

# Normal Values in the Adult Zambian

## V. PLASMA ALPHA-2 MACROGLOBULIN

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### SUMMARY

A study on the normal concentration of alpha-2 macroglobulin in the adult Zambian is presented. The values are time-related but fall within the normal range for Europeans and North Americans. An important difference in concentration between males and females is recorded.

shown to be a major inhibitor of several plasma factors: Kallikrein (Harpel, 1970), thrombin (Lanchantin et al, 1966) and plasmin (Schultze et al, 1963 Ganrot, 1967). It is also said to be an inhibitor of trypsin (Karlson, 1969).

The following table shows what is known of the physical properties of this macroglobulin:

### INTRODUCTION

Human plasma alpha-2 macroglobulin has been

| Item  | Diem & Lentner (1970) | White et al (1973) | Karlson (1969) |
|---|-----------------------|--------------------|----------------|
| Serum Content (mg/100ml)  | 150-450               | 200                | 130-380        |
| Iso-electric point (ph)   | 5.4                   | 5.4                |                |
| Electrophoretic mobility ( $10^{-5} \text{ Cm}^2 \text{ V}^{-1} \text{ S}^{-1}$ ) | 4.2                   |                    |                |
| Sedimentation Constant (Svedberg Units)   | 19.4                  | 19.6               |                |
| Diffusion Constant  | 2.4                   |                    |                |
| Molecular Weight  | 900,000               | approx.820,000     | 820,000        |
| Amino Acid Content (g/100g. protein)  | 85.63                 |                    |                |
| Carbohydrate Content  |                       | 10%                | 8.4%           |

The concentration of this macroglobulin has so far not been estimated in any systematic way in African populations and it is the purpose of this paper to report a study of its concentration in the serum in a normal group of adult Zambians.

**MATERIAL AND METHOD**

This is a further part of a study of 30 normal Zambian adult males and a similar number of females. Details on the subjects have already been given (Kibukamusoke & Snook, 1975).

A set of the serum stored in several aliquots at - 30°C was allowed to thaw and alpha-2 macroglobulin concentration estimated using the single radial immunodiffusion technique of Fahey et al (1965) and Manchini et al (1964). Alpha-2 macroglobulin immunoplates from Hyland Laboratories were used for this study. The Reference sera supplied with kits was employed as a standard in the usual way.

Statistical analysis of the figures was done using Students' T-test.

**RESULTS**

The results on total concentration of alpha-2 macroglobulin are given in table 1.

**TABLE 1**

|        | MALE  |      |      |             | FEMALE |      |     |             |
|--------|-------|------|------|-------------|--------|------|-----|-------------|
|        | Mean  | SD   | SEM  | Range (2SD) | Mean   | SD   | SEM | Range (2SD) |
| 4 hrs  | 174   | 51.3 | 9.4  | 73-275      | 146.7  | 38.7 | 7.0 | 70-224      |
| 16 hrs | 218.5 | 74.9 | 13.7 | 69-367      | 189.6  | 49.8 | 9.0 | 90-290      |
| 48 hrs | 268.5 | 76.4 | 14.0 | 116-420     | 226.0  | 50.7 | 9.3 | 126-326     |

Concentrations given in mg/100 ml.

It will be seen that the mean figure for females at 48 hours (226.0 mg/100 ml) is significantly lower than the mean for males for this period (268.5 mg/100 ml),  $t = 2.57$ ;  $p > 0.005$ .

This difference is reflected in all the values at each period of estimation (Table II):

**TABLE II**

Statistical Analysis: Males Vs Females for each estimation period.

|          |            |              |
|----------|------------|--------------|
| 4 Hours  | $t = 2.30$ | $p > 0.0125$ |
| 16 Hours | $t = 1.76$ | $p > 0.025$  |
| 48 Hours | $t = 2.57$ | $p > 0.005$  |

All the p values are significant

The ranges however are both within the normal for Europeans and North Americans (in mg/100 ml Table III):

**TABLE III**

|         | This Study | Diem & Lentner (1970) | Karlson (1969) |
|---------|------------|-----------------------|----------------|
| Males   | 116-420    | 150-540               | 130-380        |
| Females | 126-326    | —                     | —              |

The difference between the male and female figures is not related to use of the "pill" (Table IV):

**TABLE IV**

Statistical Analysis of figures: Females on the Pill Vs No Pill.

|          |            |             |
|----------|------------|-------------|
| 4 Hours  | $t = 0.32$ | $p > 0.350$ |
| 16 Hours | $t = 0.25$ | $p > 0.490$ |
| 48 Hours | $t = 0.04$ | $p > 0.475$ |

None of the p values is significant

The values obtained for each estimation period differ significantly from those for the next period and similarly for the third (Table V). Thus it is necessary to have normal values for each period available separately.

**DISCUSSION**

During the intrinsic blood coagulation mechanism the Hagemanfactor (factor XII) activates plasma thromboplastin antecedent (factor XI) which in turn activates Christmas factor (factor IX) (Harpel, 1971). Hageman factor activation is also required for the conversion of plasma prekallikrein into bradykinin-releasing enzyme, kallikrein (Webster, 1968). Bradykinin itself is considered to play an important role in the mediation of the inflammatory reaction of many pathological states (Kellermeyer et al, 1968). The sequence of events leading to the activation of kallikrein by Hageman factor is not clear and is at present the subject of much research. Human plasma alpha-2 macroglobulin itself has been shown to be a major inhibitor of kallikrein (Harpel, 1970). It is therefore important that some work should be done on this subject among inhabitants of this continent. The purpose of this paper is to establish the normal concentration similar to that found among Europeans

TABLE V

|         | 4 Hours Vs 16 Hrs  | 16 Hours Vs 48 Hours | 4 Hours Vs 48 Hours |
|---------|--------------------|----------------------|---------------------|
| Males   | t = 2.68; p>0.005  | t = 2.58; p>0.01     | t = 5.64; p>0.0005  |
| Females | t = 3.73; p>0.0005 | t = 2.80; p>0.005    | t = 6.81; p>0.0005  |

All the t and p values are significant.

and North Americans.

Values of alpha-2 macroglobulin obtained by this method get larger depending on the time allowed for radial diffusion. Thus the mean concentration at 4 hours is significantly different from that at 16 hours ( $p > 0.005$ ) and this is similarly smaller than that at 48 hours ( $p > 0.01$ ). The values are therefore time-related and this factor need to be reported for every value estimated. Ranges for normal values ought also to be available for each estimation period. These values are given in this report for each of the estimation period studied.

We have been unable to find any study which reports a difference between males and females in this regard and we believe this is the first time it has been done. The difference reported here is important and significant. It is revealed at all the observation periods:

4 hours: ( $p > 0.0125$ ); 16 hours: ( $p > 0.025$ ); 48 hours: ( $p > 0.005$ ) we have been unable to relate it to use of the pill and may be a fundamental intrinsic difference between the sexes.

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