Evaluation of Hormonal Contraception Effects on Strength and Power Across the Menstrual Cycle

nutrition metabolism performance body composition
APPLIED PHYSIOLOGY LAB

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INTRODUCTION

49.5% of female athletes report using hormonal contraceptives, with oral contraceptives (OC) and intrauterine devices (IUD) being the commonly used.[1]

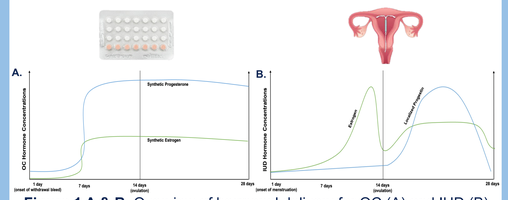


Figure 1 A & B. Overview of hormonal delivery for OC (A) and IUD (B).

The biphasic response of endogenous hormones in eumenorrheic (EUM) females is altered with the delivery of exogenous hormones (figure 2), which may have undesirable consequences on muscle strength and power performance.[2]

PURPOSE

To evaluate the effects of OC and IUD use, compared to a EUM cycle, on maximal strength and power between menstrual cycle (MC) phases.

PRACTICAL APPLICATION

OC and H-IUD altered strength by an **average of 4.8%,** which may correspond to **~15-20 lb difference between MC phases**. These small changes **may affect acute performance** but may be **less relevant for overall training and testing**.

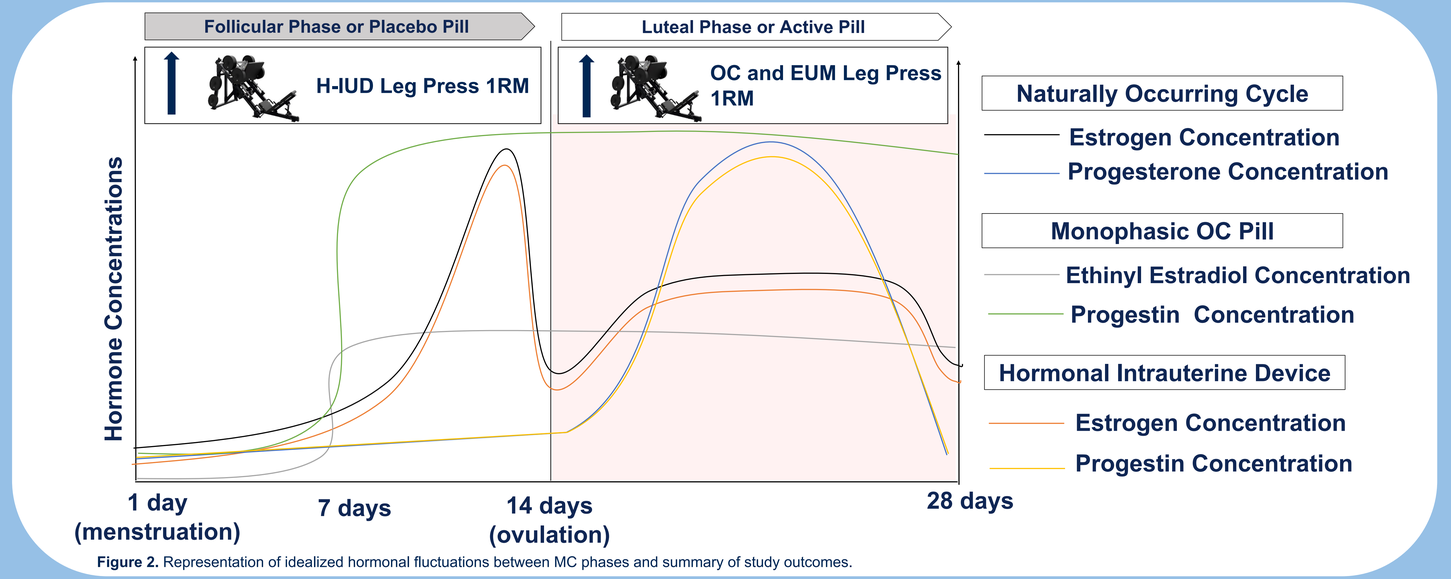


Figure 2. Representation of idealized hormonal fluctuations between MC phases and summary of study outcomes.

As hormonal contraception may impact strength and power performance across the MC, strength and conditioning staff should be aware of the type of contraceptive methods used by their athletes.

METHODS

Table 1. Participant characteristics presented as mean ± SD

	OC Group (n= 21)	H-IUD Group (n= 20)	EUM Group (n= 19)
Age (yrs)	24.0 ± 5.9	27.4 ± 7.5	28.4 ± 7.3
Height (cm)	163.7 ± 6.3	165.5 ± 5.6	166.2 ± 6.9
Weight (kg)	64.5 ± 8.9	66.7 ± 10.0	65.0 ± 8.9
BMI (kg/m²)	22.9 ± 6.0	24.0 ± 2.9	23.0 ± 2.4

Study Groups:

1) Monophasic Oral Contraceptive: (OC; use ≥ 6 months)
2) Hormonal Intrauterine Device: (H-IUD; use ≥ 6 months)
3) Eumenorrheic: (EUM; had regular naturally occurring MC or were using a non-hormonal IUD)

Randomized to begin in the follicular phase/placebo pill (FP) or the luteal phase/active pill (LP); tested once in each phase.

Maximal Strength (1RM; kg) | **Peak Force (PF; N)** | **Power (cm and cm/s)**

Leg Press One Repetition Max (1RM); York Leg Press York Barbell USA, York, PA

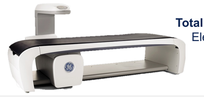
Bench Press 1RM; York Bench Press York Barbell USA, York, PA

Knee Extension Isometric Dynamometry; HUMAC Norm, Computer Sports Medicine Inc. Stoughton, MA

Upright Row Isometric Dynamometry; Biopac Systems Inc., Goleta, CA

Vertical Jump Height (cm) and Reactive Strength Index (cm/s); Odel 4060-NC, Bertec Corporation, Columbus, Ohio

Lean Mass (LM)



Total LM, Dominant Leg LM, and Total Arm LM; Lunar iDXA, General Electric Medical Systems Ultrasound & Primary Care Diagnostics, enCORE software Version 16, Madison, WI, USA

Confirmation of Cycle Phase

Estrogen and Progesterone

Collected once in the FP and once in the LP
Salivary 17 β-Estradiol Enzyme Immunoassay Kit,; Salivary Progesterone (P4) Enzyme Immunoassay Kit, Salimetrics, LLC, State College, PA, USA. Mean CV%: 4.6%

Table 2. Salivary estrogen and progesterone values presented as mean ± SD

	OC Group	H-IUD Group	EUM Group
FP Estrogen (pg/mL)	0.9 ± 0.5	0.7 ± 0.3	1.2 ± 1.0
LP Estrogen (pg/mL)	1.0 ± 0.6	0.8 ± 0.3	1.1 ± 0.4
FP Progesterone (pg/mL)*	67.3 ± 45.4	80.2 ± 72.0	83.5 ± 81.5
LP Progesterone (pg/mL)*	132.7 ± 120.9	74.2 ± 65.8	73.1 ± 59.5

*, Indicates significant change (LP-FP) between OC and H-IUD across cycle phase (p<0.05).

LH Testing- Days 12-16

H-IUD Users and EUM; Ovulation Test Kit; Femometer, Princeton, NJ

Statistical Analysis:

Separate univariate ANCOVAs were used to assess the change from FP to LP between groups, with LM and progesterone as covariates.

RESULTS

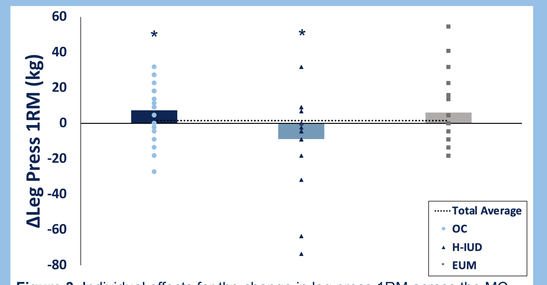


Figure 3. Individual effects for the change in leg press 1RM across the MC phases between groups (p=0.037). Post-hoc analyses demonstrated a higher leg press 1RM for OC group in the LP compared to H-IUD (p=0.043).

Table 2. Mean ± standard deviations for leg press 1RM between groups and phases. Boxes under the table represent mean differences (LP-FP) ± SD. * indicates significant difference between OC and H-IUD (p=0.043).

	Leg Press 1RM		
	OC (n=21)	H-IUD (n=20)	EUM (n=19)
FP 1RM (kg)	151.2 ± 46.1*	181.2 ± 51.6*	161.6 ± 59.3
LP 1RM (kg)	158.7 ± 45.7*	172.3 ± 50.5*	167.7 ± 63.2
	Δ 7.4 ± 15.9 kg	Δ -8.9 ± 23.8 kg	Δ 6.1 ± 19.7 kg

Table 3. Mean differences (LP-FP) for maximal strength and power outcomes between groups. There were no significant changes across phases between groups (p>0.05). Grey boxes represent higher value in the LP while blue boxes represent higher value in the FP.

	OC (n=21)	H-IUD (n=20)	EUM (n=19)
Bench Press 1 RM (kg)	-0.6 ± 2.8	0.3 ± 3.6	0.2 ± 2.5
Lower Body Isometric Dynamometry (N)	-7.0 ± 32.2	4.0 ± 24.7	9.7 ± 25.0
Upper Body Isometric Dynamometry (N)	11.8 ± 53.3	-0.1 ± 60.2	-3.4 ± 45.9
Vertical Jump Height (cm)	0.5 ± 2.4	-0.8 ± 6.8	-2.4 ± 9.1
Reactive Strength Index (cm/s)	-3.7 ± 17.1	-2.5 ± 15.7	-7.0 ± 20.9

CONCLUSIONS

Strength and power were similar across the **MC for OC and H-IUD users**. Lower body strength was **greater** in the **LP** for **OC users** (5% increase) compared to H-IUD suggesting measures of lower body maximal strength performance **may be influenced by hormonal contraception type.**

REFERENCES

[1] Cabre et al. Hormonal Contraception Prevalence and Perceived Side Effects in Active Adult U.S.A. Women. Women's Health Issue. 2023. In Review. **[2]** Elliot-Sale et al. The Effects of Oral Contraceptives on Exercise Performance in Women: A Systematic Review and Meta-analysis. Sports Medicine. 2020.

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