PRESS RELEASE

EMBARGOED UNTIL 9 MAY 2026 AT 00:01 CET

AI-driven wearable patches help identify undetected hormone disruption in unexplained infertility

Men and women who appear hormonally 'normal' may still have undetected disruptions in the timing and coordination of their reproductive hormones that could impair fertility, according to research presented at the 28th European Congress of Endocrinology in Prague. Now, a newly developed wearable skin sensor patch, combined with artificial intelligence (AI), not only can measure the quantity of reproductive hormones but also how reproductive hormones fluctuate over time, which could help patients and doctors detect infertility early and improve conception.

Unexplained infertility affects about 15-30% of couples and is diagnosed after standard tests reveal no obvious cause. Standard tests for men who are infertile or have hypogonadism — clinically low testosterone — include single morning serum testosterone measurements, while fertility tests for women include assessing the menstrual cycle and reproductive hormones, such as luteinizing hormone (LH), follicle-stimulating hormone (FSH), estradiol and progesterone. However, hormones are highly dynamic that follow a circadian rhythm, rising and falling in regulated patterns throughout the day.

In one study, Dr Tinatin Kutchukhidze from Oxford University and New Anglia University examined 102 men in Georgia and the UK, between the ages of 22 and 38, who had normal morning total testosterone (12-35 nmol/l), with or without infertility or hypogonadal symptoms. She and her team analysed data on their testosterone levels every 15 minutes over four days, using an AI-enabled wearable skin sensor patch they developed, and found that men with symptoms had significantly disrupted testosterone rhythms, despite having normal testosterone levels in standard laboratory tests. In addition, these unmasked rhythm abnormalities were associated with reduced sperm concentration and symptoms of androgen deficiency.

"For the first time, we have been able to track androgen patterns in real time over several days with a novel, non-invasive continuous AI-driven testosterone monitoring patch, compatible with Android and iPhone mobile devices," said Dr Kutchukhidze.

"Previous research suggests that a normal morning testosterone level is sufficient to exclude clinically significant androgen deficiency. However, our findings challenge that assumption by demonstrating that men with normal serum testosterone may still exhibit marked disturbances in hormonal rhythmicity associated with reproductive dysfunction," said Dr Kutchukhidze.

In another study, Dr Kutchukhidze and colleagues developed the AI-driven metric, Endocrine Rhythm Integrity (ERI), to analyse data on key reproductive hormones during the luteal phase, basal body temperature, heart rate and sleep patterns of 312 women, aged 18-22 years, with self-reported regular menstrual cycles, who were fertile or had unexplained infertility. She found that women with unexplained fertility had lower ERI scores, even with normal hormone levels, which predicted infertility. Lower ERI scores were also associated with a higher incidence of implantation failure.

"Our study reveals that a woman may have a seemingly healthy menstrual cycle and normal hormone levels but still experience hidden endocrine dysfunction that affects her ability to

conceive," said Dr Kutchukhidze. "Rather than analysing hormone levels as isolated values, ERI evaluates whether reproductive hormones are changing in the correct pattern, at the correct time and in the correct relationship to one another across the menstrual cycle."

"Our AI-driven rhythm analyses were significantly better at identifying subclinical reproductive dysfunction than conventional testing, suggesting that both female and male endocrine disorders may not simply be disorders of hormone quantity, but rather disorders of hormonal timing, synchronisation and biological rhythm," said Dr Kutchukhidze.

Dr Kutchukhidze will next assess whether this new tool can reliably predict fertility outcomes across different reproductive conditions in larger and more diverse populations. "We aim to move fertility care toward predictive, rhythm-based reproductive medicine, where clinicians can identify dysfunction earlier, personalise interventions and improve outcomes before infertility becomes clinically evident," said Dr Kutchukhidze. "If successful, this research could lead to the first clinically actionable tool for measuring endocrine-rhythm health and redefine how fertility is evaluated worldwide."

Dr Kutchukhidze added: "Importantly, this technology could also be widely applied in transgender medicine, where hormone therapy currently relies on intermittent blood tests that may not reflect real-time hormonal dynamics. Our long-term goal is to establish wearable hormonal chronodiagnostics as a new standard not only in reproductive medicine and personalised endocrinology, but also in transgender healthcare, enabling more precise, adaptive and patient-centered management across diverse clinical settings."

--------ENDS--------

Abstract
P336

Unmasking Hidden Androgen Rhythms with a Real-Time AI-Enhanced Testosterone Patch

Background:
Hypogonadism and infertility evaluation relies on single morning serum testosterone measurements, which fail to capture the dynamic nature of androgen secretion. Up to 25-30% of men with normal testosterone levels present with symptoms of hypogonadism or unexplained infertility, suggesting the presence of subclinical androgen rhythm disorders undetectable by testing. Continuous hormonal monitoring has never been implemented in males, which is a critical gap in male reproductive endocrinology. This study introduces continues transdermal testosterone monitoring system combined with an AI-driven analysis platform as a novel method to detect previously unrecognised androgen rhythm disorders and provide real-time hormonal analysis.

Methods:
A prospective, observational study with 102 men aged 22-38 years with normal morning total testosterone (12-35 nmol/l) was conducted, including 54 men presenting with infertility or hypogonadal symptoms and 48 age-matched health controls. Participants wore a non-invasive transdermal biosensor patch cable of continuously captured testosterone every 15 minutes for 96 hours. Data were analysed in a real-time dedicated mobile application with integrated AI algorithms, which automatically quantified diurnal amplitude, peaking time, and rhythm stability using the coefficient of variation, phase delay, and AI-derived rhythmicality indices. The app provided clinical immediate visualisation and analysis of variability of sleep, basal body temperature, and correlated endocrine fluctuations.

Results:
Mean morning serum testosterone did not differ between symptomatic and control groups (22.4± 3.1 vs 23.1±3.5nmol/l; p+0.38). Continuous AI-assisted monitoring revealed significant differences in androgen dynamics. Men with symptoms exhibited lower diurnal amplitude (5.2±1.1 vs 8.7±1.4nmol/l; $p<0.001$)compared to controls. Disrupted androgen rhythmicity correlated with reduced sperm concentration ($r=0.047$; $p=0.002$). Rhythm indices, computed in real time by an AI platform, predicted subclinical dysfunction with superior accuracy (AUC 0.87) compared with static serum testosterone (AUC0.61).

Conclusion:
Continuous AI-driven transdermal testosterone monitoring patches uncover hidden androgen rhythm disorders in men with normal morning testosterone levels, redefining male hypogonadism and subclinical reproductive dysfunction as disorders of dynamic endocrine regulation rather than absolute deficiency. AI-integrated system enables real-time analysis and clinical decision support, offering a foundation for rhythm-based diagnostic approaches, for transgender medicine, personalized interventions, and timing-optimized testosterone therapy.

Abstract
P333

Endocrine Rhythm Integrity: A Novel AI-Derived Metric of Menstrual Cycle Health of the Cycle Length

Background:
Clinical assessments of the menstrual cycle remain largely focused on cycle length and bleeding regularity, although these measures account for less than 30% of inter-individual variability in reproductive endocrine functions. 30-40% of women with regular menstrual cycles experience unexplained infertility, indicating subclinical dysfunction not detected by standard evaluations. We introduce Endocrine Rhythm Integrity (ERI), a novel quantitative metric capturing the temporal coherence, phase synchrony, and feedback stability of Hypothalamic-Pituitary-Ovarian hormone dynamics across the menstrual cycle. ERI reframes menstrual health as a property of endocrine rhythm organisation rather than static hormone levels or cycle duration, enabling identification of clinically relevant dysfunction with hormonal “normal” cycles.

Methods:
A prospective, observational clinical trial enrolled 312 reproductive-aged women (18-22 years) with self-reported regular menstrual cycles (24-35 days). Participants were stratified into fertility controls (n=162) and women with unexplained infertility (n=150). Over two consecutive cycles, participants underwent dense longitudinal hormonal profiling with serum LH, FSH, estradiol, and progesterone sampling during the luteal phase. Continuous physiological data (basal body temperature, heart rate, sleep metrics) were collected using wearable devices. An AI-based model integrating hormonal dynamics and physiological signals was developed to compute the ERI score, incorporating metrics of phase alignment signal entropy and feedback loop stability. Primary outcomes included between-group differences in ERI and its predictive performance for infertility status. Secondary outcomes assess correlations between ERI and implantation failure history.

Results:
Mean cycle length did not significantly differ between fertile and infertile groups (28.9±2.3 vs 28.9±2.5 days, p=0.42). In contrast, ERI scores were lower in the infertility group (0.61±0.12 vs 0.78±0.10; p <0.001). Disrupted endocrine rhythm integrity was observed in 64% of infertile participants despite hormonally” normal” mid-luteal progesterone levels. ERI independently predicted infertility status after adjustment of age, BMI, and AMH (OR 2.84, 95% CL1.96-4.1; p<0.001). Receiver operating characteristic analysis demonstrates superior discrimination of infertility by ERI (AUC 0.86) compared with cycle length (AUC 0.52) and single-time point progesterone assessment (AUC 0.64). Lower ERI scores were also associated with a higher incidence of implantation failure (r=-0.48,p<0.001)

Conclusion:
Endocrine rhythm integrity is an AI-driven mechanism that captures subtle but clinically relevant endocrine dysregulation and outperforms traditional metrics in identifying subclinical infertility. It represents a previously unmeasured dimension of menstrual cycle health that is independent of cycle regularity. These findings support a paradigm shift from static cycle assessment to dynamic endocrine rhythm evaluation in reproductive endocrinology.

Notes for Editors:

1. For press enquiries, or to arrange an interview with the study authors, please contact the ECE 2026 Press Office:

   Julianna Photopoulos
   Mob: +44 (0) 777 2264482
   Email: media@ese-hormones.org

2. The studies **'Unmasking Hidden Androgen Rhythms with a Real-Time AI-Enhanced Testosterone Patch'** and '**Endocrine Rhythm Integrity: A Novel AI-Derived Metric of Menstrual Cycle Health of the Cycle Length'** will be available as a poster /e-poster from **Saturday 9 May 2026** at the European Congress of Endocrinology at the Prague Congress Centre (PCC) in the Czech Republic.

3. The 28th European Congress of Endocrinology (ECE) is held at the Prague Congress Centre (PCC) in the Czech Republic, on 9-12 May 2026. See the full scientific programme here.

4. The European Society of Endocrinology (ESE) provides a platform to develop and share leading research and best knowledge in endocrine science and medicine. By uniting and representing every part of the endocrine community, we are best placed to improve the lives of patients. With over 5,400 individual members and through the 50 National Societies involved with the ESE Council of Affiliated Societies (ECAS) ESE represents a community of over 20,000 European endocrinologists. We inform policy makers on health decisions at the highest level through advocacy efforts across Europe.