



OBSERVATIONS ON PLASMA-PROTEINS AND IT'S RELATIONSHIP WITH THE BODY WEIGHT AT PMCH, PATNA

Physiology

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ABSTRACT

Background : The human body is composed of five substances namely water, protein, fat, carbohydrate and minerals. All these substances are very closely interrelated, each acting with the other. Among these water acts as a bridge. **Methods :** The subjects included were medical students, staff of Patna Medical College, Patna, Bihar, businessman, serviceman and housewives. **Results :** The present study has been made on plasma protein in 54 normal healthy subjects of both sexes, 27 subjects of vegetarian group and 27 subjects of non-vegetarian group. In the whole study group the level of mean plasma protein ranged from 5.8 g/dL – 8.4 g/dL with a mean of 6.96 g/dL. (S.D. - 0.50, S.E. - 0.06). **Conclusion :** The plasma protein level in the study group is almost identical with the standard reference level.

KEYWORDS

Plasma Protein, Body Weight

INTRODUCTION

Evaluation of body composition in humans is of great value in metabolic, nutritional and energy balance studies. It is also important to establish reference data on body composition in different ethnic groups and in different age groups of both sexes so that it would enable comparison of inter-laboratory data on studies of similar nature.

The human body is composed of five substances namely water, protein, fat, carbohydrate and minerals.

All these substances are very closely interrelated, each acting with the other. Among these water acts as a bridge.

On weight basis a healthy body is composed of:

60%	Water
18%	Protein
14%	Fat
1%	Carbohydrate
7%	Minerals

AIMS AND OBJECTIVES

To observed the plasma-protein with relation to body weight in humans is of great value in metabolic, nutritional and energy balance.

MATERIALS AND METHODS

The present study on plasma proteins and it's relationship with body weight has been carried out among healthy subjects. The subjects included were medical students, staff of Patna Medical College, Patna, Bihar, businessman, serviceman and housewives.

The subjects were interviewed and a general clinical examination was done.

Thereafter dietary history was taken. The case analysis has been done in following sequence – Age, Sex, Occupation, Body weight, Body Height, B.M.I., Dietary History, Dietary Habits : Protein Intake Index, Plasma Volume and The Plasma Protein Level

STEPS

- Serum was obtained from the whole blood and albumin and globulin were estimated.
- Whole blood was taken and mixed with anticoagulant (3.8% citrate). The fibrinogen was measured from the plasma.

(1) **The A : G ratio** – A : G ratio was dermined.

(2) **Total Amount of Plasma Protein** – It was determined by

multiplying the plasma protein level with the plasma volume.

- (3) **Tissue Protein (exchangeable)** – This pool of protein was determined by calculation.

Tissue Protein (exchangeable) = Total amount of plasma protein × 33

- (4) **Total Body Protein** – Taking 66 percent of protein as exchangeable pool, the total body protein was calculated.

Tissue Protein (exchangeable) × 100

Total body protein = $\frac{\text{Tissue Protein (exchangeable)} \times 100}{66}$

- (5) **Tissue Protein (Non exchangeable)** – It was calculated as Total body protein – Exchangeable pool.

- (6) **Percentage of Protein in The Body** – This was determined to know the protein status of the body.

Total protein estimation : Method used for estimating total protein was modified biuret, Endpoint colorimetry.

Albumin estimation : The method employed for albumin estimation was Bromocresol green, end point colorimetry.

Fibrinogen estimation : Determination of fibrinogen level in plasma was done by clotting method of Clauss.

RESULTS

The whole study group comprised of 54 subjects – 30 males and 24 females. The subjects were of different age groups in both sexes. The subjects were divided into following groups –

TABLE – I

Sl. No.	Groups	No. of Subjects
1.	Whole study group	54
2.	Male subjects	30
3.	Female subjects	24
4.	Vegetarians in both sexes	27
5.	Non-vegetarians in both sexes	27
6.	Male vegetarians	14
7.	Male non-vegetarians	16
8.	Female vegetarians	13
9.	Female non-vegetarians	11

TABLE – II : Table showing distribution of subjects according to dietary habits.

Groups	Dietary Habits	No. of Subjects	Males	Females
Group A	Vegetarian	27	14	13
Group B	Non-vegetarian	27	16	11
	Total	54	30	24

The level of total plasma protein in both sexes are presented in the following tables.

TABLE – III : Total plasma protein level in male subjects.

No. of Subjects	Range of Plasma protein (g/dL)	Mean	S.D.	S.E.
30	5.8 – 8.4	7.01	0.56	0.103

TABLE – IV : Total plasma protein level in female subjects.

No. of Subjects	Range of Plasma protein (g/dL)	Mean	S.D.	S.E.
24	5.9 – 7.8	6.90	0.43	0.088

The level of Albumin, Globulins and Fibrinogen in both sexes are presented in the following tables.

TABLE – V : Albumin, Globulins and Fibrinogen levels in male subjects.

No. of Subjects	Range of Albumin g/dL	Globulins g/dL	Fibrinogen g/dL
30	3.5 – 4.6	1.6 – 3.8	0.2 – 0.4
Mean	3.98	2.78	0.26
S.D.	0.28	0.52	0.06
S.E.	0.051	0.094	0.012

TABLE – VI : Albumin, Globulins and Fibrinogen levels in female subjects.

No. of Subjects	Range of Albumin g/dL	Globulins g/dL	Fibrinogen g/dL
24	3.0 – 4.5	2.1 – 3.3	0.2 – 0.3
Mean	3.80	2.87	0.23
S.D.	0.37	0.29	0.04
S.E.	0.077	0.059	0.009

Study of table V and VI reveals the fact that the mean albumin and fibrinogen levels are more in males (3.98 g/dL and 0.26 g/dL) than in females (3.80 g/dL and 0.23 g/dL). However the mean globulin level is more in females (2.87 g/dL) than in males (2.78 g/dL).

TABLE – VII Comparison of the total plasma protein level in male and female subjects.

Sex	No. of Subjects	Mean (g/dL)	S.D.	S.E.	t and p value
Male	30	7.01	0.56	0.103	t=0.713
Female	24	6.90	0.43	0.088	p > 0.5 Statistically insignificant

Table VII reveals that the mean total plasma protein value in males is slightly more (7.01 g/dL) than females (6.90 g/dL) with t and p value respectively 0.713 and p > 0.5 hence not significant.

The levels of Total Plasma proteins in vegetarian and Non-vegetarian subjects are presented in the following tables.

TABLE – VIII : Total plasma protein level in vegetarian of both sexes.

No. of Subjects	Range of Plasma protein (g/dL)	Mean (g/dL)	S.D.	S.E.
27	6.2-7.8	7.06	0.42	0.080

TABLE – IX : Total Plasma protein level in Non-vegetarians of both sexes.

No. of Subjects	Range of Plasma protein (g/dL)	Mean (g/dL)	S.D.	S.E.
27	5.8-8.4	6.87	0.57	0.110

The table No. VIII and IX shows the mean level of total plasma protein in vegetarian and non-vegetarian of both sexes.

The mean level is more (7.06 g/dL) in the vegetarians than non-vegetarians (6.87 g/dL). The S.D. and S.E. are respectively 0.42, 0.080 and 0.57, 0.110 in vegetarians and non-vegetarians.

The level of Albumin, Globulins and Fibrinogen in vegetarian and non-vegetarian are presented in following tables.

TABLE – X : Levels of Albumin, Globulin and Fibrinogen in vegetarians.

No. of Subjects	Range of Albumin g/dL	Globulins g/dL	Fibrinogen g/dL
27	3.0 – 4.6	2.2 – 3.7	0.2 – 0.4

Mean	3.86	2.94	0.25
S.D.	0.39	0.33	0.06
S.E.	0.076	0.063	0.012

TABLE – XI : Levels of Albumin, Globulins and Fibrinogen in non-vegetarians.

No. of Subjects	Range of Albumin g/dL	Globulins g/dL	Fibrinogen g/dL
27	3.4 - 4.3	1.6 – 3.8	0.2 – 0.4
Mean	3.93	2.70	0.24
S.D.	0.25	0.50	0.05
S.E.	0.049	0.096	0.011

Close study of table X and XI reveals that the mean albumin level is more in the non-vegetarian group (3.93 g/dL) than vegetarians (3.86 g/dL). The mean globulin level is more in vegetarians (2.94 g/dL) than non-vegetarians (2.70 g/dL). Fibrinogen level is nearly equal, 0.25 g/dL and 0.24 g/dL respectively.

TABLE – XII : Comparison of the Total Plasma Protein level in vegetarian and non-vegetarian subjects.

Dietary Habits	No. of Subject	Mean (g/dL)	S.D.	S.E.	t & p value
Vegetarian	27	7.06	0.42	0.080	t = 1.37
Non-vegetarian	27	6.87	0.57	0.110	p > 0.1 Statistically Insignificant

Table XII reveals that the mean Total Plasma Protein level is greater (7.06 g/dL) in vegetarians than the non-vegetarians (6.87 g/dL) with t and p value respectively – 1.37 & p > 0.1, hence statistically Insignificant.

The table presented below shows the mean Plasma Protein level in male and female vegetarians and non-vegetarians.

TABLE – XIII : Table showing mean Plasma Protein level in vegetarian and non-vegetarian males.

Dietary Habit	No. of Subject (Males)	Range of Plasma Protein (g/dL)	Mean (g/dL)	S.D.	S.E.
Vegetarian	14	6.4 – 7.8	7.18	0.39	0.105
Non-vegetarian	16	5.8 – 8.4	6.86	0.65	0.164

TABLE – XIV: Table showing mean Plasma Protein level in vegetarian and non-vegetarian females.

Dietary Habit	No. of Subject (Females)	Range of Plasma Protein (g/dL)	Mean (g/dL)	S.D.	S.E.
Vegetarian	13	6.2 – 7.7	6.92	0.43	0.119
Non-vegetarian	11	5.9 – 7.8	6.89	0.45	0.137

On studying the table XIII and XIV it is clear that the mean plasma protein level in both male and female vegetarians (7.18 g/dL and 6.92 g/dL) are more than that of male and female non-vegetarians (6.86 g/dL and 6.89 g/dL) respectively.

The table presented below shows the mean percent of protein in body among male and female, vegetarian and non-vegetarian subjects.

TABLE – XV : Table showing Mean percent of protein in body in male and female subjects.

Sex	No. of Subject	Range of Percent Protein in body	Mean (Percent)
Male	30	14.50 – 21.00	17.53
Female	24	14.75 – 19.50	17.28

TABLE – XVI : Table showing Mean percent of protein in body in vegetarian and non-vegetarian subjects.

Sex	No. of Subject	Range of Percent Protein in body	Mean (Percent)
Vegetarian	27	15.50 – 19.50	17.65
Non-vegetarian	27	14.50 – 21.00	17.17

It is clear from the table XV and XVI, that the mean percent of protein content in body is more in the males and in the vegetarians (17.53 percent and 17.65 percent) than the females and non-vegetarians (17.28 percent and 17.17 percent) respectively.

DISCUSSION

The plasma protein estimation is a valuable, informative procedure which can indicate many symptomatic or asymptomatic disease conditions. Furthermore, it denotes the protein status of the body, and in fact it reflects the total amount of protein present in the body.

The present study was carried out among 54 healthy subjects of both sexes. Among the 30 male subjects the mean plasma protein level was found to be 7.01 gm/dL (Range 5.8 – 8.4 g/dL), S.D. 0.56, S.E. 0.103.

In 24 females the mean plasma protein level was found to be 6.90 g/dL (Range 5.9 – 7.8 g/dL), S.D. 0.43, S.E. 0.088 respectively. On comparison, the difference between mean level of plasma protein in male and female was statistically insignificant with $t = 0.713$, $p > 0.5$.

The albumin and fibrinogen level in the male was slightly more than the females. Globulins were increased among females on comparison.

The difference between mean percent of protein content of body was statistically insignificant in males and females as in the case of mean plasma protein level.

The 27 vegetarian subjects have a mean plasma protein level 7.06 g/dL, with S.D. 0.42 and S.E. 0.080 respectively.

The 27 non-vegetarian subjects have a mean plasma protein level 6.87 g/dL, with S.D. 0.57 and S.E. 0.110.

On comparison the difference between the mean level of plasma protein among vegetarians and non-vegetarians was found to be statistically insignificant. As stated above (in Review of Literature) the type of protein synthesized in the body depends upon origin of the protein ingested, here also this can be seen since, the vegetarians have increased level of globulins (mean 2.94 g/dl) than the non-vegetarians (mean 2.70 g/dL). On the other hand non-vegetarians have increased level of albumin (mean 3.93 g/dL) than the vegetarians (mean 3.86 g/dL). Fibrinogen level have variable tendencies.

Table XIII and XIV shows the mean plasma protein level in male and female vegetarians and non-vegetarians. Here the vegetarians (male and female) have better level of plasma protein than non-vegetarians of either sex.

The present protein in body varies with the level of plasma protein. The total amount of body protein depends upon the body weight. As stated above the body protein is divisible into 2 pools –

(I) Exchangeable pool –

- Plasma Protein – 2%
- Tissue Protein – 66%

(ii) Non-exchangeable pool –

- Tissue Protein – 32%

All metabolic either anabolic or catabolic process of the body involves the exchangeable pool while the non-exchangeable pools remains inert. So the plasma protein maintains its relationship with the exchangeable pool of tissue protein.

The fat and water content of the body affects the protein content of the body. When in a body the protein content declines (i.e. as in protein malnutrition) the water content correspondingly increases. Furthermore when a body gains protein, the water content again increases since protein containing tissues of the body are rich in water (e.g. skeletal muscle contains 75% water).

But, in the case of fat there is an inverse relationship between it and the water content of the body. As a body gets more fat its water content declines. Converse is also true.

Since the water content of the body may vary to a broader range e.g. from 50% to 70%, it plays a very important role in balancing the composition of the body. It now appears that with 70% of body water, there will be least amount of fat in the body. On the other hand when body contains 50% water there will be maximum possible amount of fat in the body.

When a body gains protein – It also gains water, so there will be decline

in the fat content of the body.

The plasma protein level of the subjects with PII more than 0.6 was found to be within normal range. This shows that even if a subject takes protein at 0.6 gram per kg body weight, he can have good protein status.

The A.:G ratio of the subject studied was found normal. The mean was 1.41 with S.D. 0.29 and S.E. 0.04.

CONCLUSION

The plasma protein level in the study group is almost identical with the standard reference level.

There is no significant effect of type of diet like vegetarian or non-vegetarian on the protein status of the body. No statistically significant difference has been found between the protein status of male and female subjects. The plasma protein level serves as a useful index for determining the total protein content of the lean body. This establishes a relationship between the level of plasma protein with the body weight.

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