

CHANGES IN PLASMA LIPOPROTEINS OVER THE MENSTRUAL CYCLE

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More research on the dietary effects on plasma cholesterol has been conducted in men than women. Plasma cholesterol is believed to vary more in women, with the menstrual cycle, yet our review of the literature did not find any consistent pattern. We therefore undertook a new examination of plasma lipoproteins in relation to fluctuations in ovarian hormones. The time of ovulation was determined by measuring plasma luteinising hormone.

Twelve normally-menstruating women participated: mean age 23.1(range 19-37)years, mean BMI 22.3(range 19.2-27.3) kg/m². Fasting blood was obtained on four mornings each week for one complete cycle. Plasma concentrations of blood lipids: total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and triacylglycerols (TAG), were measured and the mean concentrations calculated for six phases of the cycle. Ovarian hormones, oestradiol and progesterone, were also measured. Two-way analysis of variance was used to test for significant heterogeneity between mean intakes in the six phases; the Newman-Keul's test was used to locate significant differences.

Phase of menstrual cycle	TC mmol/L	HDL-C mmol/L	LDL-C mmol/L	Oestradiol pmol/L	Progesterone nmol/L
1.Menses	4.12 ± 0.18	1.24 ± 0.07	2.61 ± 0.16	107 ± 12	3.1 ± 0.9
2.Post-menses	4.52 ± 0.25 ^b	1.28 ± 0.08 ^a	2.99 ± 0.22	248 ± 48	1.8 ± 0.3
3.Ovulatory	4.67 ± 0.38 ^{ac}	1.34 ± 0.08 ^{ad}	3.03 ± 0.34 ^d	856 ± 84	3.8 ± 0.7
4.Post-Ovulatory	4.61 ± 0.39 ^a	1.34 ± 0.07 ^{ad}	3.00 ± 0.37 ^d	343 ± 37	13.6 ± 3.9
5.Mid-luteal	4.37 ± 0.23	1.31 ± 0.06 ^a	2.77 ± 0.22	468 ± 44	41.4 ± 6.1
6.Pre-menses	4.10 ± 0.27	1.13 ± 0.06	2.69 ± 0.23	313 ± 33	20.2 ± 4.4

Data presented as mean ± SEM, n=12

^{a,b} significantly higher than corresponding value in phase 6 (a: P<0.01, b: P<0.05)

^{c,d} significantly higher than corresponding value in phase 1 (c: P<0.01, d: P<0.05)

Mean TC, HDL-C AND LDL-C showed a consistent pattern of change over the cycle. Concentrations were highest at the time of peak oestradiol secretion, corresponding to ovulation, and lowest at menses when ovarian hormone levels were low. HDL-C increased by 13% from pre-menses to ovulatory phases. TC and LDL-C increased by 9% and 7% respectively. Plasma TAG did not change.

This study shows that blood lipoproteins undergo consistent variations during the menstrual cycle, with significant elevations of TC, LDL-C and HDL-C corresponding with peak oestradiol levels at ovulation. In rat models, oestrogen has been shown to inhibit hepatic lipase activity and to increase LDL receptor activity, thereby influencing levels of circulating lipoproteins. It would seem unlikely that the observed changes in plasma cholesterol could be mediated through a reduced energy intake (by 17%) at ovulation (Lyons et al 1989). Given the magnitude of changes in TC, particularly LDL-C, the timing of the menstrual cycle should be considered when interpreting plasma cholesterol measurements in women. Our findings do not necessarily mean that within-subject variation of plasma cholesterol is greater in women than in men, but that its timing is more predictable in women.

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