EVALUATION OF URINARY EXCRETION OF RIBOFLAVIN AS AN INDEX OF RIBOFLAVIN DEFICIENCY

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Abstract

The urinary excretion of riboflavin and its relationship to protein and riboflavin intake and creatinine excretion was studied in 13 healthy subjects and 13 patients with acute or chronic renal disease. The riboflavin excretion was normal in individuals with adequate protein and riboflavin intake and with normal creatinine excretion. An inverse relationship was observed between the excretion of creatinine and riboflavin. Low protein intake diminished the utilization and thus increased the excretion of riboflavin. The subclinical riboflavin deficiency in Pakistan may be due to low protein rather than low riboflavin intake. As the excretion of riboflavin in the urine is affected by diet and the adequacy of renal function, therefore, to determine the actual frequency of the riboflavin deficiency serum levels should be estimated.

Introduction

Subclinical riboflavin deficiency has been observed in Pakistan. Biochemical data on riboflavin excretion in urine showed deficient and low levels in 7.6% of cases in urban and 2.2% in rural areas. (Pakistan. Nutr. Survey of West Pakistan, 1970). Riboflavin is released when protein reserve is depleted and stored when it is replenished (Najjar et al., 1944; Horwitt et al., 1950). This preliminary study was undertaken to determine the effect of protein intake and impairment of renal function on urinary excretion of riboflavin.

Material and Method

The urinary excretion of riboflavin was determined in 13 apparently healthy subjects from various socio-economic groups and 13 patients with acute and chronic renal diseases referred from the Department of Nephrourology, Jinnah Postgraduate Medical Centre, Karachi.

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Six hours urine specimens were collected in amber coloured glass bottles. Hydrochloric acid was added as a preservative and the specimens were kept in a refrigerator until analysed. The analysis for riboflavin was done by flourometric method (U.S. ICNND, 1963) and creatinine by picrate method (Lynch et al., 1969).

Data on the intake of protein and riboflavin was collected from the normal subjects through a questionnaire and from the patients by checking the hospital diet. The nutritional contents of foods were calculated from the tables supplied by U.S. Agriculture Research Service (1963).

Results

The daily intake of protein and riboflavin and six hours excretion of creatinine and riboflavin in healthy subjects and patients with renal disorders is shown in Table I and II.

Table I: Excretion of Creatinine & Riboflavin and the Intake of Portein and Riboflavin in Healthy Subjects

No. of subjects	*Intake of riboflavin (mg/day)*	*Intake of protein (gm/day)*	*Excretion of Creatinine (mg/hours)*	*Excretion o riboflavin (Mcg/gm Creatinine)*
Normal range	0.83	59.5	200—500	80—269
1	1.1	50	320	312
2	1.0	44	500	220
3	1.3	52	665	209
4	1.9	30	570	39
5	.39	40	352	293
6	1.06	40	450	173
7	1.06	40	550	149
8	1.06	40	520	187
9	1.06	40	475	127
10	1.06	40	504	137
11	1.06	40	240	266
12	.7	42	972	42
13	1.5	62	364	100

Table II: Effect of Protein Intake on the Excretion of Creatinine & Riboflavin

Diseases	*Intake of Riboflavin (mg/day)*	*Intake of Protein (G/day)*	*Excretion of Creatinine (mg 6 hrs)*	*Excretion of Riboflavin (Mcg/gm Creatinine)*
Nephrotic Syndrome	0.92	50	220	151
	1.4	90	580	150
	1.4	90	1288	27
	1.4	90	234	153
Acute and Chronic Renal Failure	0.72	20	168	404
	0.72	20	132	712
	0.69	20	301	33
	0.69	20	369	92
	0.69	20	810	74
Miscellaneous Chronic Nephritis 2	0.72	40	492	136
	0.69	40	475	253
	0.72	40	540	31
Hypertension 2	0.72	40	203	246

Creatinine excretion was normal in 11(85%) and high in 2(15%) healthy subjects (Table III). Both the subjects were on low calorie intake and one on low riboflavin intake.

Table II shows the effect of protein and riboflavin intake on the urinary excretion of creatinine and riboflavin in patients with renal disorders. Urinary riboflavin excretion was low in 1 patient with nephrotic syndrome and two with chronic renal failure and high in 2 patients with renal failure.

A negative correlation was observed between creatinine and riboflavin excretion in both patients and controls as shown in the accompanying figure, when creatinine excretion increases the riboflavin excretion is diminished.

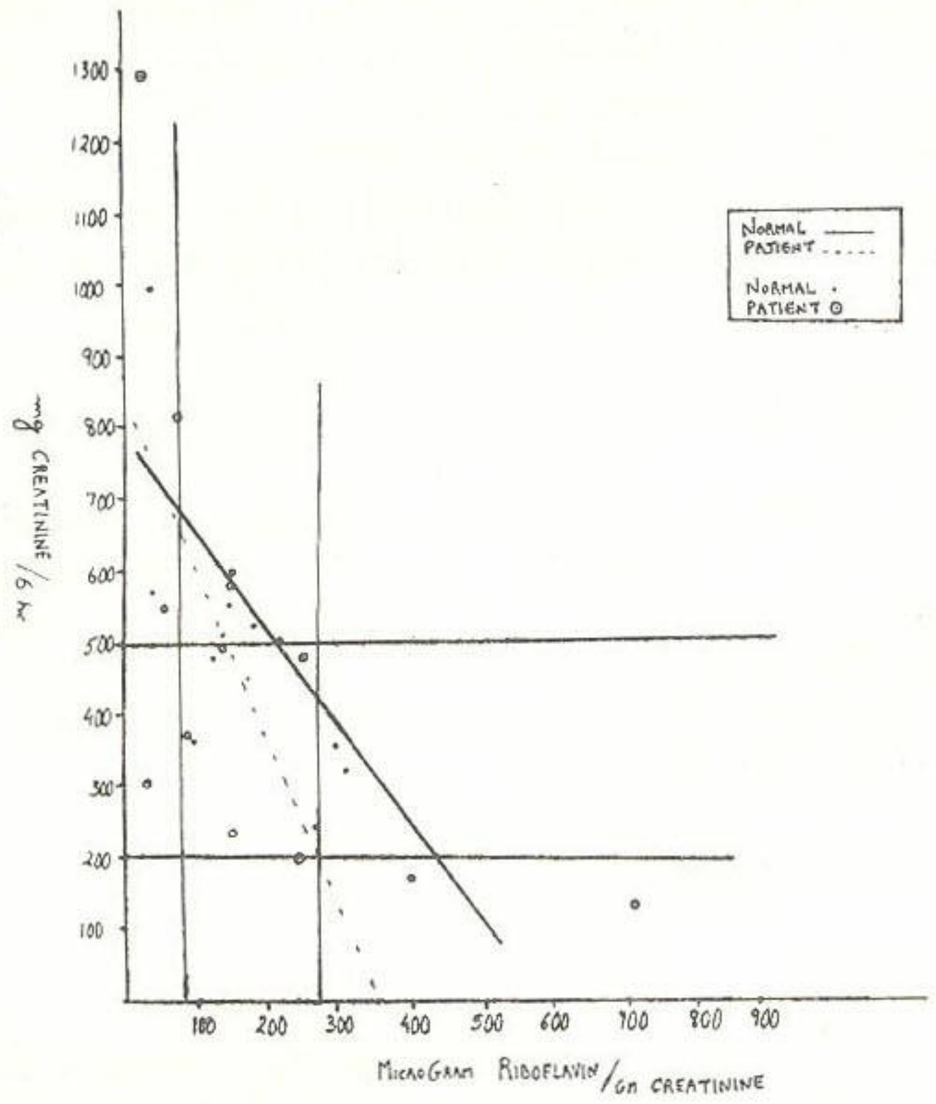

Fig: Relationship of Creatinine and Riboflavin Excretion

Discussion

The storage of flavoprotein decreases early in the course of protein starvation (Horwitt 1966; Unna et al., 1944; Muntwyler et al., 1950). Adequate intake of protein is necessary for utilization of riboflavin and of riboflavin for utilization of protein (Bro-Rasmussen, 1958; Czackes and Gugenhiem, 1946; Sarett and Perlzweig, 1943; Oldham et al., 1947). The results obtained in healthy subjects show that excretion of riboflavin was normal in individuals on adequate protein intake. The creatinine excretion was high in 2 healthy subjects. One of them had a low calorie but an adequate protein and riboflavin intake and normal riboflavin excretion while the other had a low calorie and low riboflavin intake and diminished riboflavin excretion. Low calorie intake leads to breakdown of endogenous proteins and thus raises creatinine excretion without affecting the urinary riboflavin levels (Pollak and Bookman, 1951).

Increased excretion of riboflavin was seen in two patients with renal failure who were on low protein intake indicating that diminished protein intake reduces the retention of riboflavin excretion. Excretion of riboflavin was normal in 3 patients with nephrotic syndrome, one with renal failure and 3 with other renal disorders. Reabsorption of protein was probably adequate in these cases as shown by normal excretion of creatinine.

The excretion of riboflavin was low in 2 patients with chronic renal failure, one with nephrotic syndrome and 1 patient of chronic nephritis with proteinuria. This may be due to diminished renal clearance as the riboflavin is not only excreted by glomerular filtration but also by renal tubular secretion (Levy and Jusko,

Table III: Intake of Protein and Riboflavin and Excretion of Creatinine and Riboflavin

Groups	*No of Subjects*	*Intake of Rib. mg/day/Mean (Range)*	*Intake of Protein G/day Mean (Range)*	*Extcretion of creatinine mg/6 hours*			*Excretion of Rib. Mcg/G. Creatinine*		
				Normal	*Low*	*High*	*Normal*	*Low*	*High*
Healthy Subjects	13	1.02 (0.7—1.5)	38.5 (30—62)	11(85%)	—	2(15%)	11(85%)	2(15%)	—
Nephrotic Syndrome	4	1.28	80	3(75%)	—	1(25%)	3(75%)	1(25%)	—
Renal Failure	5	0.70 (0.69—0.72)	20	2(40%)	2(40%)	1(20%)	1(20%)	1(20%)	2(40%)
Miscellaneous (Chronic Nephritis Hypertansion Jaundice with Obliguria)	4	0.71	40	3(75%)	—	1(21%)	3(75%)	1(25%)	—

1966; Rennick, 1960). Riboflavin excretion was normal in all but one patient in the miscellaneous group who had proteinuria and increased excretion of creatinine.

The exact frequency of riboflavin deficiency in Pakistan is not known. The survey figures are based on urinary excretion of riboflavin which is affected by protein and calorie intake and adequacy renal function and thus is of limited value. It is therefore suggested that serum riboflavin levels should be estimated in apparently healthy subjects to determine the normal levels of serum riboflavin and the extent of subclinical deficiency.

Acknowledgements

Authors are thankful to Dr. S.A.J. Naqvi and the medical and laboratory staff of the Department of Nephrourology for referring their cases and providing laboratory facilities for creatinine clearance studies.

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