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BLOOD BIOCHEMICAL AND HAEMATOLOGICAL ALTERATIONS IN *SCHISTOSOMA MANSONI* INFECTED PATIENTS IN IJORA – BADIA NIGERIA

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ABSTRACT
Schistosomiasis is an infection of significant health concern. The aim of this study was to assess the alterations of some blood biochemical and haematological parameters in *Schistosoma mansoni* infected patients. Blood specimens were collected from 35 patients infected with 2+ ova of *Schistosoma mansoni* (experimental group) and another 35 subjects with no evidence of *Schistosoma mansoni* infection (control group) into lithium heparinized and ethylene diamine tetraacetic acid (EDTA) anticoagulated bottles respectively. The following biochemical and haematological parameters were measured using the specified methods: alanine aminotransferase (colorimetric), aspartate aminotransferase (colorimetric), alkaline phosphatase (colorimetric endpoint), total bilirubin (Jendrassik and Grof), total protein (biuret), albumin (bromocresol green), C-reactive protein (latex turbidimetry), haemoglobin (cyanmethaemoglobin), erythrocyte sedimentation rate (westergren) and total white blood cell count (improved neubauer chamber). The results showed that the mean values of plasma alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total bilirubin, total protein, albumin, C-reactive protein, blood haemoglobin, erythrocyte sedimentation rate and total white blood cell count were statistically significant ($p \leq 0.05$) in the experimental group as compared with the mean values of the control group. However, the mean values of plasma cholesterol and uric acid were not statistically significant ($p \geq 0.05$) in the experimental group as compared with that of the control group. The percentage of subjects in the experimental group having plasma alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total bilirubin, cholesterol, uric acid, C-reactive protein, erythrocyte sedimentation rate and total white blood cell concentrations above the existing reference ranges maximum of 12.0U/I, 12.0U/I, 35.0 IU/L, 17.0 µmol/L, 5.17 mmol/L, 416µmol/L, 6.0mg/L, 7.0mm and 11.0×10^3cmm were 80%, 74%, 57%, 57%, 20%, 17%, 66%, 60% and 57% respectively while the percentage of subjects in the experimental group with concentrations lesser than the existing reference ranges minimum of 64g/l (total protein), 38g/l (albumin) and 12g/dl (haemoglobin) were 74%, 74% and 60% respectively. In conclusion this study has shown that the above mentioned blood biochemical and haematological parameters with statistical significant mean values are altered in chronic *Schistosoma mansoni* infection.

KEYWORDS: *Schistosoma mansoni infection*, blood biochemical alterations, blood haematological alterations, Ijora-Badia, Nigeria.

INTRODUCTION
Schistosomiasis also known as bilharziasis is an infection of parasitic origin that is caused by trematodes and often infects humans. There are four main species that infect humans and these are: *Schistosoma mansoni*, *Schistosoma haematobium*, *Schistosoma japonicum* and *Schistosoma mekongi*, however, among these species it is only *Schistosoma haematobium* that is associated with urinary schistosomiasis, others are associated with intestinal schistosomiasis.[1]

This infection is considered by World Health Organization (WHO) as the second to malaria socioeconomically among the parasitic infections and

third among the infections of parasitic origin that is of significant public health concern.[2] Previous literatures have reported this infection as extremely prevalent in Middle East, Caribbean, South America, certain tropical as well as sub tropical areas of sub-Saharan Africa[3] with Yemen, Algeria and Egypt currently having the largest number of cases.[4] The largest and latest epidemiological survey in Egypt revealed that the upper Egypt is having about 7.8% prevalence of *Schistosoma haematobium* infection while the lower Egypt has about 36.4% prevalence of *Schistosoma mansoni* infection.[5]

However, continuous researches in this area are still been advocated for in order to completely unfold the health burden of this infection which is reported to be responsible for high rate of morbidity and mortality in humans.[6,7] This present study is therefore aimed at evaluating the changes in some blood biochemical and haematological parameters in patients infected with *Schistosoma mansoni* in Ijora-Badia Lagos State of Nigeria.

MATERIALS AND METHODS

Seventy subjects who as at the time of conducting this research work were free from any ailment and were not on any therapeutic drugs were recruited for this study.

The consents and approval from these subjects who were referred to Quality Diagnostic Laboratories Ijora-Badia, Lagos State, Nigeria by some private hospitals in Lagos state were obtained before the commencement of this study. These subjects were classified into two groups, the first group consisted of thirty five subjects of both sexes within the age range of 35-50 years whose stool samples upon direct smear microscopic examination using × 40 objective were found to be infected with 2+ 0va of *Schistosoma mansoni* (experimental group) while the other group consisted of 35 subjects of both sexes within the age range of 35-50 years whose stool samples upon direct smear microscopic examination using ×40 objective were found not to be infected with ova of *Schistosoma mansoni* (control group).

10ml blood specimen was withdrawn from each of these subjects via a standard venipuncture technique with 5ml dispensed into lithium heparinized and ethylene-diamine-tetra acetic acid (EDTA) anticoagulated bottles respectively. The specimens in the lithium heparinized anticoagulated bottles were gently mixed, spun for 10 minutes at 1,500 revolution/minute using Gulfex Medical and Scientific Macro Centrifuge model 800D England and the plasma obtained used for the quantitative measurement of biochemical parameters while the blood samples in the ethylene diamine tetra acetic acid (EDTA) anticoagulated bottle were gently mixed and used for the quantitative measurement of haematological parameters.

Biochemical Parameters: The following blood biochemical parameters were quantitatively measured with S23A13192 model spectrophotometer using the specified methods: alanine aminotransferase (ALT), colorimetric method as described in the manual of 11th February, 2009 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT294QY, United Kingdom[8,9], aspartate aminotransferase (AST), colorimetric method as described in the manual of 5th January, 2007 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT294QY, United Kingdom[10,11], alkaline phosphatase (ALP), colorimetric endpoint method as described in the manual of September, 2001, A506 edition of Teco Diagnostics, 1268N, Lakeview Avenue, Anaheim, CA92807, 1-800-222-9880[12], total bilirubin, colorimetric method as previously described by Jendrassik and Grof in 1938 and revised in the manual of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT 294QY, United Kingdom[13], total protein, Biuret method as described in the manual of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT294QY, United Kingdom[14,15], albumin, Bromocresol green method as described in the manual of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT294QY, United Kingdom[16,17], cholesterol, enzymatic endpoint method as described in the manual of 22nd May, 2009 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT294QY, United Kingdom[18,19], uric acid, enzymatic colorimetric method as described in the manual of 20th October, 2009 revised edition of Randox Laboratories Limited, 55, Diamond Road, Crumlin, County Antrim, BT294QY, United Kingdom[20], C-reactive protein, Latex turbidimetry method as described by Spin-react Diagnostic manual Spain.[21,22]

Haematological Parameters: The following haematological parameters with the specified methods were quantitatively measured in the ethylene diamine tetraacetic acid (EDTA) anticoagulated blood samples: haemoglobin, cyan methaemoglobin method as described by[23], erythrocyte sedimentation rate (ESR), westergren method as described by[24], total white blood cell count (WBC) measurement using the Improved Neubauer Chamber Counting method as described by.[25]

Statistical analysis: The results obtained were expressed as mean and standard deviation, while the differences between the control and experimental groups were assessed using the student's 't' tests with the results considered statistically significant at $p \leq 0.05$.

RESULTS AND DISCUSSION

In this study the mean values of blood biochemical and haematological parameters in the control group were compared with that of the experimental group as shown in Tables 1 and 2, while Table 3 shows the percentage of patients in the experimental group with values greater than the existing reference ranges maximum as well as those lesser than the existing reference ranges minimum

for the quantitatively measured blood biochemical and haematological parameters.

The results from this study showed that the mean values of the liver parameters: plasma alanine aminotransferase (ALT), plasma aspartate aminotransferase (AST), plasma alkaline phosphatase (ALP) and plasma total bilirubin were significantly higher statistically ($p \leq 0.05$) in the experimental group as compared with that of the control group as shown in Table 1. These findings affirm that *Schistosoma mansoni* infection damages the membrane of liver, a situation which presumably may be responsible for the significant elevation of these liver parameters in the plasma of the experimental group as confirmed in this study which is in agreement with the previous work of.[26] 80%, 74%, 57% and 57% of the *Schistosoma mansoni* infected patients (experimental group) as confirmed in this present study were found to have elevated plasma alanine aminotransferase (ALT), plasma aspartate aminotransferase (AST), plasma alkaline phosphatase (ALP) and plasma total bilirubin concentrations greater than the existing reference ranges maximum of 12U/I, 12U/I, 35IU/L and 17µmol/L respectively, these findings which are quite significant are as shown in Table 3.

It was further revealed in this study that the mean values of plasma total protein and plasma albumin were significantly lower statistically ($p \leq 0.05$) in the experimental group as compared with that of the control group as shown in Table 1. This finding which is confirmed in this study is in agreement with the previous work of[27] who attributed these lower mean values to mal-absorption, which may be due to damaged intestinal mucosa resulting from the extrusion of large number of egg. However, as shown in Table 3, 74% of the *Schistosoma mansoni* infected patients were found to have lower plasma total protein and plasma albumin concentrations respectively lesser than the existing reference ranges minimum of 64g/l and 38g/l respectively. This finding which is quite significant is as confirmed in this present study.

The results from this present study showed that the mean values of plasma cholesterol and plasma uric acid in the experimental group were not significantly different ($p \geq 0.05$) from that of the control group as shown in Table 1. However, as shown in Table 3, 20% and 17% of these subjects showed both plasma cholesterol and plasma uric acid concentrations greater than the existing reference ranges maximum of 5.17mmol/L and 416µmol/L respectively as confirmed in this present study.

The result from this study showed that the mean value of plasma C-reactive protein (Crp) in the experimental group was significantly elevated statistically ($p \leq 0.05$) as compared with that of the control group as shown in Table 1. This finding which is confirmed in this present study may be attributed to the invasive infection of ova of *Schistosoma mansoni* which presumably has led to inflammation with the resultant elevation of plasma concentration of C-reactive protein (Crp). However, as shown in Table 3, 66% of these infected patients (experimental group) showed elevated plasma C-reactive protein (Crp) concentration greater than the existing reference ranges maximum of 6.0mg/L as confirmed in this present study.

The result from this study showed that the mean value of haemoglobin in the *Schistosoma mansoni* infected patients (experimental group) was significantly lesser statistically ($p \leq 0.05$) as compared with that of the control group as shown in Table 2. This finding is in agreement with the previous work of[28] who attributed this statistically significant lesser mean value of haemoglobin to be due to the massive consumption of blood by the adult schistosomes. However, evidence from this study revealed that 60% of the *Schistosoma mansoni* infected patients (experimental group) had lesser haemoglobin concentration than the minimum reference range of 12g/dl as shown in Table 3 which is suggestive that *Schistosoma mansoni* infected patient are prone to anaemia.

The result from this study showed that the mean value of erythrocytes sedimentation rate (ESR) in the *Schistosoma mansoni* infected patients (experimental group) was significantly elevated statistically ($p \leq 0.05$) as compared with that of the control group as shown in Table 2. This finding as confirmed in this study is presumed to be due to blood loss which may have resulted from bleeding as a result of the migration of worms through the intestinal wall and/or due to the consumption of blood by the adult schistosomes as supported by.[29] However, evidence from this study showed that 60% of the *Schistosoma mansoni* infected patients (experimental group) had elevated erythrocyte sedimentation rate (ESR) than the maximum reference range of 7mm as shown in Table 3.

The result from this study also showed that mean value of total white blood cell (WBC) count in the *Schistosoma mansoni* infected patients (experimental group) was significantly lesser statistically ($p \leq 0.05$) as compared with that of the control group as shown in Table 2. The result agrees with the previous work of[30] who reported significant decrease in total white blood cell (WBC) count in mice infected with schistosomiasis. However, as confirmed in this study, 57% of the *Schistosoma mansoni* infected patients were found to have decreased total white blood cell (WBC) count than the existing reference range minimum of 4×10^3 cmm as shown in Table 3.

Table 1: Results of the biochemical parameters measured in the control and experimental groups.

Parameters	Control Group (n=35)	Experimental Group (n=35)	Remark
ALT (U/I)	6.2 ± 0.18	25.0 ± 0.63	S
AST (U/I)	7.1 ± 0.25	20.1 ± 0.68	S
ALP (IU/L)	20.0 ± 2.40	40.2 ± 3.72	S
T. Bil.(µmol/L)	12.0 ± 1.40	27.3 ± 2.08	S
T. Prot.(g/L)	71.0 ± 3.22	50.2 ± 2.10	S
Albumin (g/L)	40.0 ± 2.71	30.1 ± 1.80	S
Cholesterol (mmol/L)	2.2 ± 0.22	2.3 ± 0.23	NS
Uric acid(µmol/L)	210.0 ± 2.82	209.0 ± 2.80	NS
Crp (mg/L)	2.7 ± 0.85	12.3 ± 3.24	S

NS: Not statistically significant, S: Statistically significant, n: Number of subjects, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, ALP: Alkaline phosphatase, T.Bil: Total bilirubin, T. Prot: Total protein, Crp: C-reactive protein.

Table 2: Results of haematological parameters measured in the control and experimental groups.

Parameters	Control Group (n=35)	Experimental Group (n-35)	Remark
Hb (g/dl)	13.2 ± 1.27	7.0 ± 0.42	S
ESR (mm)	5.0 ± 0.28	16.0 ± 1.49	S
WBC (cmm)	8.0×10^3 ± 2.10	2.5×10^3 ± 0.12	S

S: Statistically significant, Hb: Haemoglobin, ESR: Erythrocyte sedimentation rate, WBC: White blood cell.

Table 3: The percentage of patients in the experimental group with values greater than the existing reference ranges maximum and lesser than the existing reference ranges minimum for the measured blood biochemical and haematological parameters.

Parameters	Reference Ranges	Experimental Group (n=35)
ALT (U/I)	(upto 12.0)	80 (28)
AST (U/I)	(upto 12.0)	74 (26)
ALP (IU/L)	(9-35)	57 (20)
T. Bil (µmol/l)	(upto 17.0)	57 (20)
T.Prot (g/l)	(64-83)	74 (26)*
Albumin (g/l)	(38-44)	74 (26)*
Cholesterol (mmol/l)	(≤ 5.17)	20 (7)
Uric acid (µmol/l)	(142-416)	17 (6)
Crp (mg/L)	(≤ 6.0)	66 (23)
Haemoglobin (g/dl)	(12-15)	60 (21)*
ESR (mm)	(3-7)	60 (21)
WBC (cmm)	$(4\text{-}11\times10^3)$	57 (20)*

*n: Number of subjects in experimental group, number of subjects in the experimental group with values greater than the existing reference ranges maximum are in parenthesis, *: number of subjects in the experimental group with values lesser than the existing reference ranges minimum are in parenthesis.*

CONCLUSION

In conclusion, this present study has shown that the concentrations of plasma alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, total protein, albumin, cholesterol, uric acid, C-reactive protein (crp), haemoglobin (Hb), erythrocyte sedimentation rate (ESR) and total white blood cell (WBC) count are significantly altered in 80%, 74%, 57%, 57%, 74%, 74%, 20%, 17%, 66%, 60%, 60% and 57% of the *Schistosoma mansoni* infected patients respectively. These alterations as confirmed in this study may be associated with the huge health burden imposed on humans by this parasite.

Recommendation

It is recommended that efforts should be intensified by the appropriate agencies/ authorities to improve sanitation, reduce exposure to contaminated water, intermediate host of the parasite (snail) and cercariae shed by the intermediate host (snail).

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