

A STUDY OF THE INTAKE OF FLUID, OUTPUT AND TITRATABLE ACIDITY OF URINE IN MEDICAL STUDENTS

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Summary 183 students of 17—22 years age group were studied in respect of fluid intake, urine output and urine titratable acidity under normal conditions for two consecutive days. The study was performed in early winter in eastern part of U.P. Male students were observed to have higher fluid intake and urine output as compared to female. Average fluid intake and urinary output in male students were observed to be 2860 S.D. ± 780 ml and 1860 S.D. ± 880 ml respectively while corresponding readings for female students were 1980 S.D. ± 390 ml and 1550 S.D. ± 840 ml. Titratable acidity was observed to be high with a mean of 47.46 meq S.D. ± 16.2 meq as compared to commonly accepted average range of 25-35 meq. Nonvegetarian subjects were found to have significantly higher titratable acidity. Fluid intake and urine output did not have any significant effect on titratable acidity of urine in both the sexes. Need for further studies on this subject has been stressed.

Key words : fluid intake urine output urine titratable acidity

INTRODUCTION

It is being increasingly realized that many vital functions of human body are greatly affected by environmental, racial, dietary and other factors which are well much in evidence in developing countries like India. In fact the need of evolving normal standard values for the Indians has been stressed from time to time. The present paper is a preliminary communication dealing with titratable acidity of urine, daily urine output and fluid intake under physiological conditions.

MATERIALS AND METHODS

The present study has been carried out on 183 young (143 males and 40 females) motivated medical students in the age group between 17-22 years. All the students were subjected to a thorough clinical examination including a record of height and weight. Routine urine and blood tests were done in every case to exclude any illness affecting renal functions.

The aim and importance of the study was explained to all the students and essentiality of keeping the accurate records of fluid intake and collection of urine was stressed. Participants were advised to continue with their normal daily routine activities and not to participate in any exertional process like out-door games etc.

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All the 183 volunteers were hostellers and consumed almost identical diets. Of these, 139 were vegetarians while remaining 44 were non-vegetarians. During period under study, an average per day vegetarian diet consisted of 6 slices of bread (about 100 g), one boiled egg or 25 g butter, wheat chapaties (approximately 250 g), rice (approximately 100 g), 250 ml of milk, two bowls of a cauliflower vegetable, 100 g onion, two bowls dried potato vegetable and four bowls 'Arhardal' (*Cajanus cajan*). Non-vegetarians in addition also took roughly 100 g of cooked fish. Urine collections were made daily for two consecutive days using formaldehyde as a preservative. The mean of these samples was taken into consideration for analysis. All the above mentioned information was recorded by the students in separate individual proforma provided to them.

The information regarding the mean environmental temp. and mean relative humidity during the days of the experiments was obtained from the Meteorological Observatory Office.

The precautions to be observed (13) were explained to the group and individual participants.

Titrateable acidity of the urine was estimated by the method of Folin (10).

OBSERVATIONS AND RESULTS

The physical characteristics of the subjects are given in Table I.

TABLE I: Physical characteristics of the subjects.

	Age (years)	Height (cm)	Weight (kg)	Surface area (m ²)
Mean	18.8	160.4	49.4	1.48
Range	17-22	149.2-170.5	39.5-62.5	1.287-1.725

During the period of study in the month of November, environmental temp. during the days of experiments ranged from 14.6 to 25.4 C° with a mean of 20.0 C° and relative humidity ranged from 63.0 to 77.5% with a mean R.H. of 70.25%. Fluid intake: The 24-hr fluid intake in the form of drinks (water, milk, tea, coffee, beverages etc.) in males varied between 1474 and 3465 ml (mean 2860 S.D. ± 780 ml) while in females, it ranged from 1250 to 2430 ml (mean 1980 ml S.D. ± 390 ml). The difference in fluid intake in either sex was statistically significant, males consuming more fluid as compared to their counter-parts (Table II).

Urine output: The daily urinary volume in male subjects ranged between 870 and 3160 ml with a mean of 1860 ml S.D. ± 880 ml while in female, it was between 684 and 2320 ml with a

mean of 1550 S.D. \pm 840 ml. Females had statistically significant lower out put as compared to males (Table II).

TABLE II: Daily fluid intake and urinary output in male and female subjects:
Percentage and number of subjects

Fluid volume	<1 l	1 l—	2 l—	between 3-4 l	Mean \pm S.D.	't'	P
<i>Fluid intake per day</i>							
Males (143)*	—	18.18% (26)	27.27% (39)	54.54% (78)	2.86 \pm 0.78) 9.8	Highly significant P < .001
Females (40)*	—	70.0% (28)	12.5% (5)	17.5% (7)	1.98 \pm 0.39		
<i>Urine output per day</i>							
Males (143)*	18.18% (26)	37.06% (53)	35.66% (51)	9.09% (13)	1.86 \pm 0.88) 2.07	Significant P < .05
Females (40)*	25.0% (10)	52.5% (21)	15.0% (6)	7.5% (3)	1.55 \pm 0.84		

*No. of the subjects. P — Probability statistically.

Titratable acidity: The daily urinary titratable acidity in males ranged between 27.6 and 87.5 meq with a mean of 46.61 meq S.D. \pm 14.4 meq and in the females it ranged from 29.2 to 85.5 meq with a mean of 50.50 meq S.D. \pm 20.1 meq. Although a little higher readings were observed in females as compared to males but the difference was not statistically significant (Table III).

TABLE III : Titratable acidity of urine in males and females (meq/day).

	20—	30—	40—	50—	60—	70—	80—90	Mean \pm S.D.	't'	P
M.(143)	8.39 % (12)	25.87% (37)	37.06% (53)	9.70% (14)	11.19% (16)	4.19% (6)	3.50% (5)	46.61 \pm 14.4) 1.3	Insignificant
F. (40)	20.0 % (8)	20.0% (8)	10.0 % (4)	17.5% (7)	7.5% (3)	17.5% (7)	7.5% (3)	50.50 \pm 20.1		
Total (183)	10.93% (20)	24.59% (45)	31.15% (57)	11.48% (21)	10.38% (19)	7.10% (13)	4.37% (8)	47.46 \pm 16.2		

Figures within brackets indicate the number of cases.

Table IV shows the titratable acidity of urine observed in veg. and non-veg. subjects. Titratable acidity of vegetarian subjects varied from 22.5 to 52.8 meq/day with a mean value of

36.7 meq while in non-vegetarians it was in much higher range i.e. from 44.0 meq to 88.4 meq with an average of 70.3 meq. The difference was observed to be highly significant ($P < .001$).

TABLE IV : Effect of diet on urinary titratable acidity (meq/day).

Subject	20—	30—	40—	50—	60—	70—	80—90	Mean \pm S.D.	t	P
Vegetarian (139)	14.4% (20)	32.37% (45)	39.56% (55)	13.67% (19)	—	—	—	36.7 \pm 9.05	11.9	Highly significant, $P < .001$
Non-vegetarian (44)	—	—	4.54% (2)	4.54% (2)	43.18% (19)	29.54% (13)	18.18% (8)	70.3 \pm 9.66		

Figures within brackets indicate the number of cases.

DISCUSSION

Fluid intake: Daily fluid intake only through drinks of an average adult person has widely been described to be round about 1-1.5 litres in almost all text books of physiology (2,10,11). But this is also well accepted that this value varies widely and is dependent upon a number of factors like environment, working conditions, type of diet, and even varies in same individual from day to day. In the present study, it has varied considerably. It was more in males while female subjects consumed less fluid (Table II). The higher intake has been attributed to tropical climatic conditions predominantly. The lower fluid intake in females evidently is more so due to lesser physical activity and lower surface area.

Urine output: Average daily urine output in present study has been observed to be 1.79 litres S.D. \pm 0.88 litres for both sexes (Table II). These observations are quite in conformity with observations of Ray and Ganguly (12) and Ahuja and Sharma (1) in studies conducted during winters. However, there is quite much diversity in urine output values reported by other Indian workers. Mc Cay (9), Gokhale (6), Butany *et al.* (4) have observed average urine output to be 1177 ml, (both sexes), 1175 ml (both sexes) and 998 ml (for females) respectively. In the present study majority of the subjects had daily urine output in the range of 1-2.5 litres and there were only 8.74% of the cases where it was more than three litres per day.

Generally it was observed that males had higher urinary output as compared to female which can very well be expected in view of significantly higher fluid intake of males (*vide supra*). Similar findings have also been reported by other Indian workers (1,6,7,12).

Titratable acidity: The Titratable acidity of urine has been reported to vary within a narrow range of 20-50 meq with an average value of 25-35 meq (8,10) under normal conditions in healthy subjects. In the present study higher readings with an overall average of 47.46 meq S.D. \pm 16.2 meq have been observed. Titratable acidity has not been observed to be affected by age, weight, height, fluid intake, urine output and sex under identical physical and environmental conditions of the present study.

The most significant observation of the present study was the much higher titratable acidity in urine specimens of nonveg. subjects (mean 70.3 meq S.D. \pm 9.66 meq) as compared to vegetarians (mean 36.7 meq S.D. \pm 9.05 meq). It is evident from the data that an intake of nearly 100 g of non-veg. dish (fish) is responsible for the rise in titratable acidity by an average of 33.6 meq. Diet like meat, fish, milk, cheese, whole wheat products etc. (10) tend to elevate titratable acidity of an individual. Since the diet of the veg. and non-veg. was the same except fish item in case of non-veg., therefore, one can conclude that an intake of fish causes an increase in titratable acidity of urine.

In view of the paucity of the literature available on the aspect of the effect of the amount of non-vegetarian diets on the titratable acidity of urine in human, it is difficult to give a comparative explanation at present.

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