VARIATIONS IN LARGE NEUTRAL AMINO ACIDS DURING THE MENSTRUAL CYCLE

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Tryptophan has an important regulatory role as precursor of the brain neurotransmitter serotonin. Therefore changes in the availability of tryptophan to the brain have the potential to alter behaviours, such as feeding, that are under serotonergic control. A previous study on eating behaviour during the menstrual cycle (Lyons et al.1989) showed that food intake was reduced around the time of ovulation. An increase in availability of tryptophan to the brain at this time, measured by an increase in the plasma tryptophan:LNAA (large neutral amino acids) ratio could explain the reduced food intake.

The aim of this study was to examine changes during the menstrual cycle of fasting plasma LNAAs and the tryptophan:LNAA ratio in relation to fluctuations in the ovarian hormones, estradiol and progesterone. The time of ovulation was determined by measuring plasma luteinising hormone. Fasting blood samples were provided four mornings each week for a complete cycle by 15 healthy, normally menstruating women. Mean plasma concentrations of LNAAs were calculated for six cycle phases: menses, post-menses, ovulatory, post-ovulatory, mid-luteal and pre-menses.

Plasma LNAAs were highest in the menses and post-menses phases, when ovarian hormones were low. Maximum fall occurred at ovulation at the time of peak estradiol activity, and LNAAs remained low during the post-ovulatory and mid-luteal phases when progesterone was elevated. Individual LNAAs decreased between 3% to 14% (tyrosine, $P<0.0001$; isoleucine, leucine, tryptophan, $P<0.025$; valine, phenylalanine, N.S.). However, the tryptophan:LNAA ratio showed no trend over the cycle.

These results provide no evidence that central serotonin activity, measured indirectly by the tryptophan:LNAA ratio, might be increased at ovulation. The fall of LNAAs at ovulation remains unexplained by concurrent changes in ovarian hormones. There was no association between estradiol levels at ovulation and the falls in LNAAs. The continued suppression of LNAAs in the luteal phase may be partly explained by elevated progesterone levels. A trend towards a positive correlation was seen between progesterone in the mid-luteal phase and the fall in Σ LNAAs ($r=0.69$, $P<0.01$). The correlation was strongest with tyrosine ($r=0.72$, $P<0.01$) and, unexpectedly, there was a highly significant correlation between progesterone and the fall in tyrosine:LNAA ratio ($r=0.81$, $P<0.001$). Tyrosine is the precursor of the catecholamine neurotransmitters which like serotonin can influence feeding behaviour. Furthermore, brain catecholamine activity is thought to be responsive to precursor availability in blood. High progesterone levels, by reducing tyrosine availability to the brain could explain the increased appetite observed in certain women during the luteal phase.

LYONS P.M., TRUSWELL A.S., MIRA M., VIZZARD J. and ABRAHAM S.F. (1988). Am. J. Clin. Nutr. 49: 1164.

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