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Uses and Effects of Norethisterone on Menstrual Cycle of Professional Women Athletes in Pakistan

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Abstract

Background: Professional female athletes frequently struggle to control their menstrual cycles because of the physiological demands of competition and training. Unplanned menstruation can have an impact on general health, recuperation, and sports performance of female athletes. A synthetic progestogen called norethisterone is frequently used to regulate the menstrual cycle and may be an option for athletes who want to maximize their sports performance without the interruptions of menstruation.

Aim: The present study examines how norethisterone affects professional female athletes' menstrual cycles, assessing its effectiveness in delaying periods, sports performance, and possible physiological adverse effects.

Methodology: The study lasted six months and involved (n=100) female athletes belonging to endurance, strength-based, and mixed-sport disciplines. Two groups of participants were formed: one that used norethisterone to treat menstrual delay and the other that followed their normal cycle as a control. Hormonal profiling, performance evaluations, and self-reported surveys on symptoms, well-being, and adverse effects were used to gather data. To assess the effectiveness of menstruation suppression, changes in sports performance indicators and side effects, statistical analysis was done using SPSS v-26.

Result: The study indicated that 80% of athletes utilizing norethisterone effectively postponed menstruation during important competitive times. In addition to modest side effects including bloating and mood swings, 20% of users reported no discernible reduction in performance indicators like strength, endurance, and response speed. Follow-up evaluations revealed no discernible long-term hormonal abnormalities. Professional sportsmen find that norethisterone is a safe and efficient way to suppress their periods. Individual differences in reaction, however, emphasize the necessity of tailored medical advice. Although there was no discernible significant influence on sports performance, mild side effects highlighted the significance of keeping an eye on athletes' health.

Discussion: Professional sportswomen found that norethisterone is a safe and efficient way to suppress their periods. Individual differences in reaction, however, emphasize the necessity of tailored medical advice. The study emphasized the need for more investigation into the long-term hormonal impacts and psychological consequences of progestogen use in top athletes.

Conclusion: Considering little side effects, norethisterone helps professional female athletes to control their menstrual cycles. For individuals who want to avoid menstruation during competition without suffering major performance consequences, it provides a good alternative. Future studies should examine its long-term consequences and compare it with various menstrual suppression strategies.

Key words: Norethisterone, Menstrual cycle regulation, Professional women athletes.

Introduction

Female athletes' physical and mental health is greatly impacted by the menstrual cycle which frequently affects their preparation, performance, and recuperation. Stress, low body fat percentages, and rigorous training routines can cause professional female athletes' periods to be disrupted which can result in disorders including irregular menstruation and amenorrhea, lack of menstruation (De Souza et al., 2017). Over the last few years, the number of professional female athletes has risen as the range of sports in which women compete is expanding. In line with this, researchers' interest in the health effects of this trend has grown (Constantini et al., 2005; Costello et al., 2014).

The impact of physical activity on female physiology has resulted in a substantial number of women participating in various sports disciplines suffering from several menstrual cycle diseases. Emotional or mental stress, young reproductive age, low

body weight, a sudden rise in exercise load, and eating disorders are all important in their pathogenesis (Loveless & Hewitt, 2017). The menstrual cycle is a superb example of a bio-psycho-social process. It is a normal part of physiology influenced and impacted by behavior (Chrisler, 2013; Thompson & Han, 2019).

The menstrual cycle is an important physiological rhythm that happens monthly from the age of about 13 years (Ozbar et al., 2016). Menstrual stigma still exists and is regarded as an educational and socioeconomic issue around the world. A survey found that one out of every four girls did not know what to do when their period began, with 48% feeling guilty about their period (Koff & Rierdan, 1995). Female sex steroid hormones have a variety of effects on the body other than the reproductive axis. Female athletes, coaches, researchers, and medical professionals have long been concerned about the potential impact of menstrual cycle hormone changes on athletic performance components (Lebrun & Rumball, 2001).

Large cyclic changes in endogenous sex hormones, such as progesterone and oestrogen, are noted during the menstrual cycle (Davis & Hackney, 2017). The relatively predictable changes in progesterone and oestrogen throughout the menstrual cycle produce considerably different transitory hormonal profiles that are used to distinguish between menstrual cycle phases (Jonge, 2003). Hormonal fluctuations during the menstrual cycle may probably affect human performance. Feedback loops within the hypothalamic-pituitary-ovarian axis control physiological events during the regular menstrual cycle (Reilly, 2000). The periodic variations in oestrogen and progesterone over the menstrual cycle are thought to affect performance in various ways.

Oestrogen is known to have an anabolic impact on skeletal muscle in particular (Owen et al., 2010). The menstrual cycle, hormonal variations, and numerous aspects of well-being, health, and athletic performance are all intertwined in complex ways (Constantini et al., 2005). Athletes with a natural menstrual cycle suffered physical problems, as well as psychological issues and a lack of enthusiasm to work out. The aim to limit the influence on competition to alleviate anxiety about meeting weight requirements or to eliminate distractions to manage during competition prompted many women to intentionally control their menstrual cycles (Brown, Knight, & Forrest, 2021). Both perceived and physical factors can influence overall sport performance (Carmichael, Thomson, Moran & Wycherley, 2021).

Literature Review

The first analogue of testosterone, nandrolone, was produced in the 1960s. Nandrolone has been heavily misused since its inception due to its powerful muscle-building and pain-relieving properties. Nandrolone is a testosterone analogue with one methyl group lacking in the 19th position, hence the name 19-nortestosterone (Hemmersbach & Grosse, 2010). The main urine metabolite of the anabolic steroid nandrolone and its prohormones is 19-norandrosterone.

The World Anti-Doping Agency (WADA) has banned the use of these 19 19-nortestosterone androgens in sports; however, negative results for 19-nortestosterone continue to be widely reported (Walker et al., 2009). Norethisterone, commonly known as norethindrone, is a synthetic progestogen that acts similarly to progesterone but has weak estrogenic and androgenic effects. Norethisterone, in a dose of 5 mg three times a day for 21 days, is often used to treat menorrhagia and is thought to be as successful as the intrauterine levonorgestrel system (Endrikat et al., 2009). In a therapeutic FVF programme where oocyte recovery was limited to two days each week, the use of norethisterone to manage the timing of the preceding menstrual cycle and, as a result, the timing of the in-vitro fertilization (IVF) cycle was studied (Wardle et al., 1986).

In the acute context, the usage of norethisterone is an effective and dependable therapy choice for teenagers who want to manage irregular uterine bleeding (Papapanagiotou et al., 2019). Nandrolone is utilized in clinical settings for pathological disorders defined by a negative nitrogen balance, catabolic states such as serious burns and cancer. It has been demonstrated that using it increases muscular cross-sectional areas and fat-free mass (Velema et al., 2012). A lack of understanding of the effects that athletes experience during the menstrual cycle is also a problem (Martin, Sale, Cooper & Elliott-Sale, 2018).

Estrogen's effect on the cardiovascular system is one of its most essential functions. Estrogens affect plasma fibrinolytic activity and platelet aggregation, increasing the risk of thrombosis. However, they protect against atherosclerosis by lowering total cholesterol and low-density lipoprotein (LDL) levels while raising high-density lipoproteins (HDL) (Sarrel, 1990). Female sex hormones, both endogenous and exogenous, have been demonstrated to affect a variety of respiratory, cardiovascular, and metabolic parameters, but these changes are likely to have a minor impact on most recreational athletes' ability to engage in and enjoy their sport (Frankovich & Lebrun, 2000).

Low-dose norethisterone acetate (2.5 mg/day) is effective in reducing the severity of rectovaginal endometriosis pain symptoms without causing major side effects (Vercellini et al., 2005). In women with rectovaginal endometriosis, norethisterone acetate successfully lowers pain feelings while having no short-term negative effects on mineral bone density (Remorgida et al., 2007). Norethisterone acetate has beneficial effects on postmenopausal bone metabolism, increasing bone mass more than predicted and more than alendronate treatment (Riis, Juel, Lehmann, & Christiansen, 2002).

In comparison to other substances, norethisterone acetate has an excellent control of uterine haemorrhage, has a favorable effect on bone metabolism, and has modest effects on lipoprotein profiling at low doses (Vercellini et al., 2009). Nandrolone is a prominent physical enhancer that is mostly used in bodybuilding since it allows the bodybuilder to get an advantage by utilizing it several months before the competition (Sahin, Senturk, Barlas & Yasarcan, 2020).

Nandrolone has a stronger affinity than testosterone; however, after 5a-reductase-catalyzed biotransformation, the situation for the corresponding dihydro metabolites is exactly the opposite (Bergink, Janssen, Turpun, & Vies, 1985). Testosterone or nandrolone is expected to affect muscle cells in their natural molecular forms (Celotti & Cesi, 1992). Aromatization of nandrolone-related compounds may occur via a separate mechanism in the liver (Kuhl & Wiegratz, 2007). All available information is examined to establish that when administered in the proper dosage, norethisterone acetate has no deleterious effect on serum lipids and lipoproteins. Furthermore, as compared to other progestogens, norethisterone acetate appears to give greater haemorrhage management and endometrial protection (Riis et al., 2002).

Research Methodology
A mixed-method approach is used in this study combining quantitative and qualitative research techniques. A cross-sectional survey and a randomized controlled trial (RCT) were used to assess how norethisterone affected professional female athletes' menstrual cycles.

Study Population and Sampling
The study included (n=100) professional women athletes from different sports fields, aged between 18 to 35 years. Professional athletic clubs and national sports organizations were the sources of the participants: (i) normal menstrual cycles before the research, (ii) no underlying reproductive or endocrine diseases, and (iii) active engagement in professional sports for at least three years were the requirements for inclusion. Hormonal therapy-incompatible athletes were not included.

Data Collection Methods
Participants were divided into two groups:
1. The experimental group (n=50) was administered norethisterone (5 mg daily) for up to 10 days before their expected menstruation.
2. The Control Group female athletes (n=50) did not employ any hormonal therapies.

Menstrual Cycle Tracking: Using a digital menstruation monitoring software, participants tracked changes in their menstrual cycles for three months before and after the intervention.
Performance Metrics: Self-reported questionnaires and pre-established physical examinations were used to measure changes in sports performance.
Hormonal Analysis: To evaluate changes in estrogen, progesterone, and other hormones, blood samples were taken before, during, and following the administration of norethisterone.
Psychological Impact: To evaluate mood swings and psychological health, a validated questionnaire called the Profile of Mood States (POMS) was employed.
Adverse Effects Monitoring: Headaches, bloating, mood fluctuations, and other physical symptoms were among the adverse effects that participants reported.
Data was gathered over six months. Through standardized questionnaires and hormone level measurements (FSH, LH, and progesterone), the study documented changes in the menstrual cycle, performance measures, and self-reported side effects. Sport-specific standards were used to assess performance indicators.

Results
Statistical software (SPSS) v-26 used to assess the experimental group and control group. While inferential statistics (t-tests, ANOVA) evaluated the effect of norethisterone on menstrual cycles and sports performance, the association between norethisterone usage and alterations in athletic performance was examined using Pearson's correlation coefficient. To evaluate the predicted factors affecting menstruation delay and symptom severity, regression analysis was used. Descriptive statistics provided an overview of the prevalence and scope of norethisterone usage.
Menstrual Cycle Alterations
The research indicated that the results found that 80% of the athletes in the experimental group experienced a delay in their menstrual cycles due to Norethisterone use. The mean menstrual cycle length increased from (28±3) days to (36±4) days significantly ($p<0.05$). Moreover, 5% of female athletes had irregular spotting during the research period and 15% reported amenorrhea.

Performance Metrics
Short-Term Performance Benefits: 65% of athletes revealed that their training and performance were enhanced by increased focus and decreased premenstrual symptoms. The experimental and control groups' athletic performance was not significantly different ($p>0.05$).
Long-Term Effects: There was no discernible effect on the VO2 max, endurance, or strength metrics. The findings indicated that athletes in the experimental group experienced less menstrual-related fatigue and pain while competing.
Athlete Perception and Satisfaction
70% of athletes who used norethisterone reported feeling more comfortable throughout training and competition indicating that they are satisfied with the hormone's ability to regulate the menstrual cycle.

Psychological and Physiological Impact
Mood Variability: There were no reported any significant psychological discomfort, however, minor mood fluctuations were observed by 45% of the experimental group.
Side Effects: 30% of the athletes on norethisterone reported moderate adverse effects such as alterations in mood, headaches, and nausea. Nevertheless, no serious side effects were reported.

Hormonal Changes
Progesterone Levels: Progesterone levels were elevated throughout the norethisterone treatment period but they returned to normal after stopping the medication.
Estrogen Fluctuations: Estrogen levels did not differ significantly from those in the control group.

The results showed that professional female athletes can safely and effectively use norethisterone to postpone their periods. Athletes can efficiently control their menstrual cycles using norethisterone, especially during high-performance events without experiencing major long-term disturbances in their hormonal balance or sports performance. A few minor adverse effects were noted but they had no appreciable influence on the athletes' general health or preparedness for competition. In light of these results, norethisterone may be a good short-term treatment for female athletes' menstrual cycle control. To evaluate long-term effects and improve dose recommendations, more research with bigger sample sizes and longer follow-ups is advised.

Discussion

To maximize performance and control menstruation-related discomfort, elite female athletes frequently utilize the synthetic progestogen norethisterone (NET) to alter their menstrual cycles. Because professional sports have significant physiological demands, athletes frequently look for ways to manage menstruation symptoms that might interfere with practice and competition. This conversation examines how norethisterone affects the menstrual cycle, performance issues, and possible health consequences for female professional athletes (Elliott-Sale et al., 2021).

By changing the hormonal balance that controls the menstrual cycle, norethisterone is frequently administered to postpone menstruation. It prevents the decline in progesterone a level that leads to menstruation by imitating endogenous progesterone. For athletes who wish to avoid menstruation symptoms during important events, this artificial lengthening of the luteal phase may prove advantageous (Liu et al., 2024). According to studies, taking 5 mg of NET three times a day, beginning three days before the anticipated period, can successfully postpone menstruation. For female athletes who suffer from performance-limiting menstrual problems, including premenstrual syndrome (PMS), excessive menstrual bleeding (menorrhagia), or dysmenorrhea (painful periods), this mechanism offers a tactical edge (Martin et al., 2018).

There is much disagreement on how the menstrual cycle phase affects sports performance, however, some research indicates that symptoms like bloating, exhaustion, and hormonal changes may affect performance (McNulty et al., 2020). Athletes can prevent these oscillations and maintain training intensity and competition preparation by manipulating or suppressing their menstruation using norethisterone. However, other research indicates that norethisterone may potentially cause hormonal imbalances that might impact muscle repair, endurance, and injury risk, even, if it can have short-term positive effects (Bruinvels, 2016). Norethisterone has androgenic effects due to its synthetic origin, which can occasionally result in mood swings, water retention, and possible reductions in aerobic capacity (Elliott-Sale, 2023).

Conclusion

A common synthetic progestogen, norethisterone, provides elite female athletes with a dependable method of controlling their menstrual cycles allowing them to perform at their best throughout crucial practice and competition periods. Its capacity to postpone menstruation offers a workable way to deal with tiredness, pain, and hormonal changes associated with cycles that could otherwise impair sports performance. The advantages are obvious but it is important to carefully weigh the possible impacts on performance metrics, fluid retention, and hormonal balance. Individualized medical advice is crucial to ensuring the safe and efficient use of norethisterone, especially considering the great physical demands imposed on professional athletes. Future studies should concentrate on long-term effects including how it affects top athletes' muscular recovery, endurance, and general well-being. Norethisterone usage may be used to empower female athletes while preserving their physiological well-being by finding a balance between menstrual health and physical performance.

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