# SERUM ALBUMIN REFERENCE INTERVAL IN A GROUP OF APPERENTLY HEALTHY SRILANKAN ADULTS FROM KANDY DISTRICT

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**ABSTRACT:** For clinical diagnosis and therapeutic management, clinicians have to be sure of the reference limits of the laboratory parameters. International guidelines recommend every laboratory to establish their own reference intervals for healthy individuals belong to a group of homogenous healthy population. Considering varied dietary habits, races and geographical differences in Sri Lanka, there is a need for a specific reference interval for Sri Lankan population. The aim of this study was to establish reference interval for albumin in 106 healthy Sri Lankan adults between 20 to 80 years of age in Kandy district. Ethical clearance for the study was obtained from Ethics Committee, Postgraduate Institute of Science, University of Peradeniya. Albumin was measured using bromocresol green method. Reference interval established considering $2.5^{th}$ to $97.5^{th}$ percentile for albumin was 3.35- 4.52 g/dl. The mean serum albumin concentration was significantly ($p<0.05$) higher in males (4.02 ± 0.32 g/dl) than females (3.77 ± 0.25 g/dl). Therefore separate reference intervals are proposed for males (3.38- 4.66 g/dl) and females (3.27- 4.27 g/dl). The mean serum albumin concentration was significantly ($p<0.05$) higher in age groups 21-30 years (3.96±0.30 g/dl) and 31- 40 years (3.91±0.035 g/dl) than other age groups (41-50 years, 3.77 ±0.25 g/dl; 51-60 years, 3.76 ±0.25 g/dl; >60 years, 3.78 ± 0.33 g/dl). Mean concentration of albumin in Muslims (3.76 g/dl) was significantly ($p>0.05$) lower than Tamils (3.92 g/dl), but mean albumin in Sinhalese (3.88 g/dl) showed no significant ($p>0.05$) differences with Tamils and Muslims. The mean value of albumin reported from Kenyann, Kuwaits, Rwanda and America are higher than the present study, possibly because of differences in the test procedure and ethnicity. Therefore each country should establish reference interval that are representative of local populations.

**Keywords:** Reference Interval, albumin, Kandy district

## INTRODUCTION

Reference values refer to all the test results obtained by the observation or measurement of a particular type or quantity on an adequate number of persons selected to represent the general population. Reference interval is defined by a specific percentage, usually middle 95 % of the results obtained, when organized in an order (Zeh *et al*, 2012). Reference interval serve as the basis to decide whether the results obtained for the laboratory tests are within the normal limit. It is one of the most used medical decision making tools that aid physicians to identify patients from the healthy population and guide them to take appropriate clinical actions. Nearly 80 % of physicians' medical decisions are based on information provided by laboratory reports (Clinical Lab Products, 2012).

Reference intervals available for subjects in other countries are used in Sri Lanka because of its unavailability. According to IFCC (1979) the analytical outcome is affected by genetic make-up, dietary habits, life style, socio-economic and many other environmental and biological factors of different population. On these accounts, the focus of this study was to establish serum albumin reference interval usinghealthy adults aged between 20-80 years and to study how the reference interval vary with age, gender, race and Body Mass Index(BMI).

## METHODOLOGY

Between July 2012 to September 2013, 106 blood samples were collected from apparently healthy subjects, 20 to 80 years of age, from Kandy district. Ethical clearance for the study was obtained from Ethics Committee of Postgraduate Institute of Science, University of Peradeniya, Sri Lanka. Data were categorized by sex, age, race and BMI (According to WHO (2000) Body Mass Index (BMI), calculated as the weight in kilograms divided by the square of the height in metres, with BMI<18.5 denoting "under weight", BMI = 18.5 -24.99 denoting "normal weight", BMI>25 denoting "overweight" and BMI>30 denoting "obese") and analyzed by mean comparison using t-test. Albumin was measured by bromocresol green method (Doumas, Watson and Biggs, 1971). All techniques used for estimation were subjected to quality control. The test results were accepted when the quality control results were within the accepted range given by manufacturer. The reference interval was obtained from the $2.5^{th}$ and $97.5^{th}$ percentile of a plot.

## RESULTS AND DISCUSSION

The serum albumin concentration ranged from 3.14 g/dl to 4.8 g/dl with a mean value of 3.87 g/dl. The results of albumin showed non Gaussian distribution and the established reference interval was 3.35- 4.52 g/dl.

The mean serum albumin concentration in males and females showed significant difference, therefore different reference intervals were established for each gender which is given in Table 1.

*Table 1. Gender wise Reference Intervals*

| Gender | Albumin (g/dl) | |
|---|---|---|
| | Mean ±SD | Reference Interval* |
| Male (n=40) | $4.02 \pm 0.32^{a}$ | 3.38- 4.66 |
| Female (n=66) | $3.77 \pm 0.25^{b.}$ | 3.27- 4.27 |
| Total (n=106) | 3.87±0.32 | 3.35- 4.52 |

n-number of subjects, *- Estimated as the values between $2.5^{th}$and $97.5^{th}$ percentile. Values with different superscript letters are significantly ($p<0.05$) different.

*Table 2. Reference Intervals According to Age Groups*

| Age Groups | Albumin (g/dl) | |
|---|---|---|
| | Mean ±SD | Reference Interval* |
| 20 - 29 | $3.96 \pm 0.30^{a}$ | 3.36 – 4.56 |

| | | |
|---|---|---|
| (n=36) | | |
| 30 - 39 (n=24) | 3.91 ±0.35[a,b] | 3.21 – 4.61 |
| 40 - 49 (n=24) | 3.77 ±0.25[b,c] | 3.27 – 4.27 |
| 50 – 59 (n=16) | 3.76 ±0.25[b,c,d] | 3.26 – 4.26 |
| >60 (n=6) | 3.78 ±0.33[a,b,c,d] | 3.12 – 4.44 |
| Total (n=106) | 3.87 ±0.32 | 3.35 - 4.52 |

Values with different superscript letters are significantly ($p<0.05$) different.

The mean serum albumin concentration was compared between age groups using 2 samples T-test. There were significant ($p<0.05$) difference between age group 20 – 29 years and 40 – 49 years ($p=0.008$), 50 – 59 years ($p=0.011$) but there were no significant differences ($p>0.05$) between other age groups. Therefore different reference intervals are proposed for age groups which is given in Table. 2.

*Table 3. Reference Intervals According to Ethnicity*

| Race | Albumin (g/dl) | |
|---|---|---|
| | Mean ±SD | Reference Interval* |
| Muslims (n=14) | 3.76 ± 0.27 | 3.22 – 4.30 |
| Sinhalese (n=84) | 3.88 ± 0.31 | 3.26 – 4.50 |
| Tamils (n=8) | 3.92 ± 0.25 | 3.42 - 4.42 |
| Total (n=106) | 3.87 ± 0.32 | 3.35 - 4.52 |

The mean serum albumin concentration in different ethnicity and BMI groups showed no significant difference, therefore similar reference interval is proposed for ethnicity and BMI groups which are given in Table. 3 and Table. 4.

*Table 4. Reference Intervals according to BMI Groups*

| Age Groups | Albumin (g/dl) | |
|---|---|---|
| | Mean ±SD | Reference Interval* |
| Underweight (n=12) | 3.94 ±0.22 | 3.50 – 4.38 |
| Normal weight (n=64) | 3.86 ±0.31 | 3.24 – 4.48 |
| Over weight (n=23) | 3.83 ±0.32 | 3.19 – 4.47 |
| Obese (n= 3) | 4.01 ±0.30 | 3.41 – 4.61 |
| Total (n=106) | 3.87 ±0.32 | 3.35 - 4.52 |

The mean serum albumin concentration of 3.87±0.30g/dl obtained in the present study was lower than the mean values obtained for population in Kenyan(4.00± 0.56g/dl) (Waithaka *et al,* 2009), Kuwait(4.1± 0.3 g/dl) (Olusi and Al-Awadhi, 2002), Rwanda (4.2±0.46 g/dl) (Gahutu and Wane, 2006) and American (4.2 ±0.37 g/dl) (NCCLS, 1994).
The mean albumin concentration was significantly ($p<0.05$) higher in males (4.02 g/dl) than females (3.77 g/dl). Similar result was obtained in Kenyan study(male: 4.07± 0.58 g/dl; female:3.94± 0.55 g/dl) (Waithaka *et al,* 2009), Kuwaits(male: 4.20± 0.30 g/dl; female: 4.00 ± 0.30 g/dl)(Olusi and Al-Awadhi, 2002) and Rwanda (male: 4.30± 0.46 g/dl; female: 4.10 ± 0.46 g/dl) (Gahutu and Wane, 2006), but there was no difference in mean albumin concentration (4.2 ±0.37 g/dl) between genders in Americans (NCCLS, 1994). Therefore separate reference intervals were proposed for the genders (Table 1).
The mean albumin concentration was shown significant ($p<0.05$) difference between age group 20 – 29 years (3.96 ± 0.30) and 40 – 49 years (3.77 ± 0.25), 50 – 59 years (3.76 ± 0.25), but other age groups were not shown significant differences between 30 -39 years (3.91 ± 0.35), >60 years (3.78 ± 0.33). There were no significant ($p>0.05$) difference between age group 30 - 39 years and 40 – 49 years ($p=0.112$), 50 – 59 years ($p=0.081$), >60 years ($p=0.194$).Similarly there were no significant ($p>0.05$) difference between age group 40 – 49 years and 50 – 59 years ($p=0.695$), >60 years ($p=0.776$).There were no significant ($p>0.05$) difference between age group 50 – 59 years and >60 years ($p=0.987$). Therefore different reference intervals can propose for age groups for serum albumin.

Ethnicity and BMI showed no significant ($p>0.05$) differences (Table 3 & 4). There is no literatures to compare the ethnicity and BMI groups.

The possible reasons for the differences in reference interval are due to the test procedure, ethnicity, climate zones, different food habits and life style. Therefore each country should establish reference intervals that are representative of local populations.

## CONCLUSION

Serum albumin reference interval was established. Significant differences in the mean concentration of albumin was observed between gender and age. Because of the low number of subjects in age groups and gender, no reference interval was proposed and there is a need to establish serum albumin in different gender and age using larger sample size.

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