Effect of *azadirachta indica* extract on plasma lipid levels in human malaria


Lipid and Lipoprotein Research Unit, Department of Biochemistry, University of Nigeria, Nsukka, NIGERIA

*Correspondence

Pervenuto in Redazione il 20 settembre 1999

INTRODUCTION

Various disease states are known to affect the levels of serum lipids (1-3). The levels are also affected by such factors like diet, age, drug, sex, genetic factors and socioeconomic status of the individuals (4). Human malaria persists as a major disease in tropical countries, despite all attempts to eradicate the disease (5-6).

*Plasmodium vivax, falciparum, ovale, and malariae* are the most common in areas where malaria is endemic (5,6). It is well known that the liver is involved in both the pre- and exo-erythrocytic cycles of the parasite (6) and lipid metabolism also is a hepatic function (7).

There are contrasting reports on serum lipid levels in malaria especially in different countries where malaria is endemic. Some patients studied were on conventional anti-malarial drugs: chloroquine phosphate, primaquine, quinine, pyrimethamine, sulphadoxine, as well as Ayurvedic antimalarial preparation (8,9,10).

In Nigeria, a plant extract *Azadirachta indica* is extensively used for the treatment of malaria.

There are no reports to the best of our knowledge on plasma lipids of patients treating malaria with the plant extract of *Azadirachta indica*.

MATERIALS AND METHODS

Blood samples were collected from 43 patients between the ages of 17 - 56 years (average, 28 years) who reported at Bishop Shanahan Hospital Laboratory, Nsukka, and the University of Nigeria Medical Centre, Nsukka Campus with complaints of malaria.

These patients were not suffering from any ailment known to affect lipid metabolism.

One hundred patients were tested for infection and parasitaemia, but only these 43 were found positive carriers of the parasite.

The patients volunteered to participate in the study, and fasting blood samples were collected during malaria infection. Some patients were treated with chloroquine, noscapine, panadol, and B-complex vitamins, while others preferred being treated with the crude extract of *Azadirachta indica*. The drugs are not known to affect lipid metabolism (8).

Degree of infection was determined by the degree of parasitaemia following examination of Leishman-stained blood smears for parasite.

The parasite was identified as *Plasmodium falciparum*. State of infection was classified as severe.

For the follow-up studies (i.e during therapy), all the pa-
All blood samples were collected after an overnight fast of 12 hours and plasma was separated by low speed centrifugation. The lipid assay was carried out in triplicates, and all chemicals and reagents were of analytical grade. Plasma cholesterol was measured by the method of Searcy and Berquist, HDL-cholesterol by the method of Burnstein et al., LDL-cholesterol by the method of Fraedewald et al. and Triacylglycerol by the method of Gottfried and Rosenberg. Statistical analysis was by students t-test.

**RESULTS**

Cholesterol levels were found to be lower during malaria therapy using different drugs (Table I), and the decrease was statistically significant (p < 0.01) while triacylglycerol and HDL cholesterol levels were higher. LDL cholesterol was lower during malaria therapy than in non-malaria (control) groups. Tables II and III show sex differences in lipid levels during malaria therapy using different drugs. The patients exhibited similar pattern in plasma lipids when compared to the non-malaria patients (control) group.

**Table I. Plasma lipid levels in malaria patients on different therapy.**

<table>
<thead>
<tr>
<th></th>
<th>Total cholesterol mg/100ml</th>
<th>Triacylglycerol mg/100ml</th>
<th>HDL-C mg/100ml</th>
<th>LDL-C mg/100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria patients treated with Chloroquine, Novalgin, Panadol, and B-complex vitamin (8)</td>
<td>119.8±20.6</td>
<td>158.2±24.5</td>
<td>75.3±22.3</td>
<td>68.7±31.2</td>
</tr>
<tr>
<td>Malaria patients treated with plant extract, <em>Azadirachta indica</em> (25)</td>
<td>112.3±11.7</td>
<td>152.8±26.9</td>
<td>82.1±22.3</td>
<td>66.5±30.6</td>
</tr>
<tr>
<td>Control group (22)</td>
<td>162.5±19.2</td>
<td>118.2±18.7</td>
<td>71.6±23.1</td>
<td>114.6±32.1</td>
</tr>
</tbody>
</table>

**Table II. Sex differences of lipid levels in malaria patients on different therapy (males).**

<table>
<thead>
<tr>
<th></th>
<th>Total cholesterol mg/100ml</th>
<th>Triacylglycerol mg/100ml</th>
<th>HDL-C mg/100ml</th>
<th>LDL-C mg/100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria patients treated with Chloroquine, Novalgin, Panadol, and B-complex vitamin (8)</td>
<td>116.3±18.7</td>
<td>159.2±27.9</td>
<td>55.6±23.6</td>
<td>68.9±32.6</td>
</tr>
<tr>
<td>Malaria patients treated with plant extract, <em>Azadirachta indica</em> (12)</td>
<td>100.7±21.5</td>
<td>177.0±28.6</td>
<td>75.0±22.4</td>
<td>80.4±33.0</td>
</tr>
<tr>
<td>Control group (10)</td>
<td>151.2±16.1</td>
<td>122.0±18.7</td>
<td>76.0±25.3</td>
<td>99.5±34.0</td>
</tr>
</tbody>
</table>
Table III. Sex distribution of lipid levels in malaria patients on different therapy (females)

<table>
<thead>
<tr>
<th></th>
<th>Total cholesterol mg/100ml</th>
<th>Triacylglycerol mg/100ml</th>
<th>HDL-C mg/100ml</th>
<th>LDL-C mg/100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria patients treated with Chloroquine, Novalgin, Panadol, and B-complex vitamin (8)</td>
<td>117.0±22.5</td>
<td>174.0±8.2</td>
<td>52.0±18.9</td>
<td>58.5±33.8</td>
</tr>
<tr>
<td>Malaria patients treated with plant extract, Azadirachta indica (25)</td>
<td>128.9±19.5</td>
<td>154.1±23.6</td>
<td>93.1±19.4</td>
<td>74.5±52.1</td>
</tr>
<tr>
<td>Control group (22)</td>
<td>172.1±16.4</td>
<td>115.0±19.2</td>
<td>67.9±20.6</td>
<td>127.8±25.2</td>
</tr>
</tbody>
</table>

*statistically significant (p < 0.01)
Figures in parentheses indicate the number of cases.

**DISCUSSION**

The results show that the levels of plasma cholesterol, but not triacylglycerol and HDL cholesterol were significantly lower in malaria patients during therapy using different antimalarial drugs than the control group (p < 0.01). Our present study also supports earlier work on the plasma lipid changes during malaria infection and therapy in human.

A lot of factors are known to affect plasma lipids. Such factors include diet, age, sex, drugs, genetic factors, and the socio-economic status of the individual.

A lot of work on serum lipids in malaria have been reported especially on patients during infection, therapy, and after infection.

Most studies have consistent results especially on cholesterol levels but not lipoprotein patterns. Different therapies are used in different countries where malaria is endemic. Most countries use chloroquine phosphate, primaquine, quinine, pyrimethamine, and sulphadoxine as their choice drugs. Similarly, in many rural areas of Asia and Africa especially in Nigeria where malaria is endemic, most patients prefer crude drugs especially of plant origin. In Nigeria, the plant Azadirachta indica is a common crude drug preparation used extensively for malaria treatment.

The plant is macerated, soaked in water and taken orally. Some people also take it daily as a primitive therapy against malaria infection. It appears that a lot of literature supports cholesterol lowering effects of malaria patients who prefer to be treated in some of this antimalarial drug but not on the crude drugs especially of plant origin. This report therefore is of to our knowledge the first on patients treating malaria with the crude extract of Azadirachta indica on plasma lipid during infection. From our results, cholesterol levels were equally lower in patients who were treating malaria on this crude plant extract. Of interest also is the higher levels of HDL cholesterol and triacylglycerol in these patients. In an earlier study in our sister laboratory, the crude plant extract was found to have antioxidant properties. Peroxidation has been reported during malaria infection and its products could cause cancer. In our earlier study, we reported lower levels of Vitamin E. Different therapies have been advocated to protect the biological systems especially the tissues and membrane against products of peroxidation i.e., reactive oxygen species during malaria infection.

If this plant extract stabilises the membrane as has been observed and again lowers plasma lipids, especially cholesterol by decreasing possibly, the HDL lipoprotein fractions, then, the crude extract warrants further studies as to the active principle that may be involved in this therapeutic functions.

There are however, reports that the plant contains some active secondary metabolites especially flavonoids and saponins, and this might suggest its numerous roles in ethno-medicine.

These plant metabolites are known to exert hypolipidemic as well as antioxidant functions. It appears from this
study that possibly the cholesterol lowering effect associated with malaria may not be only from the host-parasite metabolism of the lipids as important precursors for synthesis of important biological compounds or for repair of tissues damaged during infection, but possibly to some pharmacological mediators produced during infection and therapy. This might from a practical point of view be useful in malaria cases associated with hyperlipidemia as such a drug might have dual roles.

Acknowledgement

The authors are grateful to the laboratory staff of St. Anthony’s Medical Diagnostic Laboratory, Nsukka, Nigeria for technical assistance.

References

18) Agomo P. U. and Akindele S. Cod liver oil and lipid peroxidation in malaria, the effect of high protein. Nig. J. Parasitol 1993, 14, 27.