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Normal Values in the Adult Zambian

VII. CERULOPLASMIN

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SUMMARY

The concentration of ceruloplasmin in normal Zambian adults is presented. The levels are comparable to those reported for Europeans but there is a distinct difference in concentrations between sexes. This difference is accentuated by taking of the "pill".

INTRODUCTION

Normally about 95% of the copper in the serum is firmly bound to an alpha-2 globulin called ceruloplasmin. In hepato-lenticular degeneration (Wilson's disease) there is a disturbance of ceruloplasmin function leading to progressive accumulation of copper in the cytoplasm of hepatocytes. After some years the concentration of copper in the liver reaches 500 to 2000 ug/gram dry weight and necrosis of liver cells occurs. The copper is then released into the serum and is deposited in other tissues where damage subsequently occurs.

During this disturbance of ceruloplasmin function only a small amount of copper is attached to the globulin and the bulk is loosely bound to serum albumin permitting deposition in other tissues and release into the urine.

The concentration of this globulin has not been estimated in the African races before and it is the purpose of this paper to report a study of its concentration in the normal adult Zambian.

MATERIAL AND METHOD

A set of aliquots stored at -30°C from a previously described group of normal Zambians (Kibukamusoke & Snook, 1975) was allowed to thaw and used for the study.

Using the radial immunodiffusion technique with standard reference sera and specific immunoplates supplied by Hyland Laboratories estimations were made for the periods: 4 hours, 16 hours and 48 hours. The results were computed for confidence limits using Student's T-test and the F-test.

RESULTS

The results on total concentration are given in Table 1.

There is a difference between time and value. This is shown in Table II.

The effects of the "Pill" are shown in Table III.

To examine further whether it is the inclusion of the females on the pill that is responsible for increase in the female value at 16 and 48 hours, a comparison is made between males and non-pill females. This is shown in Table IV.

TABLE I

Total concentration of ceruloplasmin in Males and Females

	MALES			FEMALES		
	4 Hours	16 Hours	48 Hours	4 Hours	16 Hours	48 Hours
Mean (mg/100 ml)	24.53	28.57	34.37	27.52	33.90	40.43
S.D.	5.64	5.58	8.95	10.34	9.62	11.45
S.E.M.	1.03	1.02	1.63	2.26	2.10	2.50
t value (male Vs female)	1.26	2.37	2.01			
p Value (male Vs female)	>0.15	>0.0125	>0.025			
Range (mg/100ml)	13.25–35.81	17.41–39.73	16.47–52.27	6.84–48.20	14.66–53.14	17.53–63.33

There is a significant difference between male and female only in concentrations at 16 and 48 hours.

TABLE II

Relationship between concentration and diffusion time

	MALES			FEMALES		
	4 Hours	16 Hours	48 Hours	4 Hours	16 Hours	48 Hours
Mean (mg/100ml)	24.53	28.57	34.37	27.52	33.90	40.43
Range (mg/100ml)	13.25–35.81	17.41–39.73	16.47–52.27	6.84–48.20	14.66–53.14	17.53–63.33
t value	2.79 (4 Vs 16)	3.01 (16 Vs 48)		2.07 (4 Vs 16)	2.00 (16 Vs 48)	
p value	>0.005	>0.0025		0.025< P>0.0125	0.05<P>0.025	

The concentration increases with diffusion time.

TABLE III

Effect of the "pill on Ceruloplasmin Values

	NO PILL			ON PILL		
	4 Hours	16 Hours	48 Hours	4 Hours	16 Hours	48 Hours
Mean (mg/100ml)	27.52	33.90	40.43	38.11	45.67	58.00
S.D.	10.34	9.62	11.45	14.06	14.34	22.39
t Value (Pill Vs No Pill)	2.31	2.64	2.87			
p value (Pill Vs no Pill)	0.025<P>0.0125	0.01<P>0.005	0.005<P>0.0025			
Range (mg/100 ml)	6.84–48.20	14.66–53.14	17.53–63.33	9.99–66.23	17.0–17.35	13.22–102.78

Values for those on the "pill" are significantly greater at each stage.

TABLE IV

Males Compared with non-pill females.

	MALES	NON-PILL FEMALES	MALES	NON-PILL FEMALES
	16 Hours	16 Hours	48 Hours	48 Hours
Mean (mg/100ml)	28.57	33.90	34.37	40.43
S.D.	5.58	9.62	8.95	11.45
t value (male Vs female)	2.50		2.91	
p value (male Vs female)	0.01<P>0.005		0.005<P>0.0025	
Range (mg/100ml)	17.41–39.73	14.66–53.14	16.47–52.27	17.53–63.33

Differences persist between males and females even though the group on the pill is removed.

DISCUSSION

On the total concentration (Table I) the difference between males and females shows up only in the 16 and 48 hour diffusion results. This difference still shows up clearly when men are compared both with "non-pill" females (table IV). It is therefore probably an intrinsic sex difference. The difference is however accentuated when "non-pill" females are compared with those on the pill (Table III). The latter having an effect of increasing the concentrations at all diffusion periods.

The concentration also shows a significant increase with diffusion time in both males and females. Mean Values and ranges must therefore be available for each diffusion period for interpretation. Both these are given in this study. The diffusion time must also be quoted for each test to facilitate interpretation.

The normal ceruloplasmin concentration as given in Europe (30–50 mg/% Diem et al, 1972) is comparable with our own particularly at the 16 and 48 hour periods: 17.4–39.7 (mean 28.6) and 14.7–53.1 mg/100 ml (mean 33.9) for 16 hours and 16.6–52.3 (mean 34.4) and 17.5–63.3 (mean 40.4) mg/100 ml respectively.

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