EFFECT OF AGE AND SOCIOECONOMIC STANDARDS ON THE URINARY NITROGENOUS CONSTITUENTS OF NORMAL CHILDREN

Pages with reference to book, From 116 To 119

Shahnaz A. Khanum, M. Jamil Qureshi (Foot Science Division, Nuclear Institute for Agriculture and Biology, Faisalabad.)
Masood A. Rashid (Department of Biochemistry, University of Agriculture, Faisalabad.)

Abstract

Ninety urine samples of normal children of various age groups belonging to different socio-economic standards were analysed to investigate the effect of age and socioeconomic standards on the general characters and the level of nitrogenous constituents. It was revealed that urinary nitrogen, creatinine and creatine were significantly influenced by age and socio-economic standard but ammonia remained unaffected. Uric acid was, however, significantly influenced by age but remained unaffected with the socioeconomic standards (JPMA 30:116, 1980).

Introduction

Urine is the most important medium to eliminate non-volatile substances, which under normal conditions will include non-volatile metabolites like urea, cieatinine, uric acid or materials ingested or produced in the organism in excess of metabolic requirements e.g. water and electrolytes. The quantitative composition of the urine reflects the functions of the kidneys in preserving important aspects of homeostasis and of the normal equiliorium between the organism and its environment. It will, therefore, vary widely in normal subjects at different ages and under different conditions of diet and activity (Oser, 1965).

Examination of urine is necessary to detect diseases of the kidney or disorders of the body chemistry which cause specific changes in the urine composition (Smith, 1951). Nutritional deficiencies as a result of malnutrition usually lead to abnormal growth and development (Daza, 1979). Although limited information on the composition of urine in normal children is available, yet there appears to be no report concerning the influence of age and socioeconomic standards on ceRtain constituents of normal urine of a child especially under conditions prevailing in Pakistan. The present study is a part of general investigation of the normal subjects at different ages and under different conditions of diet and activity to establish biochemical norms for this physiological fluid. The general characters of normal urine of the child and the effect of age and socio-economic standards on it's nitrogenous constituents have been investigated.

Material and Methods

The study was confined to three distinCt socio-economic groups of population e.g., lower, middle and upper standard groups. The sample subjects under each group were arranged into three age categories, each of 4, 8 and 12 years of age respectively. The sample size in each age category in the respective socio-economic group included ten subjects. Each individual was given his normal diet: and its composition is reported in Table I.

Table I: Composition of the Average Daily Mixed Diet

Average daily mixed diet	AGE OF THE CHILDREN		
	4 Years	8 Years	12 Years
Calories (K. Cal)	1351	1613	2050
Proteins (gms)	50	80	90

Urine samples were collected during July and August, 1977 from 90 apparently healthy children of either sex, and of all age groups under study. The body weight of all the subjects ranged from 15 to 25 Kgs.

A total number of ninety urine samples were collected separately in clean, sterilized bottles of one litre capacity containing 50 ml toluene in each. Each sample was carefully collected in 24 hours by discarding the urine vioded before 8 a.m. and collecting all the urine passed after this hour including that vioded before 8 a.m. on the next morning.

Total nitrogen and ammonia were determined following the method of the Association of Analytical Chemists, Washington (1970). The methods of Plentle and Schoenheimer (1944) were employed for the estimation of uric acid, creatinine and creatine. The analytical data was analysed statistically by analysis of variance (Steel and Torrie, 1960)'

Results and Discussion

A wide variation occurs daily in the volume of urine in normal child (249-958 ml) as shown in Table II.

Table II: Effect of Age and Socio-economic Standards on the General Characters, and Nitrogenous Constituents of Urine of Healthy Children

Variables*	AGES			SOCIO ECONOMIC GROUPS		
	4 years	8 years	12 years	Upper	Middle	Lower
Volume (ml/day)	3.17 a	683.67 b	735.3 c	513.17 a	685.33 a	537.47 a
pH (pH)	5.78 a	5.53 a	5.50 a	5.54 a	5.78 a	5.49 a
Specific gravity (g/l)	1.0183a	1.0176a	1.0204a	1.0202a	1.0194a	1.0166a
Total solids (g/day)	15.32 a	18.04 a	20.05 a	16.52 a	18.97 a	17.91 a
Total nitrogen (g/day)	2.84 a	5.4 b	5.88 c	5.53 a	4.89 b	3.71 c
Ammonia (g/day)	0.24 a	0.42 a	0.57 a	0.66 a	0.38 a	0.31 a
Uric acid (g/day)	0.19 a	0.44 b	0.49 c	0.40 a	0.37 a	0.34 a
Creatinine (g/day)	0.31 a	0.62 b	0.74 c	0.76 a	0.54 b	0.36 c
Creatine (g/day)	0.12 a	0.30 b	0.38 c	0.35 a	0.26 b	0.19 c

*Average of three replicates.
Values bearing similar superscripts are not significant.

Similar observations have also been reported by Nelson (1964) in children between 8 to 14 years of

age. As factors like food, fluid intake, temperature, humidity and excercises influence the rate of excretion of urine, the noted differences in these studies can be attributed to relatively high environmental temperatures in Faisalabad as the urine collection was made in summer (July-August). The volume of urine is notably lower than that previously reported. The effect of age on volume of urine is significant. Average urine volume in case of children of four years is significantly lower than those of eight and twelve years of age. However, socio-economic standards have not significantly influenced the volume of urine (TableII) The pH values (Table II) of urine of the subjects fall within the range of normal human urine e.g. 5 to 7. It can be seen that age and socioeconomic standa;ds showed no sinificant effect on pH but changes in pH values depend on diet containing acid and base forming foods. The specific gravity has also shown variation from the minimum of 1.015 to the maximum of 1 . 024 with a mean value of 1.019 at 15°C (Table II).

The general characters of the urine like volume, pH, specific gtavity and total solids were recorded following standard methods (Assoc. of Analyt. Chem. Washington, 1970). Qualitative examination of these urine samples was also performed to exclude the presence of protein, glucose, blood, bile salts and bile pigments before subjecting these samples to quantitative analysis (Jessop, 1961).

The results in general indicate that age and socio-economic standards have no significant effect on the specific gravity and the values observed are in close conformity with the reported values of 1.015 to 1.025. Daily fluctuation in the range of 13.05 to 22.17 g/day in the total solids was observed. The observed values are notably lower than the reported values for adult human urine ranging from 50-55 g/day (Thompson and Pitts, 1951). The reason for these fluctuations can be due to the seasonal effect on the sample collections (summer) and the loss of water from the skin and lungs. The low contents of the total solids are, therefore, due to the low volume of urine as reported in Table II. The results reported in Table II suggest that age and socio-economic standards have not significantly altered the total solids in the urine. Although there is apparent increase in the total solids with the increase in age but the increase is, however, not statistically significant at different age groups of children.

The total nitrogen of the analysed samples have been found in the range of 1.69-6.99 g/day (Table II). Previously reported values of total nitrogen in the urine of adults lie in the range of 13.37 and 5.234-12.74 g/day. These results suggest that daily output of urinary nitrogen depends on the intake of protein (Vysotskii et al., 1975; Vasavada et al., 1969). It can be seen that urinary nitrogen has been significantly influenced by age and socio-economic standards, respectively. However, the total nitrogen value was lower in 4 years old than in 8 and 12 years old children, whereas the differences between 8 and 12 year old children were not statistically significant. The total nitrogen values were lowest in the lower than in the middle and upper socio-economic groups. The differences between upper and middle socio-economic groups however, were not significant. The values for ammonia contents (0.213-0.599 g/day) reported in Table II are notably lower than those reported e.g. 0.70 g/day for normal adult urine. Age and socio-economic standards have not influenced significantly the ammonia contents (Table II).

Urinary uric acid levels in the analysed samples fluctuated between 0.119 to 0.522 g/day when compared with the repor ted values of 0.70 g/day for normal adult urine (Oser, 1965). Socio-economic standards have not influenced the uric acid. However, age affected significantly the Uiic acid level. It was also observed that the mean values of uric acid level were lower in 4 years old children than those in cases of eight and twelve years. The variation in uric acid level depends on urine intake e.g. end product of nucleo protein metabolism (White, 1961).

The daily creatinine output from 0.217 to 1.02 g/day. These values were similar to those reported by Clark et al (1957). Socio-economic standards and age significantly influenced creatinine contents. The creatinine contents were lower in 4 years old than those observed in older children, but the differences were not statistically significant. The lowest level of creatinine was found in lower socio-economic group and not in the upper one. No significant differences in creatinine level were observed in upper middle and lower middle groups. The minimum urinary creatine levels observed in this study were in the same range, while the maximum values were almost double than those reported by Cocuzza et al

(1969). These results suggest that creatine is a constituent of urine and its excretion increases with age (Vaccari and Grasso, 1968). The creatine content is significantly affected by the age and socio-economic standards. They were lower in 4 years old children than those observed in children of 8 and 12 years of age. Although the urinary creatine values were lower in lower socio-economic group than those in the upper and middle but the differences were not statistically significant

Acknowledgements

The senior author is indebted to Dr. S.H. Mujtaba Naqvi Director, NIAB, Faisalabad for providing laboratory facilities, and to Dr. Abrar H. Gilani and Mr. Abu-Saeed Hashmi for their valuable help. The help of M/s Idrees Khan and Ghulam Rasul Tahir in the review of manuscript and statistical analyses is gratefully acknowledged.

References

1. Cantarow, A. and Schepartz, B. Biochemistry. 3rd Col. Philadelphia, Saunders 1963, p. 320.
2. Clark, L.C. Jr., Thompson, H.L., Beck, E.I. and Jacobson, W. (1951) Excretion of creatine and creatinine by children. Am. J. Dis. Child., 81:774.
3. Cocuzza, S. and Ferrari,C. (1968) Nefrosi lipoidea efunzoine epatica nell inflanzia. Picherche sperimentali. Arch. Sci. Med., 125:902.
4. Daza, C.H. (1979) Nutrition planning to end Malnutrition. Med. News, p. 4.
5. Nelson, W.E. Text book of pediatrics. 8th ed. Philadelphia, Saunders, 1964, p. 500.
6. Official Methods of analysis (Association of official analytical chemists, Washington) 1970. 11th ed.
7. Plentle, A.A. and Schoenheimer, R. (1944) Studies in metabolism of purines and pyramidines of isotopic nitrogen. J. Biol. Chem., 153:203.
8. Smith, H.W. The kidney. New York Oxford, 1951, p. 823.
9. Steel, R.G.D. and Torrie, J.H. Principles and procedures of statistics. New York, McGraw Hill, 1960.
10. Thompson, D.D. and Pitts, R.F. (1951) Effects of alterations of renal arterial pressure on sodium and water excretion. Am. J. Physiol., 168:490.
11. Vaccari, A. and Grasso, E. (1960) Valutazione urinaria delle catecolemine, in Condizioni fisiolagiche, in soggetti in Ita. pediatrica Boll. Soc. Ital. Biol. Sper., 45(6):515 (Ita).
12. Vasavada, N.B., Vaidya, R.M. and Thahar, K.A. (1969) Nitrogen partition in urine of healthy Gujratis. Indian Med. Guz., 8:13.
13. Vysotskii, V.G., Agureer, A.N. and Brantova, S.S. (1975) Okharaktere ekskretsii donechnykh productive azotistogo olemenas mochoi pri belkovoinedostatochnostifer cheloveka. Excretion of the end products of nitrogen metabolism with urine in human beings with protein deficiency. Vapr. Pitan., 5:27 (Rus.).
14. White, A.G. Clinical disturbances of renal function. Philadelphia, Saunders, 1961, p. 254.