eventuell eggløsning) påvirker de ulike faktorene under?

Prestasjon var56

Fysisk form under trening var57

Søvnkvalitet var58

Hvor klar for trening/konkurranse du føler deg var59

Trening med lav intensitet var60

Trening med høy intensitet var61

Styrketrening var62

- Svært negativt 1
- Noe negativt 2
- Hverken eller 3

Noe positivt 4

Svært positivt 5

Vet ikke 6

Sideskift

Tidlig luteal fase

Side 19

Hvordan opplever du at den tidlige luteale fasen (fasen etter eventuell eggløsning) påvirker de ulike faktorene under?

Prestasjon var63

Fysisk form under trening var64

Søvnkvalitet var65

Hvor klar for trening/konkurranse du føler deg var66

Trening med lav intensitet var67

Trening med høy intensitet var68

Styrketrening var69

Svært negativt 1

Noe negativt 2

Hverken eller 3

Noe positivt 4

Svært positivt 5

Vet ikke 6

Sideskift

Sen luteal fase

Side 20

Hvordan opplever du at den sene luteale fasen (fasen før blødning) påvirker de ulike faktorene under?

Prestasjon var70

Fysisk form under trening var71

Søvnkvalitet var72

Hvor klar for trening/konkurranse du føler deg var73

Trening med lav intensitet var74

Trening med høy intensitet var75

Styrketrening var76

- Svært negativt 1
- Noe negativt 2
- Hverken eller 3
- Noe positivt 4
- Svært positivt 5
- Vet ikke 6

Side 21

Sideskift

I hvilken fase(r) har du opplevd å ha dine beste prestasjoner? var77

Flere valg mulig

- Tidlig follikulær fase 1
- Sen follikulær fase 2
- Tidlig luteal fase 3
- Sen luteal fase 4
- Har ikke opplevd noen forskjell 5
- Vet ikke 6

I hvilken fase(r) har du opplevd å være i best fysisk form på trening?

var78

Flere valg mulig

- Tidlig follikulær fase 1
- Sen follikulær fase 2
- Tidlig luteal fase 3
- Sen luteal fase 4
- Har ikke opplevd noen forskjell 5
- Vet ikke 6

Side 22

Sideskift

Har du i tiden som idrettsutøver benyttet medikamenter for å stå over/forskyve en menstruasjonsblødning?

var79

Ja 1

Nei 2

Du svarte ja, hvilket medikament har du benyttet? var80

Hvorfor ønsket du å stå over/forskyve en menstruasjonsblødning?

var81

Flere valg mulig

For å prestere bedre i konkurranse 1

For å prestere bedre på en test 2

For å trene mer effektivt 3

Andre trenings-/prestasjonsrelaterte grunner 4

Annet 5

Du svarte at det er andre trenings-/prestasjonsrelaterte grunner til at du har benyttet medikament for å stå over/forskyve en menstruasjonssbløding. Kan du fortelle hvilke?

var82

Har du benyttet et medikament for å stå over/forskyve en menstruasjonsblødning i perioden du har vært deltaker i forskningsprosjektet?

var83

Ja 1

Nei 2

Du svarte ja, husker du når du brukte et slik medikament for å stå over/forskyve en menstruasjonsblødning?

var84

Hvilken måned(er)

Sideskift

Har du opplevd at menstruasjonsblødningen forsvinner i perioder med høyt treningsvolum?

var85

Ja 1

Nei 2

Vet ikke 3

Har du opplevd at menstruasjonsblødningen forsvinner i perioder hvor du utfører en stor mengde høyintensive treningsøkter?

var86

Ja 1

Nei 2

Vet ikke 3

Side 24

Sideskift

Loggføring av treningsdagbok

Du har nå vært en del av vårt prosjekt og loggført ulike parametere i forbindelse med menstruasjonssyklusen i ca 6 måneder. De neste spørsmålene vil ta utgangspunkt i dine erfaringer rundt denne loggføringen.

Side 25

Sideskift

Hvor nyttig har det vært å føre de ulike dagsparameterne?

Hvilepuls var87

Søvnkvalitet var88

Søvntid var89

Hvor klar for trening/konkurranse du føler deg var90

Plager knyttet til menstruasjonssyklus var91

Nyttig 1

Hverken eller 2

Unyttig 3

Vet ikke 4

Side 26

Sideskift

Hvordan har loggføring av dagsparametere påvirket de ulike faktorene under?

Treningseffekt var92

Prestasjonsevne var93

Motivasjon til å trene/konkurrere var94

Treningsplanleggingen var95

Søvn var96

Positivt 1

Hverken eller 2

Negativt 3

Vet ikke 4

Side 27

Sideskift

Har du, gjennom å loggføre dagsparametere, oppdaget noen mønstre knyttet til menstruasjonssyklusen som påvirker trening/prestasjon?

var97

Ja 1

Nei 2

Du svarte ja, hvilke mønstre i menstruasjonssyklusen har du oppdaget?

var98

Side 28

Sideskift

Kommunikasjon

Har du diskutert hvordan menstruasjonssyklus kan påvirke trening og prestasjon med andre?

var99

Ja 1

Nei 2

Du svarte ja, hvem har du diskutert hvordan menstruasjonssyklus kan påvirke trening og prestasjon med?

var100

Flere valg mulig

Lege (fastlege eller teamlege) 1

Gynekolog 2

Trener 3

OLT 4

Lagkamerater/andre utøvere 5

Familie/kjæreste 6

Andre 7

Du svarte andre, hvem har du diskutert med?

var101

Hva har dere diskutert?

var102

Side 29

Sideskift

Har du trener(e)? var103

Ja 1

Nei 2

Følger trener(ene) deg på OLT/Bestr dagboka di? var104

Ja 1

Nei 2

Hvor ofte kommuniserer du med trener(e) angående temaer knyttet til menstruasjonssyklusen?

var105

Aldri 1

Sjelden 2

Av og til 3

Ofte 4

Har du snakket med trener om menstruasjonssyklusen i forhold til trening/prestasjon etter at du ble deltaker i forskningsprosjektet?

var106

Ja 1

Nei 2

Ja, jeg har hatt min første samtale med trener etter at jeg begynte som deltaker i forskningsprosjektet 3

Hvor ofte snakker du med trener om menstruasjonssyklusen i forhold til trening/prestasjon, sammenlignet med før du ble deltaker i forskningsprosjektet?

var107

Oftere enn før jeg ble deltaker i forskningsprosjektet 1

Sjeldnere enn før jeg ble deltaker i forskningsprosjektet 2

Antall samtaler har ikke endret seg siden jeg ble deltaker i forskningsprosjektet 3

Vet ikke 4

Side 30

Sideskift

Hvordan opplever du samtalene om dette temaet med treneren din?

var108

Naturlig 1

Noe naturlig 2

Hverken eller 3

Noe ubehagelig 4

Ubehagelig 5

Du svarte at du synes disse samtalene er noe ubehagelig eller ubehagelig, kan du forklare hvorfor?

var109

Side 31

Sideskift

Har det blitt lettere å ta opp temaer knyttet til menstruasjonssyklus med treneren din etter at du ble med på prosjektet?

var110

Ja 1

Nei 2

Du svarte ja, hvordan har det blitt lettere? var111

Side 32

Sideskift

Føler du at din trener viser interesse og forståelse for hvordan menstruasjonssyklusen din kan påvirke trening/prestasjon?

var112

Ja 1

Nei 2

Du svarte ja, på hvilken måte føler du at treneren viser interesse og forståelse?

var113

Side 33

Sideskift

Hvordan har loggføring av dagsparametere påvirket din relasjon til trener?

var114

Positivt 1

Hverken eller 2

Negativt 3

Vet ikke 4

Hvordan opplever du treneren din sitt kunnskapsnivå om hvordan menstruasjonssyklus kan påvirke trening og prestasjon?

var115

Dårlig 1

Tilfredstillende 2

Veldig bra 3

Vet ikke 4

Side 34

Sideskift

Har du vært på foredrag eller tillagt deg informasjon på andre måter knyttet til temaer om menstruasjon, trening og prestasjon i tiden du har vært deltaker i prosjektet?

var116

Ja 1

Nei 2

Du svarte ja, hvordan har du tillagt deg informasjon? var117

Flere valg mulig

Podcast 1

Foredrag 2

Bøker 3

Blogger/websider 4

Artikler/reportasjer i media 5

Sosiale medier 6

Apper 7

Forskning 8

Annet 9

Side 35

Sideskift

Ønsker du å lære mer om hvordan menstruasjonssyklus kan påvirke trening og prestasjon?

var118

Ja 1

Nei 2

Vet ikke 3

Gjennom hvilke kanaler tror du at du ville hatt best mulighet til å lære deg mer om dette temaet?

var119

Flere valg mulig

- Podcast 1
- Foredrag 2
- Artikler/reportasjer 3
- Blogger/websider 4
- Apper 5
- Sosiale medier 6
- Annet 7

Hvilke temaer knyttet til menstruasjonssyklus, trening og prestasjon kunne du tenkt deg å lære mer om?

var120

Tusen takk for at du har valgt å delta i vårt prosjekt. Side 36

Sideskift

Målet er å oppnå større forståelse og kunnskap for å bidra til å optimalisere trening og prestasjonsutvikling for deg og andre kvinner i utholdenhetsidretter. Den jobben du gjør for oss gjennom å føre en grundig treningsdagbok og svare på spørreskjema er derfor uvurderlig!

Tusen takk!

Med vennlig hilsen Tina Engseth og resten av team FENDURA

Hva heter du (fornavn og etternavn)? var1

Hvor mye veier du? var2

(kg)

Hvor fornøyd er du med sesongen (2020/2021) som har gått totalt sett?

var3

Hvilken utvikling har du hatt? var4

Med tanke på trening og prestasjon

Hvor mange timer trente du totalt foregående sesong (2020/2021)?

var5

Ca antall timer

Deltok du i mange konkurranser i sesongen som har gått (2020/2021)?

var6

Antall konkurranser

Side 2

Sideskift

Hormonelt prevensjonsmiddel

Bruker du noen form for hormonelt prevensjonsmiddel? var7

Ja 1

Nei 2

Har sluttet etter at jeg svarte på spørreskjema 2 3

Har begynt etter at jeg svarte på spørreskjema 2 4

Du svarte nei, har du benyttet noen form for hormonelt prevensjonsmiddel før du ble deltaker i prosjektet?

var8

Ja 1

Nei, har aldri brukt noen form for hormonelt prevensjonsmiddel 2

Side 3

Sideskift

Tidligere bruk av hormonelt prevensjonsmiddel

Du har svart at du ikke har brukt noen form for hormonelt prevensjonsmiddel så lenge du har vært deltaker i prosjektet, men på et tidligere tidspunkt. Vi ønsker nå å stille deg noen spørsmål om dine erfaringer rundt bruk av hormonelt prevensjonsmiddel.

Hvilket hormonelt prevensjonsmiddel har du brukt tidligere? var9

P-piller 1

Mini-piller 2

P-ring 3

P-sprøyte 4

P-plaster 5

P-stav 6

Hormonspiral 7

Jeg har brukt flere forskjellige preparater 8

Du svarte at du har brukt flere forskjellige preparater, kan du fortelle hvilke?

var10

Hvorfor sluttet du med hormonelt prevensjonsmiddel? var11

Flere valg mulig

Hormonelt prevensjonsmiddel påvirket trening/prestasjon negativt 1

På grunn av bivirkninger 2

Jeg har fått råd om å slutte på hormonelt prevensjonsmiddel 3

Andre trenings-/prestasjonsrelaterte grunner 4

Annet 5

Jeg har brukt flere preparater og sluttet av ulike grunner 6

Du svarte at du har brukt forskjellige preparater og at det er ulike grunner til at du sluttet, kan du fortelle hvilke grunner til at du sluttet med de ulike preparatene?

var12

Du svarte at du har sluttet med hormonelt prevensjonsmiddel på grunn av bivirkninger, kan du fortelle hvilke bivirkninger?

var13

Flere valg mulig

Hodepine 1

Humørsvingninger 2

Nedstemthet 3

Hudforandringer 4

Vektoppgang 5

Kraftige blødninger 6

Uregelmessige blødninger 7

Blodpropp 8

Annet 9

Du svarte annet, kan du fortelle hvilke andre bivirkninger? var14

Du svarte at det var andre trenings-/prestasjonsrelaterte grunner til at du har sluttet med hormonelt prevensjonsmiddel, kan du fortelle hvilke grunner?

var15

Side 4

Sideskift

Bruk av hormonelt prevensjonsmiddel

Ved spørreskjema 2 (sendt ut i årssikfte 2020/2021) fikk du noen spørsmål om hormonelt prevensjonsmiddel. Noen av de samme spørsmålene vil dukke opp igjen nå, i tillegg til noen nye.

Side 5

Sideskift

Bruker du det samme hormonelle prevensjonsmiddelet som da du svarte på spørreskjema 2?

var16

Spørreskjema som ble sendt ut ved årsskifte (2020-2021)

Ja, jeg bruker fortsatt p-piller 1

Ja, jeg bruker fortsatt minipiller 2

Ja, jeg bruker fortsatt p-ring 3

Ja, jeg bruker fortsatt p-sprøyte 4

Ja, jeg bruker fortsatt p-plaster 5

Ja, jeg bruker fortsatt p-stav 6

Ja, jeg bruker fortsatt hormonspiral 7

Nei 8

Side 6

Sideskift

Bruker du fortsatt det samme merket? var17

Ja 1

Nei 2

Hva heter merket du benytter nå? var18

Side 7

Sideskift

Hvilken form for hormonelt prevensjonsmiddel har du byttet til?

var19

- P-piller 1
- Minipiller 2
- P-ring 3
- P-sprøyte 4
- P-plaster 5
- P-stav 6
- Hormonspiral 7
- Annet 8

Du svarte annet, hva har du byttet til? var20

Side 8

Sideskift

Hvorfor har du valgt å bytte til et annet hormonelt prevensjonsmiddel?

var21

Flere valg mulig

- På grunn av bivirkninger 1
- Det gamle påvirket trening/prestasjon negativt 2
- Jeg har fått råd om å teste en annen form for hormonelt prevensjonsmiddel 3
- Jeg følte meg ikke tilfreds med det hormonelle prevensjonsmiddelet jeg brukte 4
- Andre trenings-/prestasjonsrelaterte grunner 5
- Annet 6

Du svarte at du har byttet til et annet hormonelt prevensjonsmiddel på grunn av bivirkninger, kan du fortelle hvilke bivirkninger?

var22

Flere valg mulig

- Hodepine 1
- Humørsvingninger 2
- Nedstemthet 3
- Hudforandringer 4
- Vektoppgang 5
- Kraftige blødninger 6
- Uregelmessige blødninger 7

Blodpropp 8

Annet 9

Du svarte annet, kan du fortelle hvilke andre bivirkninger? var23

Du svarte at det var andre trenings-/prestasjonsrelaterte grunner til at du har byttet til et annet hormonelt prevensjonsmiddel, kan du fortelle hvilke?

var24

Hva heter produktet du benytter nå? var25

Side 9

Sideskift

Du svarte at du ved spørreskjema 2 brukte en form for hormonelt prevensjonsmiddel, men at du har sluttet. Kan du fortelle hvorfor?

var26

Flere valg mulig

Hormonelt prevensjonsmiddel påvirket trening/prestasjon negativt 1

På grunn av bivirkninger 2

Jeg har fått råd om å slutte på hormonelt prevensjonsmiddel 3

Andre trenings-/prestasjonsrelaterte grunner 4

Annet 5

Du svarte at du har sluttet med hormonelt prevensjonsmiddel på grunn av bivirkninger, kan du fortelle hvilke bivirkninger?

var27

Flere valg mulig

Hodepine 1

Humørsvingninger 2

Nedstemthet 3

Hudforandringer 4

Vektoppgang 5

Kraftige blødninger 6

Uregelmessige blødninger 7

Blodpropp 8

Annet 9

Du svarte annet, kan du fortelle hvilke andre bivirkninger? var28

Du svarte at det var andre trenings-/prestasjonsrelaterte grunner til at du har sluttet med hormonelt prevensjonsmiddel, kan du fortelle hvilke grunner?

var29

Side 10

Sideskift

Du svarte at du har begynt på en form for hormonelt prevensjonsmiddel etter at du svarte på spørreskjema 2, hvilken form for hormonelt prevensjonsmiddel har du begynt å bruke?

var30

Spørreskjema 2 ble sendt ut i årsskifte (2020/2021)

- P-piller 1
- Minipiller 2
- P-ring 3
- P-sprøyte 4
- P-plaster 5
- P-stav 6
- Hormonspiral 7
- Annet 8

Du svarte annet, hva bruker du? var31

Side 11

Sideskift

Hva heter produktet du benytter? var32

Side 12

Sideskift

Hvorfor benytter du hormonelt prevensjonsmiddel? var33

Flere valg mulig

- Som prevensjon 1
- På grunn av plager i forbindelse med menstruasjonssyklusen 2
- For å få regelmessig menstruasjon 3
- På grunn av helserelaterte årsaker 4
- For å unngå blødning (med tanke på konkurranser, samlinger eller lignende) 5
- Annet 6

Du svarte at det var andre grunner til at du benytter hormonelt prevensjonsmiddel, kan du fortelle hvilke?

var34

Du svarte at det er helserelaterte årsaker til at du benytter hormonelt prevensjonsmiddel, kan du fortelle hvilke?

var35

Side 13

Sideskift

Bruk av hormonelt prevensjonsmiddel og effekt på trening og prestasjon

Opplever du noen positive effekter knyttet til trening ved å benytte hormonelt prevensjonsmiddel?

var36

- Ja 1
- Nei 2
- Vet ikke 3

Du svarte ja, kan du spesifisere hvilke positive effekter? var37

Opplever du noen negative effekter knyttet til trening ved å benytte hormonelt prevensjonsmiddel?

var38

- Ja 1
- Nei 2
- Vet ikke 3

Du svarte ja, kan du spesifisere hvilke negative effekter? var39

Side 14

Sideskift

Opplever du noen positive effekter knyttet til prestasjon ved å benytte hormonelt prevensjonsmiddel?

var40

- Ja 1
- Nei 2
- Vet ikke 3

Du svarte ja, kan du spesifisere hvilke positive effekter? var41

Opplever du noen negative effekter knyttet til prestasjon ved å benytte hormonelt prevensjonsmiddel?

var42

- Ja 1

Nei 2

Vet ikke 3

Du svarte ja, kan du spesifisere hvilke negative effekter? var43

Side 15

Sideskift

Vet du hvilken type hormonelt prevensjonsmiddel du bruker? var44

Kun progestogen (gestagen) 1

Kombinert (progestogen-østrogen) 2

Vet ikke 3

Fikk du informasjon om ulike typer og hvilke preparater som finnes da du snakket med lege om å starte på hormonelt prevensjonsmiddel?

var45

Ja 1

Nei 2

Hvorfor har du valgt å bruke det hormonelle prevensjonsmiddelet du bruker i dag?

var46

Side 16

Sideskift

Bruk av p-piller

Bruk av p-piller

Bruk av p-piller

P-piller tas enten
A) 28 dager kontinuerlig, hvorav 21 piller er aktive piller og 7 er placebopiller, eller
B) 21 dager med aktive piller + 7 dager opphold uten inntak av piller.

Den uka man tar placebopiller (A) eller har opphold (B), vil man få en blødning. De som derimot går rett på et nytt brett etter 21 piller uten å ta 7 placebopiller (A) eller velger å ikke ta 7 dagers opphold (B), vil ikke få noen blødning.

P-piller tas enten
A) 28 dager kontinuerlig, hvorav 21 piller er aktive piller og 7 er placebopiller, eller
B) 21 dager med aktive piller + 7 dager opphold uten inntak av piller.

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De neste spørsmålene omhandler bruk av p-piller i perioden fra du svarte på spørreskjema 2 og fram til nå.

De neste spørsmålene omhandler bruk av p-piller i perioden fra du svarte på spørreskjema 2 og fram til nå.

De neste spørsmålene omhandler bruk av p-piller i perioden fra du svarte på spørreskjema 2 og fram til nå.

Side 17

Sideskift

Har du i perioden fra desember 2020 og fram til nå hoppet over den pillefrie-/placebopille uka?

var47

Altså gått rett på et nytt brett etter å ha fullført 21 dager med aktive piller

Ja 1

Nei 2

Har du i perioden fra desember 2020 og fram til nå hoppet over den pillefrie-/placebopille uka?

var48

Altså gått rett på et nytt brett etter å ha fullført 21 dager med aktive piller

Ja 1

Nei 2

Har du i perioden fra desember 2020 og fram til nå hoppet over den pillefrie-/placebopille uka?

var49

Altså gått rett på et nytt brett etter å ha fullført 21 dager med aktive piller

Ja 1

Nei 2

Du svarte ja, husker du når du har hoppet over uken med blødning?

var50

hvilken måned(er)

Du svarte ja, husker du når du har hoppet over uken med blødning?

var51

hvilken måned(er)

Du svarte ja, husker du når du har hoppet over uken med blødning?

var52

hvilken måned(er)

Hvorfor ønsket du å hoppe over uken med blødning (altså starte rett på neste brett etter å ha fullført 21 dager med aktive piller)?

var53

Flere valg mulig

- For å prestere bedre i konkurranse 1
- For å prestere bedre på en test 2
- For å trene mer effektivt 3
- Andre trenings-/prestasjonsrelaterte grunner 4
- For å slippe blødningsperioden 5
- Annet 6

Hvorfor ønsket du å hoppe over uken med blødning (altså starte rett på neste brett etter å ha fullført 21 dager med aktive piller)?

var54

Flere valg mulig

- For å prestere bedre i konkurranse 1
- For å prestere bedre på en test 2
- For å trene mer effektivt 3
- Andre trenings-/prestasjonsrelaterte grunner 4
- For å slippe blødningsperioden 5
- Annet 6

Hvorfor ønsket du å hoppe over uken med blødning (altså starte rett på neste brett etter å ha fullført 21 dager med aktive piller)?

var55

Flere valg mulig

- For å prestere bedre i konkurranse 1
- For å prestere bedre på en test 2
- For å trene mer effektivt 3
- Andre trenings-/prestasjonsrelaterte grunner 4
- For å slippe blødningsperioden 5
- Annet 6

Du svarte at du har hoppet over uken med blødning av andre trenings-/prestasjonsrelaterte grunner, kan du fortelle hvilke?

var56

Du svarte at du har hoppet over uken med blødning av andre trenings-/prestasjonsrelaterte grunner, kan du fortelle hvilke?

var57

Du svarte at du har hoppet over uken med blødning av andre trenings-/prestasjonsrelaterte grunner, kan du fortelle hvilke?

var58

Side 18

Sideskift

Menstruasjonshistorikk

Har du regelmessig menstruasjon? var59

Ja 1

Nei 2

Ja, men går på hormonelt prevensjonsmiddel 3

Nei, men går på hormonelt prevensjonsmiddel 4

Ja, men kun dersom jeg bruker hormonelt prevensjonsmiddel 5

Side 19

Sideskift

Menstruasjonssyklus og effekt på trening og prestasjon

Vi ønsker at du bruker litt tid på å se over bildet som definerer de ulike fasene av en menstruasjonssyklus inkludert starten på en ny. På de neste bildene vil du bli bedt om å svare på noen spørsmål knyttet til de ulike fasene.

Tidlig follikulær fase

Side 20

Sideskift

Hvordan opplever du at den tidlige follikulære fasen (fasen med blødning) påvirker de ulike faktorene under?

Prestasjon var60

Fysisk form under trening var61

Søvnkvalitet var62

Hvor klar for trening/konkurranse du føler deg var63

Trening med lav intensitet var64

Trening med høy intensitet var65

Styrketrening var66

Svært negativt 1

Noe negativt 2

Hverken eller 3

Noe positivt 4

Svært positivt 5

Vet ikke 6

Sen follikulær fase Side 21

Sideskift

Hvordan opplever du at den sene follikulære fasen (fasen rundt en eventuell eggløsning) påvirker de ulike faktorene under?

Prestasjon var67

Fysisk form under trening var68

Søvnkvalitet var69

Hvor klar for trening/konkurranse du føler deg var70

Trening med lav intensitet var71

Trening med høy intensitet var72

Styrketrening var73

Svært negativt 1

Noe negativt 2

Hverken eller 3

Noe positivt 4

Svært positivt 5

Vet ikke 6

Tidlig luteal fase Side 22

Sideskift

Hvordan opplever du at den tidlige luteale fasen (fasen etter eventuell eggløsning) påvirker de ulike faktorene under?

Prestasjon var74

Fysisk form under trening var75

Søvnkvalitet var76

Hvor klar for trening/konkurranse du føler deg var77

Trening med lav intensitet var78

Trening med høy intensitet var79

Styrketrening var80

- Svært negativt 1
- Noe negativt 2
- Hverken eller 3
- Noe positivt 4
- Svært positivt 5
- Vet ikke 6

Sen luteal fase Side 23

Sideskift

Hvordan opplever du at den sene luteale fasen (fasen før blødning) påvirker de ulike faktorene under?

Prestasjon var81

Fysisk form under trening var82

Søvnkvalitet var83

Hvor klar for trening/konkurranse du føler deg var84

Trening med lav intensitet var85

Trening med høy intensitet var86

Styrketrening var87

- Svært negativt 1
- Noe negativt 2
- Hverken eller 3
- Noe positivt 4
- Svært positivt 5

Vet ikke 6

Side 24

Sideskift

I hvilken fase(r) har du opplevd å ha dine beste prestasjoner? var88

Flere valg mulig

- Tidlig follikulær fase 1
- Sen follikulær fase 2
- Tidlig luteal fase 3
- Sen luteal fase 4
- Har ikke opplevd noen forskjell 5
- Vet ikke 6

I hvilken fase(r) har du opplevd å være i best fysisk form på trening?

var89

Flere valg mulig

- Tidlig follikulær fase 1
- Sen follikulær fase 2
- Tidlig luteal fase 3
- Sen luteal fase 4
- Har ikke opplevd noen forskjell 5
- Vet ikke 6

Side 25

Sideskift

Har du i tiden som idrettsutøver benyttet medikamenter for å stå over/forskyve en menstruasjonsblødning?

var90

- Ja 1
- Nei 2

Du svarte ja, hvilket medikament har du benyttet? var91

Hvorfor ønsket du å stå over/forskyve en menstruasjonsblødning?

var92

Flere valg mulig

- For å prestere bedre i konkurranse 1
- For å prestere bedre på en test 2

For å trene mer effektivt 3

Andre trenings-/prestasjonsrelaterte grunner 4

For å slippe blødningsperioden 5

Annet 6

Du svarte at det er andre trenings-/prestasjonsrelaterte grunner til at du har benyttet medikament for å stå over/forskyve en menstruasjonssbløding. Kan du fortelle hvilke?

var93

Har du benyttet et medikament for å stå over/forskyve en menstruasjonsblødning i perioden du har vært deltaker i forskningsprosjektet?

var94

Ja 1

Nei 2

Du svarte ja, husker du når du brukte et slik medikament for å stå over/forskyve en menstruasjonsblødning?

var95

Hvilken måned(er)

Sideskift

Har du opplevd at menstruasjonsblødningen forsvinner i perioder med høyt treningsvolum?

var96

Ja 1

Nei 2

Vet ikke 3

Har du opplevd at menstruasjonsblødningen forsvinner i perioder hvor du utfører en stor mengde høyintensive treningsøkter?

var97

Ja 1

Nei 2

Vet ikke 3

Sideskift

Menstruasjonsplager

Opplever du noen plager i forbindelse med menstruasjonssyklusen?

var98

Ja 1

Nei 2

Du svarte ja, hvilke plager opplever du? var99

Flere valg mulig

Smerter i rygg 1

Smerter i mage 2

Oppblåsthet 3

Hodepine 4

Kraftige blødninger 5

Kvalme 6

Sløvhet/trøtthet/behov for søvn 7

Muskel-/leddsmerter 8

Økt appetitt 9

Søtsug 10

Nedstemthet/tristhet 11

Ømme bryster 12

Humørsvingninger 13

Svetting/Føler meg varmere 14

Svimmel 15

Kvalm 16

Dårlig søvnkvalitet/forstyrret søvn 17

Dårlig konsentrasjon/ufokusert 18

Redusert fysisk form 19

Annet 20

Du svarte andre plager, hvilke plager opplever du? var100

Har du stått over trening på grunn av menstruasjonsplager? var101

Ja 1

Nei 2

Har du tatt smertestillende mot menstruasjonsplager?

var102

- Ja 1
- Nei 2

Du svarte ja, har du tatt smertestillende for å kunne gjennomføre planlagt trening?

var103

- Ja 1
- Nei 2

Side 28

Sideskift

Hvordan er menstruasjonsplagene ved bruk av hormonelt prevensjonsmiddel til sammenligning med uten bruk?

var104

- Mye kraftigere 1
- Noe kraftigere 2
- Ingen forskjell 3
- Noe redusert 4
- Mye redusert 5

Opplever du at plagene kommer syklisk selv om du bruker hormonelt prevensjonsmiddel?

var105

- Ja 1
- Nei 2

Side 29

Sideskift

Dagbokføring

Tar du mer hensyn til menstruasjonssyklusen i planleggingen av trening/konkurranser enn før du ble deltaker?

var106

- Ja 1
- Nei 2

Du svarte ja, kan du fortelle hvordan du tar mer hensyn til menstruasjonssyklusen i planleggingen?

var107

Hvilke av de følgende parameterne kommer du til å fortsette å loggføre nå som prosjektet er over?

var108

Flere valg mulig

- Søvntid 1
- Søvnkvalitet 2
- Hvilepuls 3
- Fysisk klar for trening/konkurranse 4
- Mentalt klar for trening/konkurranse 5
- Plager tilknyttet menstruasjonssyklus 6
- Mensen 7
- Syk 8
- Skadet 9
- På reise 10
- Fridag 11
- Konkurranse 12
- Høydedøgn 13
- Dagsform 14
- Opplevd belastning 15
- Ingen av de over 16

Er det noe du savner/kunne tenkt at var utbedret i dagboka for å støtte enda bedre opp om loggføring av menstruasjonssyklus?

var109

- Ja 1
- Nei 2
- Vet ikke 3

Du svarte ja, kan du fortelle oss hva du savner/kunne tenkt deg var utbedret?

var110

Side 30

Sideskift

Har du trener?

var111

- Ja 1

Nei 2

Sideskift

Kommunikasjon med trener

Hvordan vil du karakterisere kommunikasjonen du har med trener totalt sett?

var112

Svært god 1

God 2

Hverken eller 3

Dårlig 4

Svært dårlig 5

Hvordan vil du karakterisere kommunikasjonen du har med trener knyttet til temaer rundt menstruasjon?

var113

Svært god 1

God 2

Hverken eller 3

Dårlig 4

Svært dårlig 5

Har kommunikasjonen, totalt sett, endret seg etter at du ble deltaker i prosjektet?

var114

Kommunikasjonen har endret seg positivt 1

Kommunikasjonen er lik som før 2

Kommunikasjonen har endret negativt 3

Vet ikke 4

Har kommunikasjonen knyttet til temaer rundt menstruasjon endret seg etter at du ble deltaker i prosjektet?

var115

Kommunikasjonen har endret seg positivt 1

Kommunikasjonen er lik som før 2

Kommunikasjonen har endret seg negativt 3

Vet ikke 4

Sideskift

Oppsummering

Har året med COVID-19 påvirket deg som idrettsutøver? var116

F.eks med tanke på trening, konkurranser, motivasjon, din utvikling som idrettsutøver eller andre faktorer.

Ja 1

Nei 2

Du svarte at COVID-19 har påvirket deg som idrettsutøver, kan du fortelle hvordan og hvorfor?

var117

Sideskift

Til slutt ønsker vi bare å spørre deg om hvordan du synes det har vært å være deltaker i prosjektet?

var118

Har du andre kommentarer eller tilbakemeldinger til oss? var119

Med dette ønsker vi bare å si tusen hjertelig takk for alt du har bidratt med og for at vi har fått følge deg gjennom året som har gått! Vi er evig takknemlige!

Lykke til på veien videre!

Med vennlig hilsen Tina Engseth og resten av team FENDURA

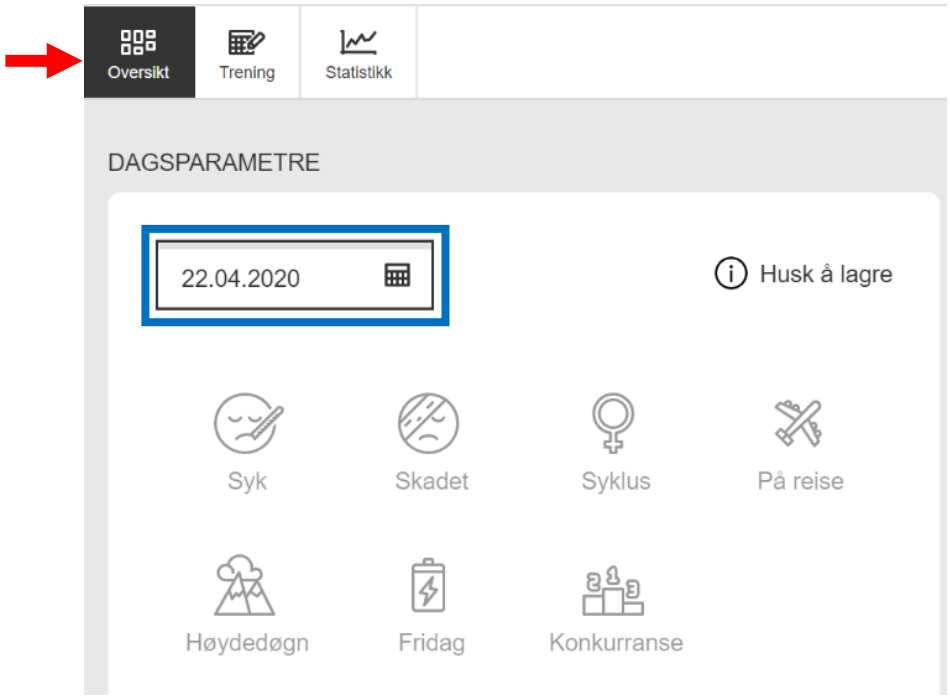
Appendix D

User manual for Olympiatoppen and Bestr training diaries

Manual for registrering av data i OLT-dagboka

Som deltager i forskningsprosjektet FENDURA, hvor vi vil undersøke hvordan menstruasjonssyklusen påvirker kvinnelige skiløperes treningskvalitet, prestasjon, motivasjon og grad av menstruasjonsplager, skal du registrere både trening og andre parametere daglig i OLT-dagboka. Vi vil innhente data fra og med 1. mai 2020 til og med 30. april 2021. Vi har laget en oversikt med forklaring til de parameterne vi vil samle inn daglig. Under er malen delt opp med utgangspunkt i de ulike «sidene/fanene» på OLT-dagboka. Avslutningsvis finner du en sjekkliste for de parameterne vi innhenter og som kan være til hjelp i den daglige registreringen.

Oversikt



Oversiktssiden er det første som møter deg når du logger inn på OLT-dagboka. Her finner du alle dagsparameterne, som skal loggføres daglig. Det optimale er om parameterne under fylles ut om morgenen, men det aller viktigste er at de loggføres hver dag. Dersom du likevel skulle glemme å fylle ut disse parameterne en dag er det viktig at du går tilbake i dagboka og registrerer disse. Du kan gå tilbake i dagboken ved å velge aktuell dato i ruten (merket med blå ramme) som du ser i bildet over.

Dagsparametere:

- **«Hvordan går det»** - fyll inn de parameterne som passer (syk, skadet, syklus, på reise, høydedøgn, fridag, konkurranse). Her trykker du på knappen **«syklus»** for å loggføre alle de dagene du har blødning.
- **«Hvilepuls»** - Dersom du bruker klokke som måler puls gjennom natten kan du benytte den for å registrere hvilepuls på OLT-dagboka. Dersom du ikke har en slik klokke følger du denne rutinen for å måle hvilepuls når du våkner hver morgen:
    - Gå på do
    - Legg deg tilbake i sengen igjen og ro ned
    - Ligg så stille og avslappet i 5 minutter
    - Det siste minuttet teller du pulsslagene dine

  Det viktigste er at du følger samme prosedyre for registrering av hvilepuls hver dag. Altså at du holde deg til en metode gjennom hele prosjekttiden.
- **«Søvn»** - Grader kvaliteten på søvnen og fyll inn søvnlengde.
- **«Readiness to train»** - Grader hvor klar du føler deg fysisk og mentalt til å gjennomføre trening eller konkurranse. Dette fylles også inn selv om du har en fridag.
- **«Plager tilknyttet menstruasjonssyklus»** - Registrer i hvilken grad du har plager/symptomer i forbindelse med menstruasjonssyklusen (fylles ut hver dag). Det kan være hodepine, oppblåsthet, sterk blødning, rygg-/magesmerter m.m. Her graderer du de plagene/symptomene du forbinder med menstruasjonssyklusen (uansett om de kommer i tilknytning til blødningsfasen eller andre faser av syklusen). 1=Ingen plager.
- **«Kommentar til dagen» -** Her kan du fylle inn annen informasjon om dagen.
- **Husk å lagre** ☺

TRENING

Alle treningsøkter må loggføres. Under beskriver vi hvilke parametere som er viktig å ha med. For skiskyttere er det også en mulighet for å legge inn skytetrening (både på oppvarming, hoveddel og avslutning, samt gradere kvalitet på skytetreningen). Nederst på treningssiden er et kommentarfelt «**Kommentarer og refleksjoner om uken»**. Dersom kommentarer i dette feltet kan være med å støtte opp om funn i ulike faser av menstruasjonssyklusen kan det være vi siterer kommentarer anonymt.

Logg utført økt:

- **«Trening, test eller konkurranse»** - Huk av for hvilken type økt du har utført.
- **«Øktnavn»** - Legg inn øktnavn.
- **«Oppvarming»** - Benytt denne dersom oppvarmingen har blitt utført i en annen bevegelsesform enn hovedaktiviteten. Velg det som passer under.
    - Utholdenhet
        - Velg bevegelsesform(er)
        - Loggfør antall minutter i ulike soner
    - Bevegelighet og tøying (dersom dette er gjennomført)
        - Loggfør antall minutter
- **«Hoveddel»** - Velg det som passer under.
    - Utholdenhet
        - Velg bevegelsesform(er)
        - Loggfør antall minutter i ulike soner
        - Eventuelt loggfør distanse
    - Styrke/spenst
        - Spesifiser hvilken type styrke/spenst økt
        - Loggfør varighet i minutter
    - Bevegelighet og tøying
        - Loggfør varighet i minutter
- **«Avslutning»** - Benytt denne dersom avslutningen har blitt utført i en annen bevegelsesform enn hovedaktiviteten. Velg det som passer under.
    - Utholdenhet
        - Velg bevegelsesform(er)
        - Loggfør antall minutter i ulike soner
    - Bevegelighet og tøying
        - Loggfør varighet i minutter

Dersom flere ulike bevegelsesformer er benyttet i f.eks. hoveddelen, registreres alle hver for seg med antall minutter i ulike soner.

- **«Totaltid og treningsbelastning»**
    - Grader opplevd belastning
    - Grader dagsform
    - Grader olympisk trening (dersom du følger denne)
    - Loggfør restitusjonstiltak (dersom du har utført noen)

- **«Kommentarer og refleksjoner om økten»**

Denne fører du slik du pleier. Dersom kommentarer i dette feltet kan være med å støtte opp om funn i ulike faser av menstruasjonssyklusen kan det være vi siterer kommentarer anonymt.

På den neste siden finner du en kort oppsummering/sjekkliste for de parameterne vi innhenter daglig.

Tusen takk for samarbeid og for din deltakelse i prosjektet!

Dersom du har spørsmål eller tilbakemeldinger må du ikke nøle med å ta kontakt.

Mvh

Tina Engseth (PhD Stipendiat)
99518687
tina.engseth@uit.no

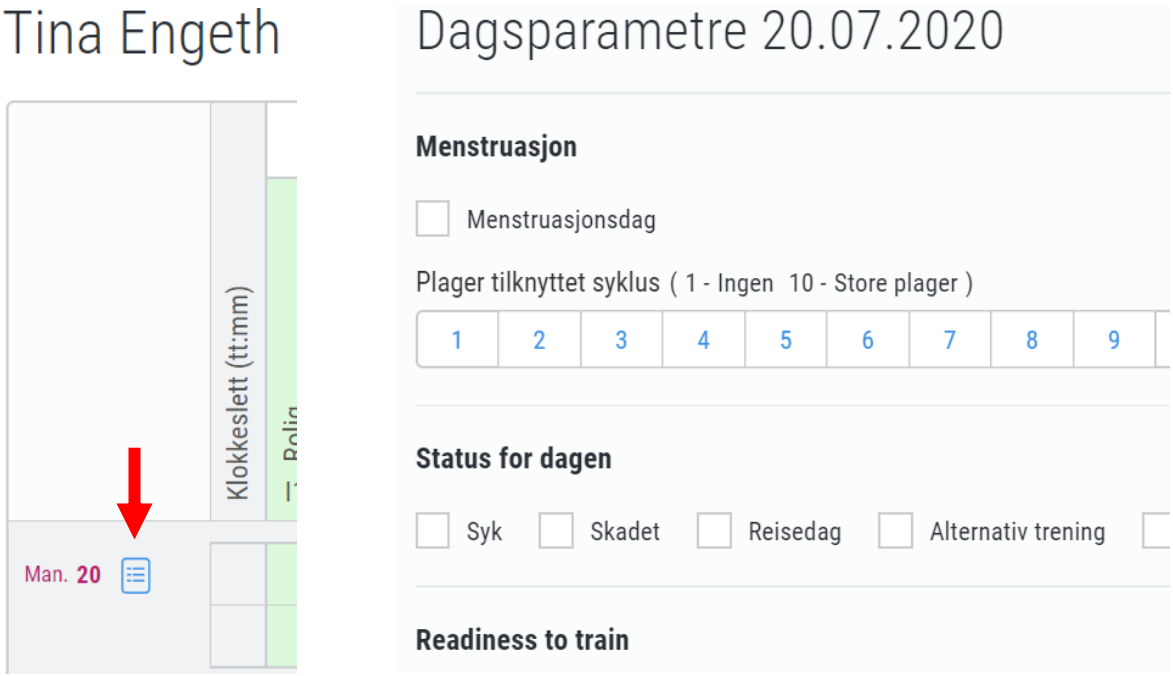
Kort oppsummert er det disse parameterne og denne informasjonen vi innhenter daglig:

- Dagsparametere (Husk å lagre)
    - Syk, skadet, syklus, på reise, høydedøgn, fridag, konkurranse
    - Hvilepuls
    - Søvnlengde og –kvalitet
    - Readiness to train –mentalt og fysisk
    - Plager tilknyttet menstruasjonssyklus
    - Eventuelle kommentarer som kan støtte opp om forskning (disse kommentarene blir anonymisert)
- Trening
    - Trening, test eller konkurranse
    - Øktnavn
    - Oppvarming (dersom annen enn hoveddel) ->Fyll ut det som passer under
        - <u>Utholdenhet</u>
            - Bevegelsesform(er)
            - Antall minutter i ulike soner
        - <u>Bevegelighet og tøying</u>
            - Antall minutter
    - Hoveddel -> Fyll ut det som passer under
        - <u>Utholdenhet</u>
            - Bevegelsesform(er)
            - Antall minutter i ulike soner
            - Distanse (dersom du vet dette)
        - <u>Styrke/Spenst</u>
            - Type styrke/spenst økt
            - Antall minutter
        - <u>Bevegelighet og tøying</u>
            - Antall minutter
    - Avslutning (dersom annen enn hoveddel) ->Fyll ut det som passer under
        - <u>Utholdenhet</u>
            - Bevegelsesform(er)
            - Antall minutter i ulike soner
        - <u>Bevegelighet og tøying</u>
            - Antall minutter
    - Totaltid og treningsbelastning
        - Opplevd belastning
        - Dagsform
        - Olympisk trening (dersom denne benyttes)
        - Restitusjonstiltak (dersom noen er utført)
        - Kommentarer og refleksjoner (vil kunne siteres anonymt dersom disse støtter opp om funn i ulike faser av menstruasjonssyklusen).

Manual for registrering av data i Bestr-dagboka

Som deltager i forskningsprosjektet FENDURA, hvor vi vil undersøke hvordan menstruasjonssyklusen påvirker kvinnelige skiløperes treningskvalitet, prestasjon, motivasjon og grad av menstruasjonsplager, skal du registrere både trening og andre parametere daglig i Bestr-dagboka. Vi vil innhente data fra og med 1. mai 2020 til og med 30. april 2021. Vi har laget en oversikt med forklaring til de parameterne vi vil samle inn daglig. Under er malen delt opp med utgangspunkt i de ulike «parameterne» i Bestr-dagboka som vi ønsker at du registrerer. Avslutningsvis finner du en sjekkliste for de parameterne vi innhenter og som kan være til hjelp i den daglige registreringen.

Dagsparametere



Dagsparameterne finner du ved å trykke på «listeknappen» til høyre for dag/dato (vist med rød pil på bildet til venstre over). Du vil da få opp oversikt over alle dagsparameterne slik som vist i bilde til høyre over (bildet viser kun et utklipp av noen av parameterne). Det optimale er om parameterne fylles ut om morgenen, men det aller viktigste er at de loggføres hver dag.

Dagsparametere:

- **«Menstruasjon»** - Her trykker du på knappen «menstruasjonsdag» for å loggføre alle de dagene du har blødning.
    - **«Plager tilknyttet syklus»** - Registrer i hvilken grad du har plager/symptomer i forbindelse med menstruasjonssyklusen. Denne fylles ut hver dag, hvor 1=Ingen plager. Plager kan være hodepine, oppblåsthet, sterk blødning, rygg-/magesmerter m.m. Her graderer du de plagene/symptomene du forbinder med menstruasjonssyklusen (uansett om de kommer i tilknytning til blødningsfasen eller andre faser av syklusen).
- **«Status for dagen»** - Fyll inn de parameterne som passer (syk, skadet, reisedag, alternativ trening, høydedøgn, hviledag, konkurranse).
- **«Readiness to train»** - Grader hvor klar du føler deg fysisk og mentalt til å gjennomføre trening eller konkurranse. Dette fylles også inn selv om du har en fridag.
- **«Søvn»** - Grader kvaliteten på søvnen og fyll inn søvnlengde.
- **«Hvilepuls»** - Dersom du bruker klokke som måler puls gjennom natten kan du benytte den for å registrere hvilepuls i dagboka. Dersom du ikke har en slik klokke følger du denne rutinen for å måle hvilepuls når du våkner hver morgen:
    - Gå på do
    - Legg deg tilbake i sengen igjen og ro ned
    - Ligg så stille og avslappet i 5 minutter
    - Det siste minuttet teller du pulsslagene dine

  Det viktigste er at du følger samme prosedyre for registrering av hvilepuls hver dag. Altså at du holde deg til en metode gjennom hele prosjekttiden.
- **«Kommentar» -** Her kan du fylle inn annen informasjon om dagen.

TRENING

Alle treningsøkter må loggføres. Under beskriver vi hvilke parametere som er viktig å ha med. For skiskyttere er det også en mulighet for å legge inn skytetrening og parametere knyttet til dette. Ytterst til høyre i skjemaet finner du «**Kommentarer»**. Dersom kommentarer i dette feltet kan være med å støtte opp om funn i ulike faser av menstruasjonssyklusen kan det være vi siterer kommentarer anonymt.

Logg utført økt:

- **«Utholdenhet»** - Loggfør antall minutter i ulike soner når dette er aktuelt.
- **«Styrke, spenst, hurtighet og bevegelighet»** - Spesifiser hvilken type økt du har gjennomført når dette er aktuelt.
- **«Bevegelsesformer»** - Loggfør hvilken bevegelsesform økten har vært utført i. Dersom flere ulike bevegelsesformer er benyttet må dette spesifiseres i egne økter (med egen oversikt over minutter i ulike soner). F.eks. dersom du har benyttet en bevegelsesmåte til oppvarming og en annen i hovedelen.
- **Skuddtrening og distanse** – Mulig å registrere

- **«Ulike parametere som også er viktige at du registrerer ved hver trening»**
    - Opplevd belastning
    - Dagsform
- **«Ulike parametere vi innhenter dersom de benyttes»**
    - Olympisk trening
    - Loggfør restitusjonstiltak (dersom du har utført noen)

- **«Kommentarer»**

Denne fører du slik du pleier. Dersom kommentarer i dette feltet kan være med å støtte opp om funn i ulike faser av menstruasjonssyklusen kan det være vi siterer kommentarer anonymt.

På den neste siden finner du en kort oppsummering/sjekkliste for de parameterne vi innhenter daglig.

Tusen takk for samarbeid og for din deltakelse i prosjektet!

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Mvh

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99518687
tina.engseth@uit.no

Kort oppsummert er det disse parameterne og denne informasjonen vi innhenter daglig:

- Dagsparametere
    - Syk, skadet, Menstruasjon, på reise, høydedøgn, hviledag, konkurranse
    - Hvilepuls
    - Søvnlengde og –kvalitet
    - Readiness to train –mentalt og fysisk
    - Plager tilknyttet menstruasjonssyklus
    - Eventuelle kommentarer som kan støtte opp om forskning (disse kommentarene blir anonymisert)

- Trening
    - Oppvarming (dersom annen enn hoveddel) ->Fyll ut det som passer under
        - Bevegelsesform og tid
        - Antall minutter i ulike soner
    - Hoveddel -> Fyll ut det som passer under
        - Bevegelsesform og tid
        - Antall minutter i ulike soner
        - Distanse (dersom du vet dette)
        - <u>Styrke/Spenst/Hurtighet</u>
            - Type økt
            - Antall minutter
        - <u>Bevegelighet, tøying og annet</u>
            - Antall minutter
    - Avslutning (dersom annen enn hoveddel) ->Fyll ut det som passer under
        - <u>Utholdenhet</u>
            - Bevegelsesform(er)
            - Antall minutter i ulike soner
    - Andre økt-parametere
        - Opplevd belastning
        - Dagsform
        - Olympisk trening (dersom denne benyttes)
        - Restitusjonstiltak (dersom noen er utført)
        - Kommentarer og refleksjoner (vil kunne siteres anonymt dersom disse støtter opp om funn i ulike faser av menstruasjonssyklusen).

Appendix E

Additional information, Paper III

MENSTRUASJONSSYKLUS OG RESTITUSJON

Introduksjon

Invitasjon

Dette er en tilleggs studie i forskningsprosjektet FENDURA (The Female Endurance Athlete) og spesielt "Den kvinnelige skiløperen: Menstruasjonssyklusen innvirkning på treningskvalitet og fysisk prestasjon". De samme rettighetene gjelder for dette forskningsprosjektet, og personvernet ditt blir behandlet på samme måte som du godtar ved å signere informert samtykke på det forrige forskningsprosjektet (for mer informasjon, se informert samtykke).

Formål

Målet med dette prosjektet er å undersøke hvordan ulike faser i menstruasjonssyklusen påvirker selvrapportert treningskvalitet, fysisk prestasjon, motivasjon og grad av menstruasjonsproblemer hos kvinnelig utholdenhetsutøver.

Hvorfor eggløsningstesten?

Ulike faser i menstruasjonssyklusen er preget av forskjellige hormonelle konsentrasjoner. Den enkleste måten å få en indikasjon på de forskjellige menstruasjonssyklusfasene er kalendertellingsmetoden, som er basert på rapportering av den første dagen i blødningsfasen: første halvdel av menstruasjonssyklusen er follikelfasen og andre halvdel er luteal fase, delt på eggløsningen. Det er imidlertid ikke nødvendigvis slik at eggløsningen foregår nøyaktig halvveis i menstruasjonssyklusen. I tillegg lider mange idrettsutøvere av anovulasjon, noe som betyr fravær av eggløsning under en menstruasjonssyklus (eggstokkene frigjør ikke en oocytt). Basert på dette ønsker vi å ytterligere dokumentere menstruasjonssyklusfasene ved å bruke en eggløsningstest for å måle urin luteiniserende hormon (LH) bølge, som er en akutt økning i LH som utløser eggløsning.

Alle opplysninger vi innhenter fra deg vil bli lagret elektronisk og kodet slik at disse avidentifiseres.

Ta kontakt hvis du har noe spørsmål!
e-mail: virginid@stud.ntnu.no

MENSTRUASJONSSYKLUS OG RESTITUSJON

Introduksjon

Hvorfor kan det være interessant for deg?

Etter studien du skal få en individuell rapport om menstruasjonssyklusen og parametrene dine. Du har muligheten til å forstå dine egne menstruasjonssyklus bedre, samt økt forståelse av hvordan kroppen din reagerer på de forskjellige faser i menstruasjonssyklusen.

Det følger **ingen ulempe eller ubehag** ved å delta i studien da vi kun vil innhente daglige data fra din treningsdagbok. Eggløsningstesten er enkel å gjennomføre da det er en ikke-invasiv test, i tillegg til at den er lite tidkrevende å utføre. Eggløsningssettet leveres gratis til deg som ønsker å delta i denne studien.

Takk for samarbeidet ditt!

Ta kontakt hvis du har noe spørsmål!
e-mail: virginid@stud.ntnu.no

MENSTRUASJONSSYKLUS OG RESTITUSJON

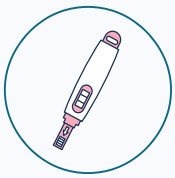
Studien innebærer

Registrering

1. Signer det informerte samtykke
2. Svar på et spørreskjema.

Dagboken

1. Opprett en konto i treningsdagboken (OLT eller BESTR) på nett
2. Gi testkoordinator «trener tillatelse» til treningsdagboken din
3. Begynn å fylle ut daglig parametrene og trening.



Eggløsningstest

1. Registrer på dagboken den første dagen av mensen
2. Tell 8 dager fra den første dagen med full blødning og start med eggløsningstest
3. Følge bruksanvisning som er vedlagt.

Ferdig

Studien varer i 4 menstruasjonssykluser: du kan slutte å føre dagbok dag 1 i neste (femte) menstruasjonssyklus.
Det kommer en individuell rapport om menstruasjonssyklusen og parametrene.

Ta kontakt hvis du har noe spørsmål!
e-mail: virginid@stud.ntnu.no

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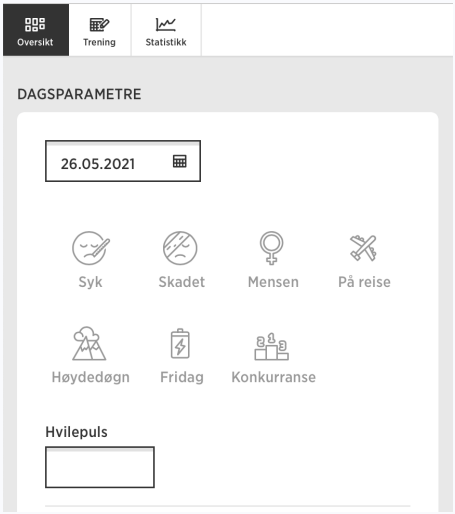
MENSTRUASJONSSYKLUS OG RESTITUSJON

Manual for bruk av dagbok

Dagsparametrene

VIKTIG: dagsparameterne skal loggføres daglig.
Husk å lagre!;)



HVORDAN GÅR DET?

Fyll inn de parameterne som passer (syk, skadet, syklus, på reise, høydedøgn, fridag, konkurranse).

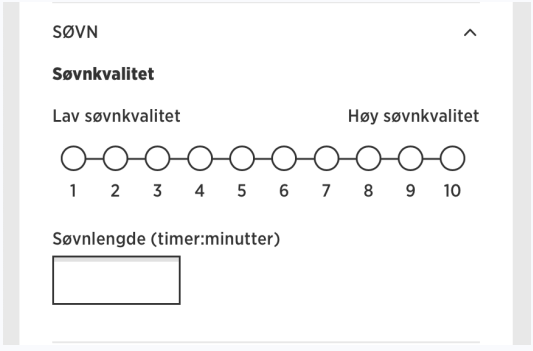
Trykk på knappen "syklus" for å loggføre alle de dagene du har blødning.

HVILEPULS

1. Dersom du bruker klokke som måler puls gjennom natten kan du benytte den for å registrere hvilepuls.

2. Hvis ikke, følg denne rutinen for å måle hvilepuls når du våkner hver morgen:
   - Gå på do
   - Legg deg tilbake i sengen igjen og ro ned
   - Ligg så stille og avslappet i 5 minutter
   - Det siste minuttet teller du pulsslagene dine.

VIKTIG: følg samme prosedyre for registrering av hvilepuls hver dag gjennom hele prosjekttiden!



SØVN

Grader kvalitet og fyll in lengde.

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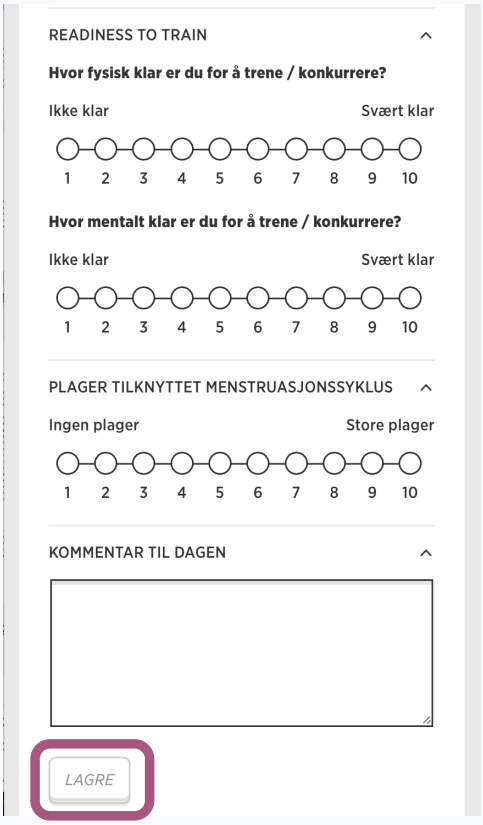

READINESS TO TRAIN

Grader hvor klar du føler deg fysisk og mentalt til å gjennomføre trening eller konkurranse.
Dette fylles også inn selv om du har en fridag.

PLAGER TILKNYTTET MENSTRUASJONSSYKLUS

Registrer i hvilken grad du har plager/symptomer i forbindelse med menstruasjonssyklusen (ikke bare tilknyttet menstruasjon).
Fylles ut hver dag. 1=Ingen plager.

KOMMENTAR TIL DAGEN

Annen informasjon om dagen, hvis aktuelt.

HUSK Å LAGRE!

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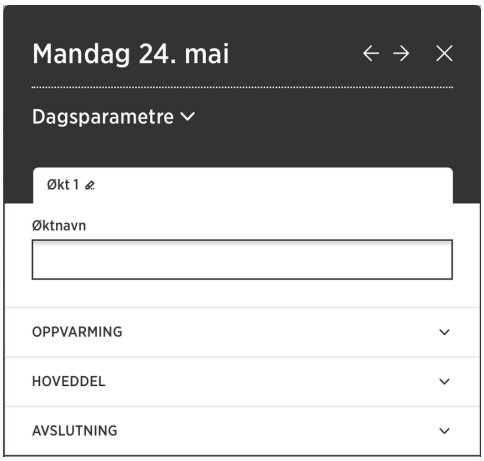
Trening

VIKTIG: alle treningsøkter må loggføres.
Husk å lagre!;)

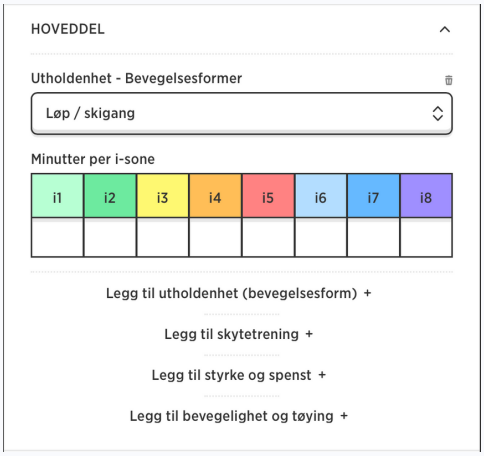


OKTNAVN

Legg inn øktnavn.

OPPVARMING

Benytt denne dersom oppvarmingen har blitt utført i en annen bevegelsesform enn hovedaktiviteten.



HOVEDDEL

- Velg bevegelsesform(er);
- Loggfør antall minutter i ulike soner, her er intensitetskala: OLT-skala;
- Eventuelt loggfør distanse o styrke/spenst; spesifiser hvilken type styrke/spenst økt;
- Loggfør varighet i minutter.

*Dersom flere ulike bevegelsesformer er benyttet, registreres alle hver for seg med antall minutter i ulike soner.

AVSLUTNING

Benytt denne dersom avslutningen har blitt utført i en annen bevegelsesform
enn hovedaktiviteten.

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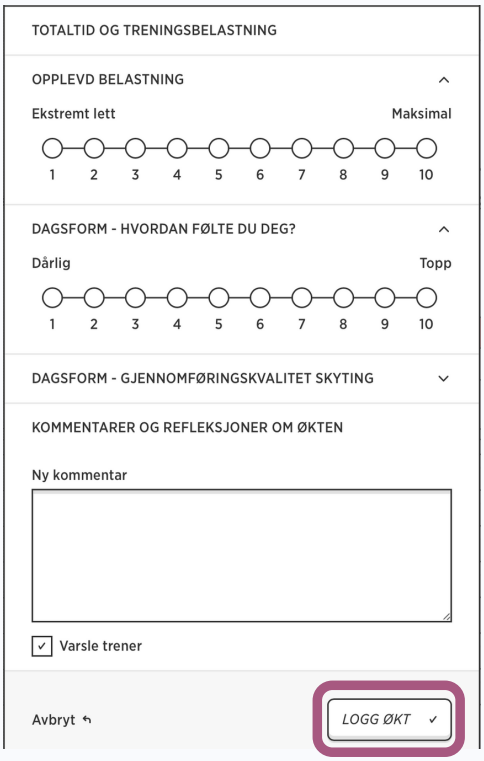

TOTALTID OG TRENINGSBELASTNING

Grader opplevd belastning: hvordan du følte den spesifikke økta kjentes på kroppen. For eksempel "hvor lett eller tungt var det å ligge på en gitt belastning i dag?"

Grader dagsform: hvordan du opplevde at kroppen din responderte. Hvor "på" var du/hadde du mye å gi/var du "fit for fight"/hvor sterk følte du deg?

Grader olympisk trening (dersom du følger denne)

Loggfør restitusjonstiltak (dersom du har utført noen)

KOMMENTARER OG REFLEKSJONER OM ØKTEN

Hvis aktuelt.

LOGG ØKT!

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MENSTRUASJONSSYKLUS OG RESTITUSJON

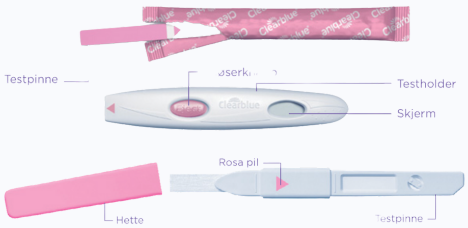
Eggløsningstest

Når du skal starte å teste

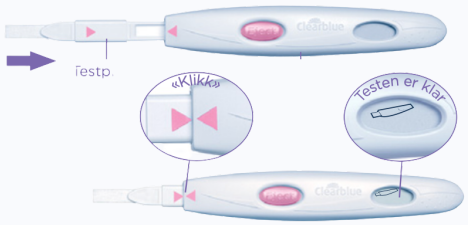
- Testen skal deretter tas omtrent på samme tid hver dag (± 1 time);
- Tell 8 dager fra den første dagen med full blødning og start med eggløsningstest;
- Det er viktig å drikke som vanlig og at du ikke har urinert på 4 timer før testing.

Gjør deg klar for testen

Fjern testpinnen fra folieinnpakningen. Bruk testpinnen med en gang den er tatt ut.
Fjern hetten og finn den rosa pilen på testpinnen.
Finn den rosa pilen på testholderen og still begge rosa pilene opp.



Sett testpinnen inn i testholderen til den klikker på plass og symbolet for «klar til test» vises. Når klar til test-symbolet vises, er du klar for å starte testen.
Hvis klar til test-symbolet ikke vises, eller hvis symbolet har forsvunnet, må du ta ut testpinnen og sette den forsiktig inn igjen.



Utfør testen

Samle urinprøven i den rene, tørre beholderen.
Dypp den absorberende spissen, pekende nedover, i urinprøven i 15 sekunder.

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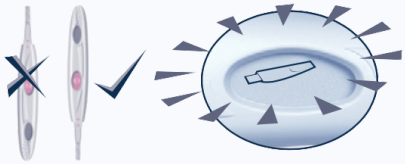

Vent

Ta ut og hold den absorberende spissen pekende nedover, eller legg testen flatt.

Etter 20-40 sekunder begynner testklar symbolet å blinke for å vise at testen fungerer. Sett på hetten igjen og vent.
VIKTIG: Under testingen må du aldri holde testen med den absorberende spissen pekende oppover! Du må heller ikke ta ut testpinnen!

Les av resultatet

I løpet av 3 minutter viser displayet resultatet ditt.

Hvis resultatet ditt er dette, har du ikke oppdaget LH-bølgen. Test igjen dagen etterpå, på samme tidspunkt med en ny testpinne.

Hvis resultatet ditt er dette, har du oppdaget din LH-bølge.
Ta et bilde av den positive testen og send den til oss på e-post eller telefon.
Registrer i treningsdagboken din: skriv "positiv LH-test" i seksjonen "Daglige parametere - kommentarer".
Stopp å teste og begynne på nytt i neste menstruasjonssyklus (dag 8).

Ingen positivt svar: hva skal jeg gjøre?

Fortsett å utføre testen til du får et positivt svar eller til neste blødningsfase.

Ferdig

Når du har lest resultatet, trykk på utløserknappen og fjern testpinnen.
VIKTIG: Ikke sett inn en brukt testpinne på nytt.

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