

**Original article:**

**Ringworm: Evaluation of C-reactive Protein and Lipid Profile as well as Their Correlation with the Patients Age and Body Mass Index**

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**Abstract:**

**Objectives:** Ringworm is a common cutaneous fungal disease with worldwide distribution. It may lead to the abnormal c-reactive protein levels and metabolism of lipid. Thus this study has been designed for determining serum CRP and also evaluating the Lipid profile in patients associated with ringworm. **Materials and methods:** This study recruited 25 patients with ringworm (cases) and 25 healthy individuals (controls). A questionnaire of personal characteristics was completed for each patient and control. Inflammatory marker (CRP) and Serum lipid profile (total, low-density lipoprotein (LDL), high-density lipoprotein (HDL) cholesterol and triglyceride) was recorded for each case and control. The test of significance was applied for statistical analysis. **Results and discussion:** The mean serum CRP were  $1.608 \pm 0.14$  and  $0.648 \pm 0.03$  mg/dl and total cholesterol level were  $175.09 \pm 3.26$  and  $182.09 \pm 3.01$  mg/dl in ringworm patients and control subject respectively. It was also observed that the serum TG; HDL; LDL levels were  $131.76 \pm 3.07$  and  $139.84 \pm 3.47$  mg/dl;  $80.79 \pm 1.79$  and  $73.35 \pm 4.14$  mg/dl;  $67.95 \pm 4.64$  and  $86.55 \pm 3.70$  mg/dl in patients and control group respectively. The value of CRP was significantly increased in patients compared to control group ( $p < 0.05$ ). There was no significant difference of lipid profile study between patients and control. **Conclusion:** Findings of this study indicate increased concentrations of CRP in patients affected to ringworm and its role in this infection. Patients should thus be routinely screened for such abnormalities. Probably observation of lipid profile in healthy individuals in compare with patients group indicates that it has no relationship in case of ringworm.

**Keywords:** evaluation, ringworm, inflammatory marker, lipid profile, patients.

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**Introduction**

Ringworm is a common infection of the skin and nails that is caused by fungus. This is called “ringworm” because it can cause an itchy, red, circular rash. Ringworm is also called “tinea” or “dermatophytosis.” Approximately 40 different species of fungi can cause ringworm. The scientific names for the types of fungi are Trichophyton, Microsporum, and Epidermophyton<sup>1</sup>. These fungi can live on skin and in the environment. They can spread: from a person who has ringworm, from an animal that has ringworm and from the environment<sup>2</sup>. C-reactive protein (CRP) is an acute-phase protein.

It is mainly produced by hepatocytes as part of an inflammatory response. In addition to serving as a marker of systemic inflammation, CRP plays an important role in the inflammatory process where it is involved in opsonisation and activation of the complement system in response to IL-6 secretion<sup>3</sup>. It is significantly elevated and associated with dermatitis disease severity<sup>4</sup>. Increased CRP levels are also associated with adult chronic atopic dermatitis<sup>5</sup>, but it remains to be determined whether CRP could serve as a marker for disease severity.

Abnormal blood lipids are an increasing health problem in the world<sup>6</sup>. Abnormal lipid profile such as

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dyslipidaemia plays a crucial role in the development of cardiovascular diseases<sup>7</sup>. Dermatological disorders, such as psoriasis, are also associated with dyslipidaemias<sup>8</sup>. Some of the dermatological therapies are known to predispose to lipid abnormalities. The long-term associations between CRP and lipid profile with ringworm, however, are not known.

Several studies have been conducted among dermatitis patients in developed countries, there is a paucity of data in the regard of ringworm in Bangladesh. As the prevalence of ringworm patients is increasing day by day in our country, this study conducted to determine C- reactive protein and serum lipid profile among the ringworm patients. The present study comparatively evaluated plasma levels of serum lipids, total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, very-low-density lipoprotein (VLDL), TG and CRP level between ringworm patients and control group.

#### **Materials and methods**

In this study, we recruited 25 individuals with ringworm patients as cases and 25 healthy volunteers as controls. Blood samples were collected from the Chittagong Medical College Hospital and People's Hospital Limited, Chattogram from January 2017 to April 2018. Ethical permission was obtained to approve the protocol. Each volunteer signed an informed consent document before entering the study and was free to withdraw from the study at any time without any obligation. Patients' history was established by using a standard questionnaire concerned with disease history

5 mL of venous blood was drawn from each patient and control after 8 h overnight fasting using a plastic syringe fitted with a sterile stainless steel needle and collected into a metal-free plastic tube.

The blood samples were allowed to stand at room temperature for half an hour and then centrifuged at 3000 rpm for 15 min. Finally, the extracted serum was aliquoted into an Eppendorf tube and stored in -80°C Freezer. All the steps were carried out in a dust-free environment to avoid the possible interference in the test readings. These samples were then used for determining the serum level of c reactive protein (CRP), triglyceride (Tg), serum total cholesterol (TC). Serum lipids, total cholesterol and cholesteryl ester, HDL cholesterol, LDL cholesterol, VLDL cholesterol and TG values were measured using

colorimetric enzyme methods.

To determine the CRP of serum sample gently shake the latex reagent to disperse the particles. Place a drop of undiluted serum onto the circle of the test slide using the disposable pipettes provided. Then add one drop of the latex reagent next to the drop of serum. Using the other end of the pipette (broad end) spread the reagent and serum sample over the entire area of the test circle. Then rotate the slide at 100 rpm in a lab rotator for two minutes. Presence of agglutination indicates a level of CRP in the sample equal or > 6mg/l. The lack of agglutination indicates a CRP level < 6mg/l in the sample. If agglutination is visible semi-quantitative test can be performed in the same way as the quantitative test using dilutions of the serum in saline, phosphate buffered saline or glycine saline as follows:

Data processing and statistical analysis were respectively carried through the creation of an Excel 2010 data bank and version 20.0 SPSS (Statistical Package for the Social Sciences) software. For descriptive analysis of quantitative variables mean and standard deviation were used. To evaluate the association between lipid profile and clinical outcome, the student's t test was applied. The statistical significance adopted was 5% confidence interval.

#### **Results**

##### ***Socio-demographic profile and clinical characteristics of the study population***

The socio-demographic profile and clinical characteristics of the study population were illustrated in **Table 1**. This study comprised of 25 ringworm patients as cases and 25 normal healthy individuals as controls. Age and BMI were expressed as mean  $\pm$  SD (standard deviation). Mean age of the patients and controls were  $42.12 \pm 1.36$  and  $48.16 \pm 7.856$  years. BMI of patients and control group were  $21.71 \pm 0.27$  and  $22.37 \pm 1.081$ . This study demonstrated that men were more prevalent for liver cirrhosis diseases than women. The relative percentages of the diseased for men and women were 60% and 40%. Primary educated (88%) and rural (80%) people were mostly affected by ringworm. The daily labor reported the higher percentage (40%) of ringworm than housewife (32%) and employee of different organization (28%). Majority of patients led to the poor (60%) or fair (36%) health condition.

**Table 1. Socio-demographic and clinical characteristics of the study population**

Criteria	Patients with ringworm (n=25)	Control group (n=25)
Age(years)	42.12 ± 1.36	48.16 ± 7.856
BMI (kg/m <sup>2</sup> )	21.71 ± 0.27	22.37 ± 1.081
Gender		
Men	15 (60%)	8 (32%)
Women	10 (40%)	17 (68%)
Education		
Primary	22 (88%)	16 (64%)
SSC	2 (8%)	3 (12%)
Above SSC	1 (4%)	6 (24%)
Residential area		
Rural	20 (80%)	22 (88%)
Urban	5 (40%)	3 (12%)
Occupation		
Labor	10 (40%)	2 (8%)
Housewife	8 (32%)	17 (68%)
Employee	7 (28%)	6 (24%)
General health condition		
Poor	15 (60%)	0
Fair	9 (36%)	3 (12%)
Good	1 (4%)	18 (72%)
Excellent	0	4 (16%)

a. Values were expressed in mean ± SD

b. BMI = Body Mass Index

### **C-reactive protein and serum lipid profile**

**Table 2** demonstrated the comparative CRP value and lipid profile such as TG, TC, HDL and LDL between the patients with ringworm and control group. The mean CRP value was higher in the patients than in the control group. This was observed  $1.608 \pm 0.687$  for patients and  $0.648 \pm 0.166$  mg/dl for control group. This difference was statistically significant ( $p = 000$ ). On the other hand, the mean lipid profile (except HDL) was shorter in patients compared with that of control group. Though our study found the lower value of the TG, TC and LDL of the patient group, but the HDL value was higher in patients than that of control group. Our study demonstrated only the significantly lower value of LDL ( $p = 002$ ) during the analysis of lipid profile of ringworm patients. The serum TG; TC; HDL and LDL levels of patients were  $131.760 \pm 15.360$  mg/dl;  $175.088 \pm 16.302$  mg/dl;  $80.788 \pm 8.975$  mg/dl and  $67.952 \pm 23.179$  mg/dl

respectively compared with  $139.842 \pm 17.395$  mg/dl;  $182.087 \pm 15.060$  mg/dl  $73.358 \pm 20.694$  mg/dl and  $86.550 \pm 18.508$  mg/dl of the control group.

**Table 2: Comparative CRP value and lipid profile between patients and control groups**

Items	Group	Mean	Standard Deviation	Standard Error	P value
CRP(mg/dl)	Control	0.648	0.166	0.033	0.000*
	patient	1.608	0.687	0.137	
TG(mg/dl)	Control	139.842	17.395	3.479	0.088
	patient	131.760	15.360	3.072	
TC(mg/dl)	Control	182.087	15.060	3.012	0.121
	patient	175.088	16.302	3.260	
HDL(mg/dl)	Control	73.358	20.694	4.139	0.106
	patient	80.788	8.975	1.795	
LDL(mg/dl)	Control	86.550	18.508	3.702	0.002*
	patient	67.952	23.179	4.636	

a. Values are expressed in mean ± SD; significant at \* $P < 0.05$  compare to control.

b. CRP = C-Reactive Protein

c. TG = Triglyceride

d. TC = Total Cholesterol

e. HDL = High Density Lipoprotein

f. LDL = Low Density Lipoprotein

### **Correlation analysis of the variables**

Correlation analysis was carried out to determine the relationship between variables. The data were further analyzed in order to establish the correlation of various lipid parameters with age and BMI represented in **Table-3**. The positive relationship means the higher age and BMI value, the higher CRP and lipid profile.

The CRP value was positively correlated with age of both patients and control group. But in case of BMI, this value was positively related to the BMI of patients while it was negative in case of control group.

In ringworm patients, the mean CRP level was positively correlated with their both age (0.107) and BMI (0.096). It was also seen that there was a positive correlation of TG ( $r = 0.112$ ) and HDL ( $r = 0.007$ ) with the age of the patients. BMI also positively associated with TG ( $r = 0.103$ ); TC ( $r = 0.170$ ); LDL ( $r = 0.216$ ) The correlation between TG and TC was also positive ( $r = 0.146$ ). But an inverse relationship between Age and TC ( $-0.156$ ); Age and LDL ( $r = -0.128$ ), BMI and HDL ( $r = -0.285$ ) were found in our study.

In Control group, though it was seen a positive

correlation of CRP ( $r = 0.147$ ) and HDL ( $r = 0.243$ ) value with the age, but the inverse relationship was observed between age and BMI ( $r = -0.118$ ); TG ( $r = -0.164$ ); TC ( $r = -0.534$ ); LDL ( $r = -0.498$ ). BMI was positively correlated with TG ( $r = 0.421$ ) and HDL ( $r = 0.319$ ). on the other hand, CRP ( $r = -0.282$ ); TC ( $r = -0.119$ ), LDL ( $r = -0.094$ ) levels were inversely related with BMI level. Inverse relationship was also found between TG and TC ( $r = -0.157$ ); CRP and TC ( $r = -0.143$ ).

Table 3 Correlation of every variable with each other's

Correlation parameters	Ringworm patients	Control group
Age and CRP	0.107	0.147
Age and TG	0.112	-0.164
Age and TC	-0.156	-0.534
Age and HDL	0.007	0.243
Age and LDL	-0.128	-0.498
BMI and CRP	0.096	-0.282
BMI and TG	0.103	0.421
BMI and TC	0.170	-0.119
BMI and HDL	-0.285	0.319
BMI and LDL	0.216	-0.094
TG and TC	0.146	-0.157
CRP and TC	0.591	-0.14282

- a. Values with negative sign indicate an inverse correlation.
- b. CRP = C-Reactive Protein
- c. TG = Triglyceride
- d. TC = Total Cholesterol
- e. HDL = High Density Lipoprotein
- f. LDL = Low Density Lipoprotein
- g. BMI = Body Mass Index

**Discussion**

The present study investigated the C-reactive protein (CRP) level and lipid profile in ringworm patients. A number of conflicting findings have been reported about the various parameters and lipid profiles studied among skin diseases such as psoriasis patients. Some studies reported high levels and some reported normal levels across a number of the same measures. CRP measurement is widely used as a biomarker of infection but also non-infectious inflammation in many disease entities<sup>9</sup>. We found higher levels of CRP in patients of ringworm compared to that of controls. This finding supported that chronic ringworm has a considerable systemic inflammatory

component [10]. It is directly linked with the overall inflammatory burden in the skin. Future large and prospective studies in Ringworm patients should determine whether the upregulated CRP levels observed in these Ringworm cohort are indeed linked to increased cardiovascular risk, beyond its role as a marker of systemic inflammation.

We found lower levels of total cholesterol, triglycerides and LDL in patients compared with that of control group. But higher HDL-cholesterol levels in patients was found compared to controls. These findings do not match with previous studies conducted on psoriasis patients. They reported the higher total cholesterol, LDL and triglyceride levels and lower HDL levels in psoriasis patients compared with that of control group<sup>11-15</sup>.

Elevated serum total cholesterol and triglyceride levels were also demonstrated in patients with pemphigus compared with controls. Neither LDL cholesterol nor HDL cholesterol was associated with pemphigus<sup>16</sup>. But our findings illustrated lower total cholesterol, triglyceride and LDL but higher HDL levels in patients compared with that of control group.

In ringworm patients, a statistically positive correlation was found between Age and CRP, Age and TG, Age and HDL, BMI and CRP, BMI and TG, BMI and TC, BMI and LDL, TG and TC, CRP and TC. But an inverse relationship between Age and TC, Age and LDL, BMI and HDL.

This study had some limitations. Number of cases and controls were limited. Histological diagnosis of Ringworm was not performed. We relied upon history, clinical findings and biochemical evidence, which may not be accurate in every case. However, the result of this study serves as a baseline for further studies on CRP and Lipid abnormalities in Ringworm.

**Conclusions**

C-reactive protein as a marker for the patients associated with ringworm. The C reactive protein (CRP) is an acute-phase reactant produced by the liver and has an increased serum concentration in a variety of inflammatory conditions. A high inflammatory burden may be determined by values of CRP in ringworm disease which is associated with high Cardio-vascular diseases risk with so many complications. It is also clear that lipid abnormalities exist in ringworm patients. The serum lipid profile



(total cholesterol, TG and LDL) is reduced in these patients. Patients with ringworm should thus be routinely screened for such abnormalities. Future large and prospective studies in ringworm patients should determine whether the upregulated CRP and lipid levels observed in these ringworm cohort are indeed linked to increased cardiovascular risk, beyond its role as a marker of systemic inflammation.

**Ethics approval and consent to participate:** This study was approved by ethical research committee of Noakhali Science and Technology University, Bangladesh. The committee's reference number is not available. Written consent was taken from the participants prior to study

**Competing interest:** The author(s) have no conflicts of interest relevant to this article.

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