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Original Research Article

Plasma Protein Patterns in Sudanese Patients with Schistosoma Mansoni Using Protein Electrophoresis

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Abstract: Schistosomiasis is the third most devastating tropical disease in the world (200,000 deaths annually). A protective granulomatous response is initiated by the arrival of eggs in the liver. The response results in chronic liver fibrosis as the infection progresses. This complication has an impact on the liver function. The aim of the study was to evaluate the effect of Schistosoma Mansoni on the plasma protein patterns. The study was conducted on 32 adult's patients with Schistosoma Mansoni and 41 adults' healthy individuals at New Half a (Sudan) during the period from 2008 to 2010. Serum protein was analysed by electrophoresis and photometric method. The mean values in g/dL± SD of the different protein patterns in the patients group are as follows: Total proteins: (7.19 g/dL ± 0.80), albumin: (3.29 g/dl ± 0.61), α-1: (0.43 g/dl ± 0.22), α-2: (1.37 g/dl ± 0.43), β-1: (1.12 g/dl ± 0.68), β-2: (0.58 g/dl ± 0.21), and γ: (0.87 g/dl ± 0.50). The mean values in g/dL± SD of the different patterns in the control group are as follows; Total proteins: (7.29 g/dl ± 0.61), albumin: (4.01 g/dl ± 0.54). α-1: (0.27 g/dl ± 0.12), α-2: (1.26 g/dl ± 0.46), β-1: (0.94 g/dl ± 1.02), β-2: (0.57 g/dl ± 0.18), and γ- globulins: (0.84 g/dl ± 0.18). The results showed that there was a significant decrease in albumin and an increase in α-1 globulins in patients group when compared to the control group. There were no differences in the remaining patterens. The study concluded that schistosoma mansoni infection may be one of the causes of low plasma albumin and increased alpha-1 globulin in Sudan. The Hypoalbuminemia may be attributed to decreased synthesis due to less albumin mRNA in hepatocytes or attributed to malabsorption due to damaged intestinal mucosa resulting from the extrusion of large numbers of eggs.
Keywords: electrophoresis, schistosoma mansoni, New Halfa

INTRODUCTION:

Schistosomiasis is a parasitic disease caused by blood flukes (trematodes) of the genus Schistosoma [1]. This infectious disease involves more than 200 million people in the world [2], and an estimated 700 million people are at risk of infection in 76 countries where the disease is considered endemic [3]. The S. mansoni females deposit eggs in the small venules of the portal and peri vesical systems. The eggs are moved progressively toward the gastrointestinal tract. The major target organs of egg deposition during S. mansoni infection are the liver and intestine [4]. The arrival of eggs in the liver during Schistosoma mansoni infection initiates a protective granulomatous response. As the infection progresses, this response results in chronic liver fibrosis [5]. In the intestine the egg damages the intestinal mucosa [6].

Granuloma and marked fibrosis in the hepatic venules resulting from immunological response to schistosome eggs are characteristics of liver involvement [7]. Hepatocellular function is affected by the presence of hepatic granulomas around deposited schistosome eggs [6].

Early disease usually improves with treatment, but if left untreated it leads to serious outcomes. These include; portal hypertension. severe pulmonary hypertension, spinal cord schistosomiasis, cardiopulmonary involvement, obstructive nephropathy

and the co-infection with hepatitis, HIV, and malaria which can raise the risk of both hepatocellular carcinoma and mortality [8].

Plasma proteins:

Albumin comprises about one-half of the serum protein. It is synthesized in the liver at a rate of 120 mg/kg daily. The synthetic rate can be doubled when serum albumin falls **[**9]. Disease alter albumin by altering synthesis, increasing degradation, or by extra vascular loss **[**10]**.**

The serum albumin level is considered a reliable marker for determining the severity of liver diseases and their prognosis [11].

The alpha (α) and beta (β) globulin fractions are also predominantly produced in the liver. These fractions include proteins involved in the normal inflammatory response (acute phase proteins), proteins involved in lipids and iron transport. Significant increases in these fractions are seen primarily with inflammation, while decreases are mainly noted with liver disease (decreased production) [12].

Immunoglobulin (antibodies) produced in response to material or organisms that are foreign to the body, are found in the γ globulin fraction [13]. Immunoglobulins increase in chronic infections, immune-mediated disease processes, some cancers and certain viral diseases, and some infectious conditions [14]. Their decreases are unusual and are seen in very young infants who may have not received sufficient colostrums [15].

Rationale:

- Electrophoresis is important in evaluating the overall pattern of change in one single test.
- Relatively little is known about the procedure and interpretation of results of electrophoresis in Sudan.
- Training in electrophoresis will indeed extend our experience in this field, allowing most institutions to carry on the same procedure.
- Performing electrophoresis locally will decrease the cost of investigation compared to the high cost when doing it outside the Sudan.

General objective:

To study the serum protein patterns in Sudanese adults with endemic diseases (S. mansoni) using electrophoresis.

Specific objectives:

To

1. Introduce the protein electrophoresis technique in Sudan. This will significantly improve the chance of resolving a complex mixture of proteins into individual constituents, and so improve diagnosis.
2. Provide new information (our own data) on the plasma protein patterns in Sudan, and to compare the results with those obtained from some countries.
3. Determine the impact of some diseases (mainly endemic) on the plasma protein concentration and fractions.
4. Evaluate the performance of the test regarding diagnostic and prognostic parameters in plasma protein.

MATERIALS AND METHODS:

Study Design:

Cross- sectional, case control study.

Study Area:

This study had been conducted in New Halfa. **(**Sudan**)**

Study Duration:

From July 2008 up to 2010

The Study Groups:

A. Patients group (S. mansoni):
Sample size is 32 adults with S. mansoni attending New Halfa Hospital. Selection of patients was based on the direct microscopy of stool and the concentration method.

B. The control group (Healthy individuals):
Sample size is 41 healthy individuals. Individuals with diseases, or taking drugs known to affect serum protein levels or electrophoretic patterns were excluded. Among drugs known to affect serum protein levels or electrophoretic patterns are; Phenytoin, procainamide, oral contraceptives, methadone, therapeutic gamma globulin, aspirin, bicarbonates, chlorpromazine, corticosteroids, and neomycin.

Laboratory analysis:

Five milliliters of blood samples were collected from each individual, serum were separated and analysed immediately for:

A. Serum protein electrophoresis (SPE):
Serum protein electrophoresis (SPE) for the participants and reference sera was undertaken using the Biotec Fischer Protein kit on the Filippo system (Biotec Fischer W. Germany).

B. **Serum Total Protein:**
Serum total protein concentrations were measured photo metrically using the Biuret reaction, on BA Semi- Auto chemistry analyzer. Results were compared with the published reference range.

Statistical Analysis:

Statistical analysis was performed by the statistical software SPSS 16. The data were presented as mean ± SD, and the range. The means of the patients and the control protein patterns were compared using ANOVA test. $P \leq 0.05$ was considered statistically significant

RESULTS:

A. Patients group:

The mean values in g/dL± SD of the different patterns in the patients group are as follows; total proteins (7.19 g/dL ± 0.80), albumin (3.29 g/dl ± 0.61), α-1 (0.43 g/dl ± 0.22), α-2 (1.37 g/dl, ± 0.43), β-1 (1.12 g/dl, ± 0.68), β-2 (0.58 g/dl ± 0.21), and γ (0.87 g/dl ± 0.50).

B. Control Group:

The mean values in g/dL± SD of the different patterns in the control group are as follows; total proteins (7.29 g/dl, ± 0.61), albumin (4.01 g/dl ± 0.54). α-1 (0.27 g/dl ± 0.12), α-2 (1.26 g/dl ± 0.46), β-1 (0.94 g/dl ± 1.02), β-2 (0.57 g/dl ± 0.18), and γ- globulins (0.84 g/dl ± 0.18).

C. Comparison Between The Patients And The Control:

The study revealed that there was a significant difference in the albumin and alpha-1 levels between the patients and the control. (Table-3)

Table- 1: The mean values of the different protein patterns of the patients group

Protein patterns	No	Mini (g/dl)	Max (g/dl)	Mean (g/dl)	SD
Total protein	32	5.9	8.6	7.19	0.81
Albumin	32	2.2	4.6	3.29	0.61
α1	32	0.2	1.5	0.43	0.22
α2	32	0.3	2.4	1.37	0.43
β1	32	0.3	2.9	1.12	0.68
β2	6	0.3	0.8	0.58	0.21
γ	32	0.1	2.2	0.87	0.50

Table- 2: The mean values of the different protein patterns of the control group

Protein patterns	No	Mini (g/dl)	Max (g/dl)	Mean (g/dl)	SD
Total protein	41	5.9	8.3	7.3	0.61
Albumin	41	3.1	5.2	4.01	0.54
α1	41	0.1	0.7	0.27	0.12
α2	41	0.4	2.1	1.26	0.46
β1	41	0.2	1.6	0.94	1.02
β2	7	0.3	0.8	0.57	0.18
γ	41	0.2	1.8	0.84	0.48

Table-3: Comparison of the mean between patients and control group

Pattern		Sum of Squares	df	Mean Square	F	Sig.
T P	Between Groups	.190	1	.190	.386	.536
	Within Groups	34.871	71	.491		
	Total	35.061	72			
ALB	Between Groups	9.277	1	9.277	28.168	.000
	Within Groups	23.383	71	.329		
	Total	32.659	72			
A1	Between Groups	.477	1	.477	15.853	.000
	Within Groups	2.138	71	.030		
	Total	2.615	72			
A2	Between Groups	.197	1	.197	.966	.329
	Within Groups	14.470	71	.204		
	Total	14.667	72			
B1	Between Groups	1.681	1	1.681	6.344	.014
	Within Groups	18.818	71	.265		
	Total	20.500	72			
B2	Between Groups	.000	1	.000	.012	.915
	Within Groups	.423	11	.038		
	Total	.423	12			
G	Between Groups	.017	1	.017	.069	.794
	Within Groups	17.224	71	.243		
	Total	17.241	72			

DISCUSSION:

The significant reduction of the plasma albumin in the patients group (3.294 g/dl) compared to that of the control group (4.012 g/dl), (P: 0.000) is in agreement with previous studies which found a significant reduction in serum albumin during schistosoma mansoni. A study of El-Lakkany [6] related the reduction of serum albumin to decreased synthesis due to less albumin mRNA which may result from parasitic injury to hepatic cells. El-Lakkany also related reduction of serum albumin to malabsorption due to damaged intestinal mucosa resulting from the extrusion of large numbers of eggs.

The results also showed that there is a significant increase in alpha-1 region. This increase may be due to the increase in the alpha-1 acid glycoprotein. This finding is in agreement with Amin [16] who suggested that increase in alpha-1 region was attributed to the increase in the synthesis of the alpha-1 acid glycoprotein as a consequence of inflammatory processes in infection with schistsomiasis. We also agree with Harvie [17] who suggested that in schistosome infection, proteins associated with stress responses, acute phase reactants, and structural components were all significantly increased.

CONCLUSION:

The study concluded that schistosoma mansoni infection may be one of the causes of low plasma albumin and increased alpha-1 globulin in Sudan. The hypoalbuminemia may be attributed to decreased synthesis due to less albumin mRNA in hepatocytes or attributed to malabsorption due to damaged intestinal mucosa resulting from the extrusion of large numbers of eggs.

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