URINARY NITROGEN IN ELDERLY INDIANS

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Summary: Urinary volumes, nitrogenous constituents eliminated in 24 hrs urine and diet taken by healthy elderly lactovegetarian Indian subjects in Bombay are reported. The average values were: diet = 1603 calories, 52.3 *gms* proteins intake per day; urinary volume 1568 cc, urea 11.27 ±3.59 *gms*/ 24 hrs, creatinine 1.09 ±0.8 *gms*, uric acid 0.56±0.21 *gms* and ammonia 0.38±0.25 *gms* per day.

While the values of all N_2 constituents - urea, creatinine, uric acid and ammonia are much lower, the total N_2 as well as urea output in elderly Indians is less than half of that of the young Europeans on meat rich diet but greater than those on protein free diets.

Key words: urinary nitrogen protein intake

INTRODUCTION

Amounts of nitrogenous substances eliminated in urine in elderly Indian people have not been reported. What influence age exerts on their excretion was therefore a matter of curiosity, since it is well known that metabolic activity as well as the food-intake are reduced with age.

MATERIALS AND METHODS

Hundred elderly subjects (91 men, 9 women) in fair state of health were selected after their clinical check up including E.C.G., X-ray, blood, urine and stool examination. The group average age was 66.6± 5.53 years (males 67.0 ± 5.12, females 62.8 ± 2.64 years). Sixty-five of the 91 males and all 9 female subjects belonged to 60-70 years age group.

Urine for 24 hrs. was collected using chloroform as preservative. It was examined for volume, Sp. gr., and routine clinical laboratory tests - albumin, sugar, microscopic appearance, etc. Amount of urea was estimated by hypobromide, ammonia by aeration titration, creatinine by Bonsnes and Tausky and uric acid by Brown's method. These values were added up and total N_2 eliminated in 24 hrs was calculated.

Each individual also kept a record for a week of the foods eaten each day, and from this the individual's nutritional intake per day was estimated. No restriction either on fluid, food, mode of living etc. was imposed on the subjects during these days. Of these elderly subjects, 27 persons had no objection to non-vegetarian foods but they partook so little of meat that they may all be taken as lactovegetarians.

RESULTS

Table I gives the values for height and weight and urine output in the subjects studied.

TABLE I: Height, Weight and Urine Volume.

Measurements	*All subjects (100)*	*Male (91)*	*Female (9)*
	Mean S.D.	*Mean S.D.*	*Mean S.D.*
Wt in *kgs*	57.2±15.4	57.6±16.1	53.2 ±8.02
Ht in *cms*	162.6±4.3	164.9±4.15	151.1 ±5.7
Surface area in m^2	1.66±0.086	1.67±0.158	1.51±0.082
Volm. of urine/24 hrs	1568±555.3	1550±576.9	1745±206.2

Excretion of N_2 substances in 24 hrs urine:

Values of different nitrogenous substances as well as of total N_2 eliminated in urine by the subjects of either sex belonging to different 5 yearly age groups above 60, were very similar (Table II).

TABLE II: Nitrogenous susbtances excreted in urine in 24 huors, in elderly subjects : 5 yrly age group & sexwise.

Age group	60 — 64		65 — 69		70 — 74		75 — 79		80 onwards		Grand Total		
Sex & No.	M(38)	F(6)	M(27)	F(3)	M(15)	F-	M(7)	F-	M(4)	F-	M(91)	F(9)	Total
Creatinine in *gms*	1.11 ±0.73	0.95 ±0.26	1.07 ±0.49	0.75 ±0.26	1.06 ±0.28	— —	1.06 ±0.37	— —	0.91 ±0.17	— —	1.08 ±0.39	0.88 ±0.30	1.06 ±0.32
Creatinine N_2 *gms*	0.42 ±0.10	0.35 ±0.14	0.40 ±0.17	0.28 ±0.10	0.39 ±0.14	— —	0.39 ±0.14	— —	0.34 ±0.00	— —	0.40 ±0.14	0.32 ±0.14	0.39 ±0.14
Urea *gms*	11.82 ±3.87	10.93 ±2.51	10.40 ±2.85	11.30 ±2.48	11.94 ±4.52	— —	12.17 ±2.81	— —	8.33 ±0.92	— —	11.30 ±3.69	11.05 ±2.51	11.27 ±3.59
Urea N_2 *gms*	5.5 ±1.54	5.1 ±1.56	4.8 ±1.61	5.23 ±1.19	5.56 ±2.85	— —	5.67 ±1.25	— —	3.8 ±0.68	— —	5.26 ±1.97	5.13 ±1.24	5.25 ±1.92
Uric acid *gms*	0.56 ±0.20	0.52 ±0.10	0.56 ±0.20	0.64 —	0.62 ±0.30	— —	0.48 ±0.14	— —	0.47 ±0.17	— —	0.56 ±0.20	0.56 —	0.56 ±0.20
Uric acid N_2 *gms*	0.19 ±0.06	0.17 ±0.03	0.19 ±0.06	0.21 ±0.08	0.21 ±0.08	— —	0.16 ±0.06	— —	0.18 ±0.09	— —	0.19 ±0.06	0.19 ±0.06	0.19 ±0.05
Ammonia *gms*	0.33 ±0.14	0.44 ±0.17	0.42 ±0.42	0.27 ±0.14	0.42 ±0.17	— —	0.36 ±0.14	—	0.49 ±0.17	— —	0.38 ±0.26	0.38 ±0.17	0.38 ±0.25
Ammonia N_2 *gms*	0.27 ±0.41	0.37 ±0.14	0.35 ±0.32	0.22 ±0.—	0.35 ±0.14	— —	0.30 ±0.10	— —	0.40 ±0.14	— —	0.32 ±0.17	0.32 ±0.10	0.32 ±0.15
Total Nitro. substances in *gms*	13.78 ±4.06	12.82 ±2.64	12.46 ±2.87	12.96 ±2.80	14.05 ±4.61	— —	14.07 ±2.89	— —	10.17 ±1.52	— —	13.30 ±3.81	12.87 ±2.70	13.26 ±3.73
Total N_2 *gms*	6.39 ±1.56	5.96 ±1.28	5.77 ±1.42	5.96 ±1.33	6.52 ±2.12	— —	6.53 ±3.02	— —	4.70 ±0.76	— —	6.16 ±1.79	5.96 ±1.28	6.15 ±1.73

All values are mean values and their ±(S.D.)

Their nutritional intake is shown in Table III, and the protein intake in Table IV.

TABLE III : Daily nutritional intake of the subjects.

Nutrients per day		*Male*	*Female*	*All subjects*
Proteins	*gms*	53.1	45.5	52.3
Fat	,,	40.7	34.8	40.1
Carb.	,,	256.8	220.0	253.1
Calcium	,,	0.82	0.64	0.8
PO_4	,,	1.26	1.10	1.24
Iron	*mgms*	19.7	15.8	19.3
Vit. A	I.U.	5433	4855	5378
Vit. B_1	*mgms*	0.7	0.7	0.7
Vit. B_2	,,	1.1	0.89	1.0
Vit. B_7	,,	5.2	4.0	5.0
Vit. C	,,	51.3	111.0	58.7
Calories		1629	1375	1603

TABLE IV: Average protein intake per day in gms.

Age	*Male*	*Female*
60—64	54.8 ±15.8	49.3±17.9
65—69	54.89±11.4	39.9±13.06
70—74	49.84±11.01	—
75—79	47.2 ± 6.25	—
80+	52.9 ±12.1	—
Grand total	53.1 ±11.4	45.5±6.68

DISCUSSION

That Indians excrete comparatively low amounts of nitrogenous substances in their urine has been observed by various workers (4, 7, 10, 11, 12, 13). These values are almost half of that obtained in Europeans by Folin (6), Bodansky (3), Davidon (5) and others. Of the various nitro-

genous constituents eliminated in urine, urea is the most prominent but most variable. The other N_2 substances such as uric acid, creatinine and ammonia are comparatively small in amount but more steadily passed in urine (Fig. 1). These end-products of protein metabolism seem to depend upon the protein intake or its turn-over in the body. In his classical observations, Folin (6) reported close relationship of total N_2 end products eliminated in urine in 24 hrs and the protein intake of his subjects, viz 16.0 *gms* of N_2 in 24 hrs on mixed diet and 3.6 *gms* N_2 in 24 hrs on a protein deficient diet. Our elderly subjects excreted in their urine 6.15 *gms* total N_2 in 24 hrs or 0.11 *gms* N_2/*kg*/day on an average intake of 52.3 *gms* proteins/day. The results are compared with figures of other workers from West and East (Table V).

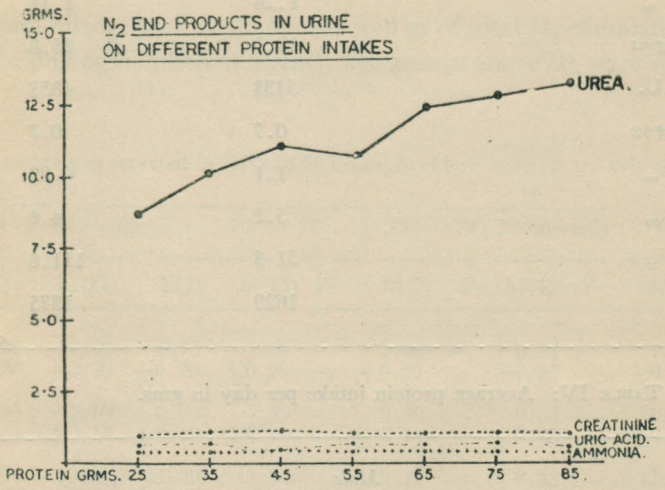

Fig. 1: N_2 end-products in urine on different protein intakes in elderly Indians.

Most of the N_2 in urine is in the form of urea and comparatively small fractions appear as uric acid, creatinine and ammonia, which are held to be the outcome of endogenous breakdown. Though the concept of exogenous/endogenous metabolism of proteins has been considerably revised in recent years, output of urea is held to vary directly with the protein intake in men.

Gopalan and Narasingarao (8), have shown that fecal N_2 in Indians in health is more or less constant i.e. about 1 *gm.* N_2/day, the remaining N_2 of the food is presumed to be absorbed and utilised or excreted. Since negligible amounts of nitrogenous substances are excreted in sweat, salivary and intestinal secretions, urea N_2 or total N_2 in urine may, therefore, be taken to indicate the breakdown of amino acids derived from food in liver (9).

Basu and Basak (1) have reported urinary N_2 output of 0.038 *gms*/*kg*/day, in young Indians kept on protein free diet. This may be taken as endogenous output of Indians. Accordingly, our subjects weighing on an average 57.2 *kg* would be eliminating 2.17 *gms* N_2 from endogenous

sources. Therefore, 3.98 *gms* (6.15—2.17) or 0.07 *gm* (0.11—0.04) N_2/*kg*/day would be the exogenous component. Folin (6) obtained 16.0 *gms* N_2 on average mixed diet and 3.6 *gms* on protein deficient diet, giving an impression that 12.4 *gms* N_2 (16.0—3.6 *gms*) was of the exogenous origin;

TABLE V: Urinary N_2 in 24 hrs.

	Urea		*Creatinine*		*Uric acid*		*Ammonia*		*Total*	
WESTERN	N_2	%	N_2	%	N_2	%	N_2	%	N_2	%
Folin Pr. rich diet	14.7	87.5	0.58	3.6	0.18	1.1	0.49	3.0	16.8	100
Pr. poor diet	2.2	61.7	0.60	17.2	0.0[c]	2.5	0.42	11.3	3.6	100
Bodansky Pr. rich diet	20.45	87.9	0.64	2.7	0.30	1.3	0.82	3.5	23.28	100
Pr. poor diet	2.9	69.0	0.52	12.4	0.11	2.6	0.17	4.0	4.2	100
Davidson Pr. (198 g)	23.7	91.15	0.63	2.42	—	—	1.15	4.42	26.0	100
Pr. (59 g)	8.5	83.33	0.63	6.18	—	—	0.53	5.2	10.2	100
Pr. (39 g)	6.2	80.52	0.65	8.44	—	—	0.38	4.93	7.7	100
EASTERN Campbell	6.2	80.5	0.41	5.32	0.12	1.60	0.58	7.5	7.7	100
Narayana	4.9	69.6	0.49	6.89	0.16	2.25	0.49	6.89	7.11	100
Ray and Ganguly	2.1	43.4	0.51	10.62	0.23	4.81	—	—	4.83	100
Gokhale	4.44	73.4	0.46	7.65	0.17	2.79	0.39	6.51	6.06	100
Present series Pr. intake 52.3 *gms*	5.25	85.4	0.39	6.3	0.19	3.1	0.32	5.2	6.15	100

and the values are higher as compared to the figures obtained in Indian subjects. Perhaps the young Europeans consuming more meat have a quicker turn over of N_2 than our elderly subjects who derived their N_2 from a dominent vegeterian diet or it may be possible that these elderly subjects were either not absorbing or utilising fully the larger amounts of vegetarian proteins taken by them in their food.

As in the case of N_2 output, the values of urine urea and creatinine are much less as compared to the values obtained by Folin (6) and others (3,5,6,) in the West, but are comparable with the findings of workers in the East (4,7,10,11,12,13) (See Table V).

The creatinine output was found to be independent of the protein intake. Expressed in terms of creatinine coefficient i.e. *mgms* creatinine in urine in 24 hrs/wt. in *kg*, the values were 18 ± 0.01 in men and 16 ± 0.01 in women. An index of 20 to 26 in young men and 14 to 22 in young women has been reported in European subjects (2).

The values for uric acid output were similar to that reported by Folin and others on protein liberal diet in Europeans and agree also with the findings of other observers in Eastern subjects (See Table V). By contrast, the ammonia output in urine was found to be much less than reported by Folin (6) and others for their European subjects on good protein diet. The excretion of ammonia in urine is a good illustration of adaptation. Where foods yielding acid end-products are consumed, kidneys release more NH_3 to neutralise the acids in urine. Since European diets include more meats whose end-products are acid in nature their kidneys have to contribute more NH_3. On Indian vegetarian diets yielding less acid end-products, the lower NH_3 content may be understandable.

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