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SALT PREFERENCE ACROSS DIFFERENT PHASES OF MENSTRUAL CYCLE

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Abstract : It is well established that women experience food craving for particular foods and gain weight in relation to phases of menstrual cycle. In this study, the preference for different concentrations of salt sprayed on bland popcorn was assessed in 55 healthy women (age 18 to 22 yrs). Salt solutions of 0, 1, 2, 3 and +3 molar strength were used. Samples of sprayed popcorn were consumed in random order and preference marked on a Likert scale. It was observed that women preferred unsalted popcorn in the menstrual phase more than in the luteal phase. The preference for salted popcorn was most during the luteal phase and was proportionate to the strength of the salt solution used. Statistical analysis revealed significant differences in the preference rating between the menstrual phase and the other two phases. There was no significant difference in preference between the luteal and follicular phases.

Key words : salt preference menstrual cycle estrogen progesterone

INTRODUCTION

Food intake and selection is influenced by neurochemical, hormonal, physiological and psychological factors. Taste, a neurochemical modality, plays an important role in maintaining appropriate nutritional balance (1). Considerable variation is found in the distribution of four basic types of taste buds in various species and amongst the individual of a given species (2).

Salt appetite of an individual is determined by taste threshold, preference and its need in body (3). It is documented that gustatory and food habits change during menstrual cycle (4, 5). Variation in preference for sucrose during different phases of menstrual cycle has been very well documented (6, 7, 8). Increase in salt appetite or intake during pregnancy and lactation in animal and in human also very well documented (9, 10) but there is scarce data related to salt preference during different phases of menstrual cycle (11). This study was undertaken to find out if there is variation in salt preference during different phases of menstrual cycle.

METHODS

Subjects included were 55 females, 18 to 22 years of age. None of the subjects had any specific medical problem or disorder

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related to eating. All females having regular menstrual cycle (28–30 days) were selected for the study. Menstrual cycle was divided into menstrual (day 1–6), follicular (day 7–14) and luteal phases (day 15–28 to 30) for this study. Eleven subjects were examined between day 1 and 6 (menstrual phase) and 19 in the follicular phase while 25 subjects were examined in the luteal phase.

Freshly made popcorns were used for this study because of their bland taste. Sodium chloride solution of five different concentrations (0M, 1M, 2M, 3M and +3M) were prepared in distilled water (+3M solution was made by mixing 10 g sodium chloride to 100 ml of 3M solution). Five sets of popcorns were made by popping 80 g (1/3 cup) unpopped corns and sprayed with 14 mL of one of the five salt solutions uniformly by using spray bottle. Then popcorns were mixed thoroughly and were allowed to dry in air. Ten to fifteen popcorns of specific concentration were kept in one packet and labeled with a coded alphabet that was not known to subjects. Such packets of all five salt concentrations were kept in random order in a large paper bag.

Test was performed in groups of 7–8 subjects. The test procedure was explained and informed consent was obtained. Subjects then completed a questionnaire, which inquired about their age, sex, height, weight, recent eating history and history of any medication for illness like common cold. Females also answered question about their menstrual cycle: date of last menstrual period (for knowing the phase of menstrual cycle), duration of cycle, menstrual flow, history of dysmenorrhea or any other premenstrual symptom). Each of the subjects was given a paper bag containing all the five packets of popcorn, a rating sheet and a glass of distilled water. They were asked to randomly take out one packet at a time and a put all popcorns in the mouth, to chew and then rate, before swallowing, first the saltiness (to assess their taste intensity discrimination for salt) and secondly the palatability on a 7–point Likert scale (1 = least salty/palatable, 7 = most salty/palatable). After rating the subjects consumed the popcorns, and drank some water in order to clean their palate and mouth. In a similar manner they were asked to rate popcorns in rest of the four packets. All of them were asked to remain silent while they made their rating to avoid influencing other subjects.

Statistical analysis

One way MANOVA was used for comparison of salt preference in three phases of menstrual cycle with all five salt concentration. Univariate analysis was done for comparison of salt preference in all phases of menstrual cycle with one specific salt concentration. Multiple group analysis (Scheffe's method) was performed for intra phase comparison at specific salt concentration (12, 13).

RESULTS

The mean age of the subjects was 20 ± 2 years. The mean salt preference rating (Table) showed that preference followed a pattern dependent upon the phase of menstruation and the concentration of salt solution used (Fig. 1).

The MANOVA test indicated that different phases of menstrual cycle had statistically significant effect on the preference rating for popcorns with different salt concentration ($F_{8,260}$ = 93.46, $P<0.001$).

TABLE I: Salt preference rating during different phases of menstrual cycle.

Phases of menstrual cycle	*Mean preference rating for different concentration of salt*				
	0M	*1M*	*2M*	*3M*	*+3M*
Menstrual phase (n=11)	4.0±1.7	3.0±1.6	3.4±1.7	2.27±1.1	2.18±1.0
Follicular phase (n=19)	2.5±1.2	3.26±2.0	4.47±2.0	4.47±1.6	5.15±1.5
Luteal phase (n=25)	1.7±0.7	2.4±1.6	4.04±1.8	5.16±1.2	5.56±1.3

Univariate analysis revealed statistically significant difference in the preference at different phases of menstrual cycle for 0M ($F_{2,52}$ = 5.10, P<0.001), 3M ($F_{2,52}$ = 4.31, P<0.001) and +3M ($F_{2,52}$ = 6.12, P<0.001) salt concentration. It was observed that preference for 0M popcorns was maximum during menstrual phase followed by follicular phase and least during luteal phase. The preference for both 3M and +3M was found maximum during luteal phase followed by follicular phase and least in menstrual phase (Table I). On multiple group comparison by Scheffe's method statistically significant difference in preference was observed when rating during menstrual phase was compared with that during follicular and luteal phase but no statistically significant difference was observed between the preference rating during follicular phase and luteal phase (For 0M : Scheffe's value $(SV)_{M,F}$ = 6.5, $SV_{M,L}$ = 7.1, $SV_{F,L}$ = 3.4 and for +3M : $SV_{M,F}$ =8.1, $SV_{M,L}$ = 8.7, $SV_{F,L}$ = 2.2 with critical value = 6.36).

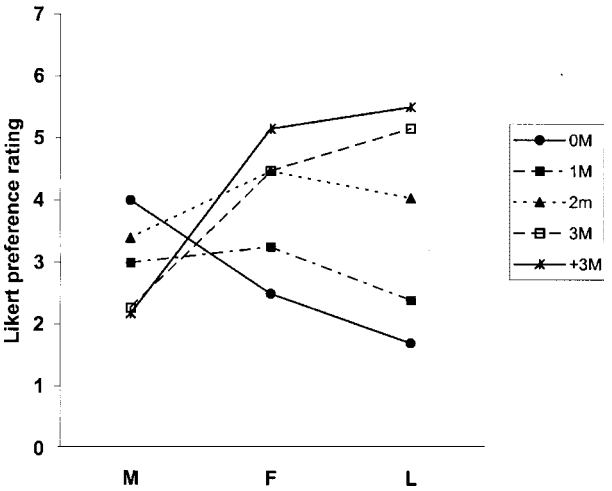

Fig. 1: Salt preference during different phases of menstrual cycle.
(M: menstrual phase, F: follicular phase, L: luteal phase)

DISCUSSION

It has been documented that physiological need for salt stimulates increased appetite for salt (14, 15). Increase salt appetite and intake has been reported during pregnancy and lactation in human (9). The present study observed a statistically significant variation in salt preference during different phases of menstrual cycle. It was found that females in luteal phase preferred extremely salty popcorns (+3M) and in menstrual phases they preferred unsalted popcorns more than in other phases of their menstrual cycle (Fig. 1). This is similar to the findings of Frye and Demolar who also observed increased preference of salt during luteal phase (11). Females in their follicular and luteal phase (periovulatory phase) of their menstrual cycle have high levels of circulating estrogen and progesterone and these hormones appear to be related to salt intake. Present data suggest that female salt preference increases during periovulatory

phase when levels of endogenous hormones are high and decline during menstrual phase when level of these hormones is lower. This view is supported by the studies which reported that salt appetite or intake increase when animal's oestrogen and progesterone levels are exogenously or endogenously increased (16, 17).

Further, the highest preference for salt during luteal phase might be associated particularly with raised progesterone level and could be correlated to increased weight gain and other premenstrual symptoms (18). Besides the direct effect of hormones on salt appetite there could be indirect effects of oestrogen on salt appetite through opioid receptor (19) while that of progesterone is by affecting the membrane fluidity and flux of ions (20) that may cause increased sodium requirement and its appetite.

Overall this study concluded that there are cyclic variation in the preference of salt during different phases of menstrual cycle just like the fluctuation in the preference for sucrose. The causes of these variations are still unclear and it seems reasonable to hypothesize that the effects are due to physiological variation in which estrogen and progesterone play a role. However, further studies involving hormonal assays along with salt preference during menstrual cycle need to be undertaken.

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