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Original Research Article

Assessment of Liver Enzymes in the Patients Infected with Plasmodium

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Abstract: Malaria is a mosquito born disease caused by protozoa belonging to family Plasmodium. According to the WHO, involvement of liver in Plasmodium falciparum is not an uncommon feature and presence of jaundice (bilirubin ≥ 3 mg/dl) is one of the signs of malaria. Involvement of liver in malaria is a common feature and may manifest as jaundice, hepatomegaly & elevated liver enzymes like aspartate & alanine transferase. Detection of malaria positive cases and correlation of all malaria positive cases with Liver Function Test (LFT). The study was performed on 100 malaria positive patients. Collection of blood sample was done by venipuncture under aseptic conditions in the EDTA vial for the diagnosis of malaria and in the plain vial to perform liver function test. Malaria was diagnosed by the microscopy of PBS. The LFT was performed using auto analyzer and Erba diagnostic kit, according to manufacturer instructions. Out of 100 malaria positive patients total 70 (70%) patients were found having liver function test deranged while rest 30 (30%) patients were having normal liver function test. 48 (48%) patients showed deranged level of Total bilirubin, 59 (59%) patients showed deranged level of deranged level of SGOT, 57 (57%) patients showed deranged level of SGPT while deranged level of ALP is showed by 34 (34%) patients. Liver dysfunction in malarial infection ranged from mild elevation of liver enzymes and serum bilirubin (≥ 3 mg/dl) to acute hepatitis. It indicates severe illness with high frequency of complications and mortality rates and P. falciparum malaria is more effective to cause hepatic dysfunction that P. vivax malaria.
Keywords: Malaria, Liver function test, Liver hepatitis

INTRODUCTION

Malaria is a mosquito born parasitic disease caused by parasitic protozoan which belongs to the family Plasmodium. Female anopheles mosquito is responsible for spreading malaria among human. After the mosquito bites parasites are transferred from its saliva into the blood of person [1]. Five species of Plasmodium are responsible for causing malaria in human; these are *Plamodium vivax, Plasmodium falciparum, Plasmodium ovale, Plasmodium malariae* and *Plasmodium knowlesi* [2].

According to World Health Organization (WHO), approximately 270 million people suffer from malaria every year all over the world, with 1-2 million deaths annually, out of which 80% deaths are caused by *Plasmodium falciparum* [3]. WHO reported that presence of jaundice (≥3mg/dl) and hepatic involvement in *P. falciparum* malaria is not rare presentation [4]? World malaria report of 2010 showed that *Plasmodium vivax* is a major health problem among world which involves billions of population at the risk of infection [5].

Falciparum malaria is one of the most important parasitic diseases of human affecting more than one billion people and is also responsible for 1-3 million deaths per year [6-8]. Falciparum malaria can mimic many diseases with its presentation and it must be considered in the diagnosis of acute illness like hepatorenal syndrome, fulminant hepatic failure, acute hepatitis, i.e., jaundice, encephalopathy, pulmonary edema, anemia, septicemia, hypoglycemia, acidosis and abdominal pain with diarrhea, hepatosplenomegaly, renal failure, spontaneous bleeding and coagulopathy, hyperpyrexia and unarousable coma [9-12].

24 to 48 merozoites are released from each merozoite in the circulation by the process of rupture of RBC with 48 to 72 hours and produce febrile paroxysm. In this way, malarial parasites are responsible for liver cell damage, jaundice with or without increased liver enzymes like Aspartate and Aminotransferases [13].

Alanine aminotransferase (SGPT) is mainly present in the liver and acts as catalyst in the transfer of amino acid from donor to recipient molecule, while aspartate transaminase (SGOT) is found in the muscle, brain and kidney in addition to the liver. Hence SGPT, not SGOT is the prime indicator of liver cell damage. Alkaline phosphatase (ALP) is secreted by the hepatocytes in the biliary canaliculi. So raised serum ALP in the patients affected by falciparum malaria, due to perturbation of host hepatocytes drainage pathway during the hepatic stage of falciparum, also leakage from damaged membrane of liver hepatocytes [14].

MATERIAL AND METHODS

This prospective study was conducted in the Department of Microbiology, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, and U.P. over a time period from March 2016 to January 2017. Total 100 confirmed patients of malaria were taken for the study. Patients having other causes of liver disease and patients who were taking anti-malarial drugs were excluded from the study.

5ml of blood was collected from the each patient under aseptic conditions by venipuncture in Ethylene Di-amine tetra Acetic Acid (EDTA) vaccutainer tube (2.5ml) for the diagnosis of malaria and 2.5 ml in plain tube for Liver Function Test.

Diagnosis of malaria was done by the microscopy of peripheral blood smear. It remains gold standard for the confirmation of diagnosis of malaria. Blood smears were prepared and both are stained with Leishman's stain, then smears were examined under the microscope by oil immersion lens at 100x for the different stages of malaria.

Diagnosis of liver function test was done by the autoanalyzer EM200 of Transasia Bio-Medicals Ltd, by the use of commercially prepared reagent of Total bilirubin, SGOT, SGPT, ALP using Erba biodiagnostic kit according to the manufacturer's instructions.

RESULTS

Out of 100 malaria positive patients total 70 (70%) patients were found having liver function test deranged while rest 30 (30%) patients were having normal liver function test. Out of 70 deranged LFT persons 34 (57.62%) were male and 36 (87.80%) were female. (Table 1, Figure 1).

Table-1: Sex wise distribution of total malaria positive patients with deranged and normal liver function test

SEX	MALARIA POSITIVE	%	DERANGED LFT	%	NORMAL LFT	%
MALE	59	59	34	57.62	35	42.37
FEMALE	41	41	36	87.8	5	12.19
TOTAL	100	100	70	70	30	30

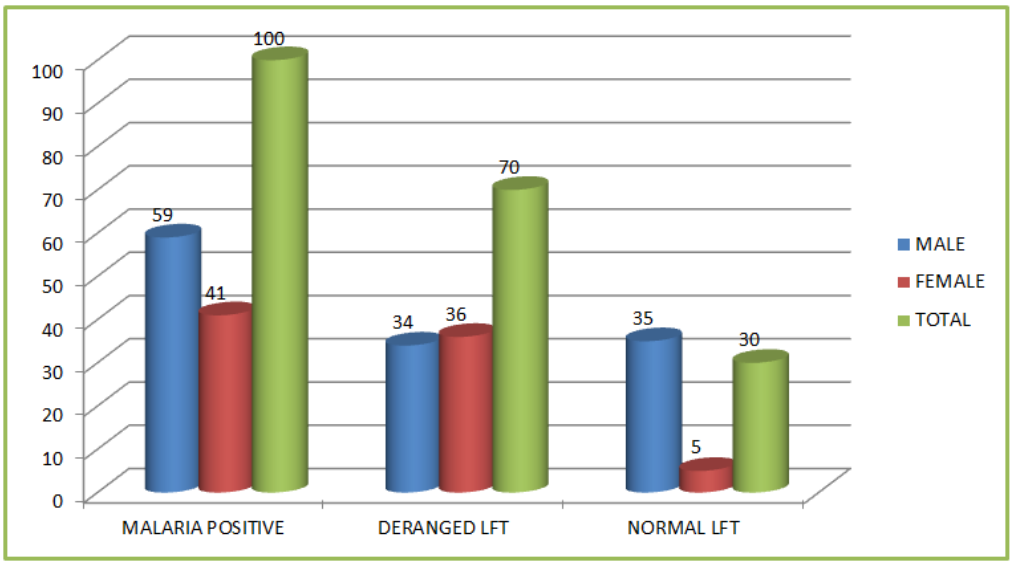

Fig-1: Graph shows Sex wise distribution of total malaria positive patients with deranged and normal liver function test

It was found that out of 89 cases of *Plasmodium vivax*, 62 (69.66%) patients were having deranged liver function test and out of 11 cases of *Plasmodium falciparum*, 8 (72.72%) cases were having deranged liver function test (Table 2, Figure 2).

Table-2: Species wise distribution with deranged and normal LFT of total malaria positive cases

Type	Positive Patients	%	Deranged LFT	%	Normal LFT	%
P. Vivax	89	89	62	69.66	27	30.33
P. falciparum	11	11	8	72.72	3	27.27
Total	100	100	70	70	30	30

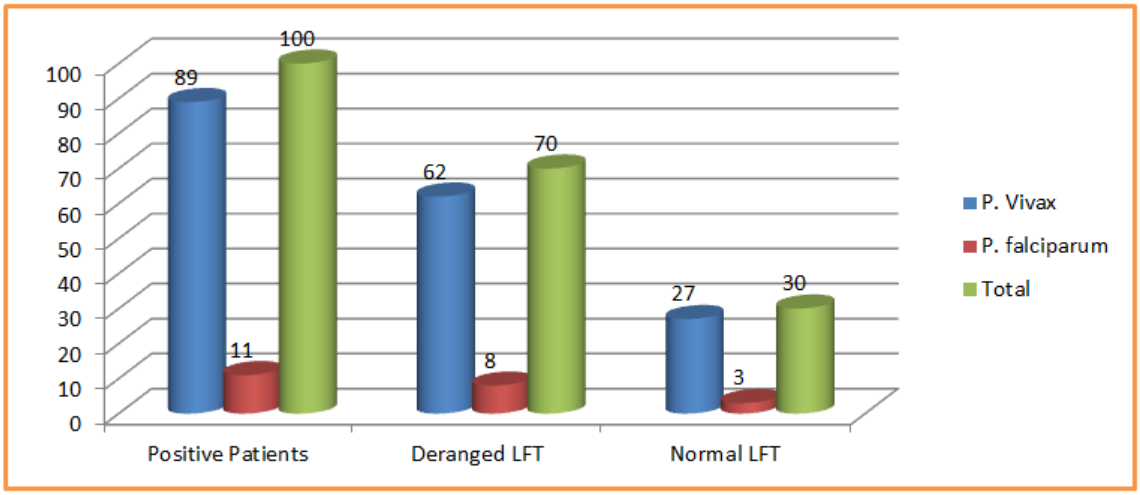

Fig-2: Graph shows species wise distribution with deranged and normal LFT of total malaria positive cases

In our study, out of 100 malaria positive patients 48 (48%) patients showed deranged level of Total bilirubin, 59 (59%) patients showed deranged level of deranged level of SGOT, 57 (57%) patients showed deranged level of SGPT while deranged level of ALP is showed by 34 (34%) patients. Out of 48 deranged cases of Total Biririubin 44 cases were of *Plasmodium vivax* and 4 cases were of *Plasmodium falciparum*. Out of 68 deranged cases of SGOT 59 cases were of *Plasmodium vivax* and 9 cases were of *Plasmodium falciparum*. Out of 57 deranged cases of SGPT 48 cases were of *Plasmodium vivax* and 9 cases were of *Plasmodium falciparum*. It was also observed that out of 34 deranged cases of ALP 27 cases were of *Plasmodium vivax* and 7 cases were of *Plasmodium falciparum* (Table 3 Figure 3).

Mean values and standard deviation of Total bilirubin, SGOT, SGPT, ALP patients affected with Plasmodium vivax were 2.05 ± 2.71, 101.86 ± 219.37, 63.90 ± 83.94 and 109.84 ± 74.80 respectively while mean values and standard deviation of liver markers Total bilirubin, SGOT, SGPT and ALP were 3.04 ± 4.55, 124.36 ± 111.98, 74.81 ± 46.83 and 177.45 ± 131.26 respectively (Table 4).

Mean and standard deviation calculated of total malaria positive patients of Total bilirubin, SGOT, SGPT and ALP 2.13 ± 2.88, 104.33 ± 209.98, 65.10 ± 86.16 and 117.28 ± 84.65 respectively in our study (Table 5).

Table-3: Species wise distribution with deranged level of LFT markers of malaria positive cases

LFT PARAMETERS	P. vivax (n=89)		P. falciparum (n=11)		Total (n=100)	
	Number	%	Number	%	Number	%
Total biririubin	44	49.43	4	36.36	48	48
SGOT	59	66.29	9	81.81	68	68
SGPT	48	53.93	9	81.81	57	57
ALP	27	30.33	7	63.63	34	34

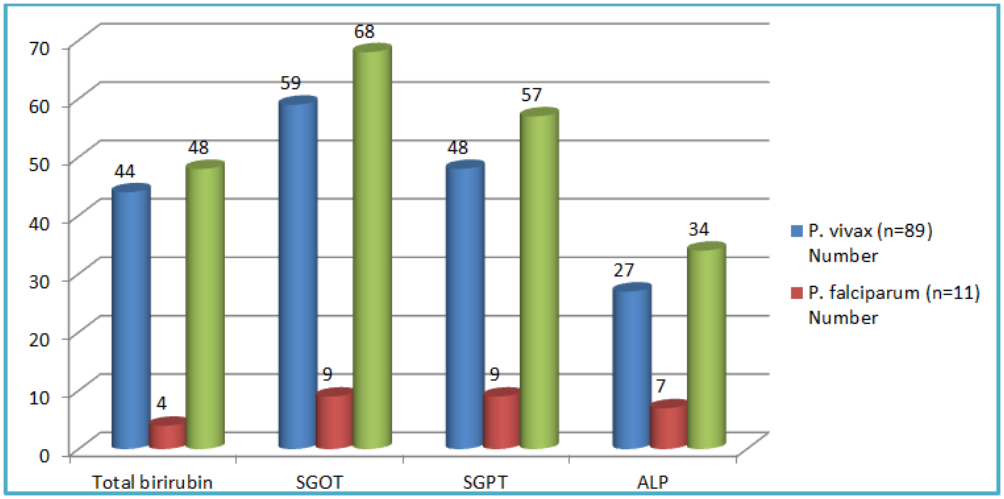

Fig-3: Species wise distribution with deranged level of LFT markers of malaria positive cases

Table-4: Species wise mean and standard deviation of all malaria positive patients

LFT PARAMETERS	NORMAL RANGE	MEAN ± SD	
		P. vivax	P. falciparum
TOTAL BILIRUBIN	0.2-1.0mg/dl	2.05 ± 2.71	3.04 ± 4.55
SGOT	5-40 IU/L	101.86 ± 219.37	124.36 ± 111.98
SGPT	5-40 IU/L	63.90 ± 83.94	74.81 ± 46.83
ALP	50-126 IU/L	109.84 ± 74.80	177.45 ± 131.26

Table-5: Mean and standard deviation of measured Liver Function Test in total malaria positive patients

LFT PARAMETERS	NORMAL RANGE	MEAN ± SD
TOTAL BILIRUBIN	0.2-1.0mg/dl	2.13 ± 2.88
SGOT	5-40 IU/L	104.33 ± 209.98
SGPT	5-40 IU/L	65.10 ± 86.16
ALP	50-126 IU/L	117.28 ± 84.65

DISCUSSION

Malaria is a major health problem responsible for causing 270 million people and 1-2 million deaths per year. Malaria involves liver where hepatocytes are invaded by sporozoites and multiply. Molyneus *et al.* suggest that hemolysis and involvement of liver with the elevation of hepatic enzymes with the jaundice is the most common feature of malaria [15].

Out of 100 malaria positive patients total 70 (70%) patients were found having liver function test deranged while rest 30 (30%) patients were having normal liver function test, out of 70 deranged LFT persons 34 (57.62%) were male and 36 (87.80%) were female and 69.66% cases of *P. vivax* and 72.72% cases of *P. falciparum* having deranged LFT, our study correlates with Rathod Chirag C *et al.* [16] who had got 59.03% cases of deranged LFT cases out of which 65.75% cases were of *P. vivax* and 53% cases were of *P. falciparum*.

Bilirubin is form by the breakdown of hemoglobin. It is formed in the reticulo-endothelial system (bone marrow, spleen) of body and is transported to the liver and finally bound to albumin. Bilirubin released by this process is water insoluble and is called indirect or unconjugated bilirubin. It is conjugated with glucuronic acid to form direct bilirubin in the liver and excreted into the intestine. Total bilirubin is found increased in obstructions of bile duct, hepatitis and cirrhosis. In case of falciparum malaria jaundice has been found more commonly as compared to vivax malaria. Hazra *et al.* from Calcutta found an association of jaundice in 40% and 9% cases with P. falciparum and P. vivax respectively.

In this study we have obtained total 48% cases of jaundice while in the study of Rajendra Kumar Verma *et al.* [17] observed 31.78% cases of jaundice and Ashish Kumar Saha [18] detected 53.07% cases of jaundice while in the another study done by Mohammad Waseem Kausar [19] 64.3% cases were detected.

Out of 89 cases of *Plasmodium vivax* bilirubin was found increased in 49% cases in our study while Rajendra Kumar Verma [17] found in 11.11% cases and Amber Mehmood *et al.* [20] found bilirubin in 42% cases.

4 cases (36.6%) were found having raised bilirubin out of 11 cases of *P. falciparum* while study conducted by Rajendra Kumar Verma *et al*. [17] suggests 14.8% cases having jaundiced and Ali Hasan Abro *et al*. [21] identified 81% cases of falciparum having increased bilirubin.

Serum Glutamate oxaloacetate transaminase (SGOT) is present in all human tissues and is found in large amount in liver, renal, cardiac and skeletal muscles. In our study, 68 (68%) cases were found having increased level of SGOT out of which 59 (66.29%) cases were of *P. vivax* and 9 (81.81%) cases were of *P. falciparum*. An elevated level of SGOT is associated with liver diseases or damage, myocardial infarction and cholecystitis [22].

Serum glutamate pyruvate transaminase (SGPT) is found in higher amount in liver whereas in kidney, heart, skeletal muscle and pancreas it is found in lesser amount. In our study SGPT was found elevated in 57 (57%) cases and major raised level of SGPT was observed in 9 (81.81%) cases of falciparum where Ali Bin Sarwar Zubairi *at al*. [23] found elevated level of SGPT in 44.4% cases of falciparum. 48 (53.93%) cases of *P. vivax* were found having elevated level of SGPT in our study while Ali Bin Zubairi observe 40.9% cases of *P. vivax.*

Alkaline phosphatse (ALP) is the group of enzymes, which is found in all tissues of human body, liver, and osteoblast of bone, kidney, placenta, intestinal wall and lactating mammary glands. ALP hydrolyse phophates at alkaline pH and may be found circulating in the serum in which is derived from the liver in adults. Raise level of ALP are often seen in bone or liver diseases. In our study 34% cases were having elevated ALP level and most elevated level was observed in 63.3% cases infected with *P. falciparum.* The slight difference in study may be due to change in environmental conditions.

Mean and standard deviation calculated of total malaria positive patients of Total bilirubin, SGOT, SGPT and ALP 2.13 ± 2.88, 104.33 ± 209.98, 65.10 ± 86.16 and 117.28 ± 84.65 respectively in our study.

Mean values and standard deviation of Total bilirubin, SGOT and SGPT patients affected with *Plasmodium vivax* were 2.05 ± 2.71, 101.86 ± 219.37 and 63.90 ± 83.94 respectively in our study while in the study of Gurjeet Singh et al [24] mean and standard deviation of Total bilirubin, SGOT and SGPT were 4.3 ± 3.03, 85.1 ± 49.65, and 79.69 ± 45.99 respectively.

Mean values and standard deviation of liver markers Total bilirubin, SGOT, SGPT and ALP were 3.04 ± 4.55, 124.36 ± 111.98, 74.81 ± 46.83 and 177.45 ± 131.26 respectively which was statistically more deranged in comparison of *P. vivax* malaria.

CONCLUSION

In our study 70% cases of malaria were found having deranged Liver Function Test and most of them were female (87.80%) which means most of the female who get infected with malaria have more chances of having deranged liver function test. SGOT levels were found raised upto 486 IU/L in case of *Plasmodium vivax* infection which indicates it may reach upto severe illness. While it was observed that 72.72% of the falciparum malaria positive patients have deranged LFT so it means more chances of having deranged liver function are in those patients who are infected with *Plasmodium falciparum*. As compared to *Plasmodium vivax* liver markers was found more deranged in person infected with *Plasmodium falciparum* which was reached upto 81.81%. Therefore, it is concluded that *P. falciparum* malaria is more effective to cause hepatic dysfunction that *P. vivax* malaria.

REFERENCES

1. March, W. H. O. (2014). Supplement to the 2013 consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: Recommendations for a public health approach. *Book March*.
2. Mueller, I., Zimmerman, P. A., & Reeder, J. C. (2007). Plasmodium malariae and Plasmodium ovale–the 'bashful'malaria parasites. *Trends in parasitology*, *23*(6), 278-283.
3. Mishra, S. K., Mohanty, S., Mohanty, A., & Das, B. S. (2006). Management of severe and complicated malaria. *Journal of postgraduate medicine*, *52*(4), 281.
4. Roberts, D. D., Sherwood, J. A., Spitalnik, S. L., Panton, L. J., Howard, R. J., Dixit, V. M., ... & Ginsburg, V. (1985). Thrombospondin binds falciparum malaria parasitized erythrocytes and may mediate cytoadherence. *Nature*, *318*(6041), 64-66.
5. World Health Organization. (2010). *World health statistics 2010*. World Health Organization.
6. Bartoloni, A., & Zammarchi, L. (2012). Clinical aspects of uncomplicated and severe malaria. *Mediterranean journal of hematology and infectious diseases*, *4*(1), 2012026.
7. Ferri, F. F. (2009). Chapter 332. Protozoal infections. *Ferri's Color Atlas and Text of Clinical Medicine*, 1159.
8. Beare, N. A., Taylor, T. E., Harding, S. P., Lewallen, S., & Molyneux, M. E. (2006). Malarial retinopathy: a newly established diagnostic sign in severe malaria. *The American journal of tropical medicine and hygiene*, *75*(5), 790-797.
9. Ferri, F. F. (2009). *Ferri's color atlas and text of clinical medicine*. Elsevier Health Sciences.

10. Taylor, W. R., Hanson, J., Turner, G. D., White, N. J., & Dondorp, A. M. (2012). Respiratory manifestations of malaria. *CHEST Journal*, *142*(2), 492-505.
11. Korenromp, E. L., Williams, B. G., De Vlas, S. J., Gouws, E., Gilks, C. F., Ghys, P. D., & Nahlen, B. L. (2005). Malaria attributable to the HIV-1 epidemic, sub-Saharan Africa. *Emerging infectious diseases*, *11*(9), 1410-1419.
12. Roberts, D. D., Sherwood, J. A., Spitalnik, S. L., Panton, L. J., Howard, R. J., Dixit, V. M., ... & Ginsburg, V. (1985). Thrombospondin binds falciparum malaria parasitized erythrocytes and may mediate cytoadherence. *Nature*, *318*(6041), 64-66.
13. Clark, I. A., & Cowden, W. B. (2003). The pathophysiology of falciparum malaria. *Pharmacology & therapeutics*, *99*(2), 221-260.
14. Anstey, N. M., Russell, B., Yeo, T. W., & Price, R. N. (2009). The pathophysiology of vivax malaria. *Trends in parasitology*, *25*(5), 220-227.
15. Molyneux, M. E., Looareesuwan, S., Menzies, I. S., Grainger, S. L., Phillips, R. E., Wattanagoon, Y., ... & Warrell, D. A. (1989). Reduced hepatic blood flow and intestinal malabsorption in severe falciparum malaria. *The American journal of tropical medicine and hygiene*, *40*(5), 470-476.
16. Rathod, C. C., Deshpande, S. V., Rana, H. M., Godbole, V. Y., Patel, V., Patel, A., ... & Panchal, M. (2012). Plasmodium falciparum versus Plasmodium vivax: Which is a lesser evil. *Natl J Community Med*, *3*(3), 541-7.
17. Tjitra, E., Anstey, N. M., Sugiarto, P., Warikar, N., Kenangalem, E., Karyana, M., ... & Price, R. N. (2008). Multidrug-resistant Plasmodium vivax associated with severe and fatal malaria: a prospective study in Papua, Indonesia. *PLoS Med*, *5*(6), e128.
18. Mandal, S. (2014). Epidemiological aspects of vivax and falciparum malaria: global spectrum. *Asian Pacific Journal of Tropical Disease*, *4*, S13-S26.
19. Kausar, M. W., Moeed, K., Asif, N., Rizwi, F., & Raza, S. (2010). Correlation of bilirubin with liver enzymes in patients of falciparum malaria. *International Journal of Pathology*, *8*(2), 63-67.
20. Mumtaz, M. W., Adnan, A., Mahmood, Z., Mukhtar, H., Malik, M. F., Qureshi, F. A., & Raza, A. (2012). Biodiesel from waste cooking oil: Optimization of production and monitoring of exhaust emission levels from its combustion in a diesel engine. *International Journal of Green Energy*, *9*(7), 685-701.
21. Abro, A. H., Ustadi, A. M., Abro, H. A., Abdou, A. S., Younis, N. J., & Akaila, S. I. (2009). Jaundice with hepatic dysfunction in P. falciparum malaria. *J Coll Physicians Surg Pak*, *19*(6), 363-6.
22. Garcia, L. S., & Bruckner, D. A. (1993). Diagnostic medical parasitology. *Washington, DC*, 131-135.
23. Nawaz, H., Imam, S. Z., Zubairi, A. B. S., Pabaney, A. H., Sepah, Y. J., Islam, M., & Khan, J. A. (2007). Smoking habits and beliefs of future physicians of Pakistan. *The International Journal of Tuberculosis and Lung Disease*, *11*(8), 915-919.
24. Singh, G., & Raksha, A. U. (2013). Candidal Infection: Epidemiology, Pathogenesis And Recent Advances For Diagnosis. *Bulletin of Pharmaceutical and Medical Sciences (BOPAMS)*, *1*(1).