

# The diagnostic role of serum biomarkers in human filariasis/elephantiasis”

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## Abstract

Human lymphatic filariasis and the resultant elephantiasis by mosquito-borne nematode infection is an ugly, disfiguring disease ramifying almost all parts of the world. Various prophylactic measures are in use to check the infection, whereas biomarkers assay are useful to take proper treatment to minimize the sufferings and ensure positive hope to the victims. The present study shows an alarming level of increase of certain serum biomarkers which reveals the kidney and liver function abnormalities in filarial/elephantoid cases is a warning signal to such victims to undergo proper prophylactic measures to safeguard the kidneys and liver.

**Keywords:** alanine aminotransferase, aspartate aminotransferase, blood urea nitrogen, elephantiasis, filariasis.

## 1. Introduction

Human lymphatic filariasis leads to elephantiasis and the latter one is an unsightly, disfiguring, slow killer common to almost all continents of the world. It is a mosquito-borne infection caused by the lymph dwelling nematode parasites *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori* (Jacoby and Youngon 2004).

The disease is endemic in 76 countries and 1.1 billion people are at risk of infection (Ramachandran 1997). The most recent estimates suggest that filariasis infects 120 million people or 2 percent of the world’s population (Michael et al. 1996; Michael and Bundy 1997). Of these 83 million people have lymphatic disability, 23 million men have hydrocoeles and 15 million people have elephantiasis (Ramachandran 1997).

Of course, filariasis/elephantiasis is mainly centered around poor socio-economic and worst environmental conditions causing untold miseries to millions of helpless masses.

Biomarkers are chemical, physical or biological parameters that can be used to measure the progress of disease or the effects of treatment (Loukopoulos et al.2003). Elevated levels of serum biomarkers in filarial/elephantoid cases such as lactate dehydrogenase (LDH) (Misra et al.1992), alkaline phosphatase (ALP) (Kar et al.1993), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and bilirubin (total) (Ojiako and Onyeze 2009), blood urea nitrogen (BUN), calcium, sodium and potassium (Ottesen 1984) are reported in earlier studies.

The present study aims at to understand the levels of certain serum biomarkers which are considered as diagnostic agents and vital clues to monitor and prevent the organ damages in filarial/elephantoid victims.

## **2. Materials and methods**

The present study is carried out in the filariasis endemic rural pockets, which are located along the West coast of Kanyakumari district, the southern land mark of Indian sub-continent (Jeeva and Murugan 2013). 10ml venous blood is collected from 24 respondents, which includes normal (control), filarial and elephantoid groups. In each category 4 male and 4 female subjects have been used for the study.

Blood samples are collected with the help of a well trained lab technician only after getting a written consent from the respondents. Serum has been separated and used for various analysis. Priority has been given to human values and the Ethics Committee's recommendations are strictly adhered during the entire course of the study.

Standard methods are used for the estimation of various biomarkers such as LDH (Moss and Henderson 1999), ALP (Tietz 1999), ALT (Wolf et al.1972), AST (Wolf et al. 1972), Bilirubin (total) (Pearlman and Lee 1974), BUN (Kaplan and Teng 1982), Calcium (Tietz 1999), Sodium (Tietz 1995) and Potassium (Friedman and Young 1997). Statistical analysis is made with SPSS statistical package (Levesque 2007).

## **3. Results**

The levels of serum biomarkers in relation to kidney function in filariasis and elephantiasis cases are shown in table.1. It is evident from the table that a marginal to moderate level of activities of sodium, calcium, potassium and blood urea nitrogen (BUN) are noticed.

Serum calcium activity in filarial male, female, elephantoid male and female patients are 7.28%, 5.5%, 7.28%, 5.5% respectively. Similar observations are also made in serum sodium activity in filarial male, female, elephantoid male, and females and the activities are 8.4%, 9.2%, 8.4%, 10.97% respectively.

A moderate level of increase of serum potassium is noticed in filarial males, females, elephantoid males and females and the activities are 50%, 48%, 51%, and 50% respectively. The same trend is also seen in serum blood urea nitrogen in filarial males, females, elephantoid males, and females and the values are 36%, 36%, 38%, 42% respectively than the control groups.

**Table.1. explains some of the serum biomarkers in relation to kidney function in filariasis and elephantoid cases.**

**(n = 24 cases; 4 males + 4 females in each subject).  
(Values are ± SD of 4 replicates).**

<b>Biomarker(s)</b>	<b>Sample</b>	<b>Male</b>	<b>Female</b>
BUN	1.control	40.5 ± 0.5	41 ± 0.71
	2.filarial	55.25 ± 1.30 <sup>S</sup>	55.75 ± 1.10 <sup>S</sup>
	3.elephantoid	56 ± 1.4 <sup>S</sup>	58.25 ± 0.43 <sup>S</sup>
Calcium	1.control	8.65 ± 0.05	8.65 ± 0.05
	2.filarial	9.2 ± 0.12 <sup>S</sup>	9.1 ± 0.07 <sup>S</sup>
	3.elephantoid	9.28 ± 0.04 <sup>S</sup>	9.13 ± 0.08 <sup>S</sup>
Sodium	1.control	157.25 ± 1.30	157.25 ± 0.83
	2.filarial	170.05 ± 1.30 <sup>S</sup>	171.75 ± 1.64 <sup>S</sup>
	3.elephantoid	170.5 ± 1.12 <sup>S</sup>	174.5 ± 1.66 <sup>S</sup>
Potassium	1.control	4.1 ± 0.09	4.13 ± 0.09
	2.filarial	6.13 ± 0.08 <sup>S</sup>	6.1 ± 0.12 <sup>S</sup>
	3.elephantoid	6.20 ± 0.04 <sup>S</sup>	6.18 ± 0.04 <sup>S</sup>

**t -test: Calculated t-value is greater than tabulated t-value = significant.<sup>S</sup>**

Some of the serum biomarkers related to liver function in the selected filarial and elephantiasis cases are shown in table.2. A two fold lactate dehydrogenase (LDH) activity is detected in both male and female filarial patients, whereas it is 30 fold in male and 30.5 fold in female elephantoid cases than their controls. A noticeable level of increase of serum alkaline phosphatase activity is noticed both in filarial and elephantoid subjects of both sexes. In male filarial patients there is 80% increase and in females it is 71%, while in elephantoid males it is 60% and in females it is 65%.

**Table.2. reveals some prominent serum biomarkers related to liver function in filarial and elephantoid cases.**

**(n = 24 cases; 4 males + 4 females in each subject).  
(Values are ± SD of 4 replicates).**

Biomarker(s)	Sample	Male	Female
LDH	1.control	398.5 ± 13.14	395.5 ± 10.90
	2.filarial	798.25 ± 18.23 <sup>S</sup>	818.5 ± 19.16 <sup>S</sup>
	3.elephantoid	11969±33.10 <sup>S</sup>	12063.75± 97.70 <sup>S</sup>
ALP	1.control	235.5 ± 6.98	236.25 ± 5.40
	2.filarial	423.5 ± 19.01 <sup>S</sup>	404.5 ± 7.83 <sup>S</sup>
	3.elephantoid	377.25 ± 18.93 <sup>S</sup>	389 ± 9.14 <sup>S</sup>
ALT	1.control	28.25± 10.24	27.25 ± 0.43
	2.filarial	35.25 ± 1.09 <sup>S</sup>	34.5 ± 1.12 <sup>S</sup>
	3.elephantoid	36 ± 0.71 <sup>S</sup>	35.75 ± 0.83 <sup>S</sup>
AST	1.control	28.25± 1.48	29.25 ± 0.83
	2.filarial	35.25 ± 1.23 <sup>S</sup>	40.75 ± 1.30 <sup>S</sup>
	3.elephantoid	61 ± 0.71 <sup>S</sup>	60 ± 0.71 <sup>S</sup>
Bilirubin (total)	1.control	0.73 ± 0.04	0.68 ± 0.04
	2.filarial	1.99 ± 0.17 <sup>S</sup>	2.21 ± 0.5 <sup>S</sup>
	3.elephantoid	15.35 ± 2.46 <sup>S</sup>	17.13 ± 0.51 <sup>S</sup>

**t -test: Calculated t-value is greater than tabulated  
t-value = significant.<sup>s</sup>**

A low level of altered activity of alanine aminotransferase (ALT) can be seen in both sexes of filarial and elephantoid patients than the controls. The increased activity is 25% in filarial males and 27% in females, whereas it is 27% in elephantoid males and 31% in females than their respective control subjects. But, another enzyme aspartate aminotransferase (AST) activity is moderately increased in filarial patients (25% in males and 39% in females) and it is sharply increased in both sexes (116% in males and 105% in females) of elephantoid cases than their respective control groups.

A moderate level of increase of bilirubin is seen in filarial males (2.7 fold) and females (3.25 fold) while it is enormous in male (21 fold) and female (25 fold) elephantoid subjects than their respective control groups.

#### **4. Discussion**

Amidst the struggle for survival mankind is victimized by diseases due to their genetic, poor socio-economic and environmental conditions. Elephantiasis is the resultant lymphatic filariasis and is one of the most common causes of disability in the world.

The association between filariasis, elephantiasis and impairment of kidney function noticed by the increased level of BUN, calcium, sodium and potassium is reported by Ottesen in 1984. Similar trend is also seen in our study subjects.

A high level of increase of BUN in serum is found in our filarial (36% increase in both males and females) and elephantoid cases (in males 38% and in females 42% increase) with respect to their controls ( $P < 0.01$ ). A very high level of increase of serum potassium is observed in the present study. In male filarial cases it is 50%, while in elephantoid subjects about 51% increase is noticed. Likely in female filarial cases it is 48%, where as it is 50% in elephantoid subjects when compared to their controls ( $P < 0.01$ ).

A marginal level of increase of both sodium and calcium is detected in our respondents. The increase of sodium is 8.4% in male and 9.2% in female filarial victims, where as it is 8.4%

in male and 10.97% in female elephantoid patients. Likely the percentage increase of serum calcium is 7.28 in both of our filarial and elephantoid males, but it is 5.5 in both filarial and elephantoid cases ( $P < 0.01$ ).

Liver function abnormalities in filarial and elephantoid cases are confirmed by the increased levels of LDH, ALP, ALT, AST and bilirubin (total). One report says, there is a 30 fold increase of LDH activity in symptomatic amicrofilaremia cases (Misra et al.1992). It is 2 fold in both sexes of our filarial subjects and 30 fold in elephantoid male and 30.5 fold in female patients with respect to their controls ( $P < 0.01$ ).

A very high level of ALP in elephantoid subjects are reported by earlier researchers (Kar et al. 1993; Thapliyal et al. 2009; Ojiako and Onyeze 2009). Similar findings are also noticed in our filarial (male 80% and female 71%) and elephantoid patients (male 60% and female 65%) when compared to their controls ( $P < 0.01$ ).

Previous reports say an enhanced level of ALP, ALT, AST and bilirubin (total) are markers of liver integrity (Peters 1989; Ojiako and Onyeze 2009). A noticeable level of increase of ALT is observed in our filarial (male 25% and female 27%) and elephantoid (male 27% and female 31%) with respect to their controls ( $P < 0.01$ ).

A high level of increase of AST is seen in our filarial (male 25% and female 39%) but a remarkably very high level of AST is found in our elephantoid (male 116% and female 105%) cases when compared to their controls ( $P < 0.01$ ). A marginal level of increase of bilirubin (total) is detected in our filarial (male 2.07 fold and female 3.25 fold) and elephantoid (male 21 fold and female 25 fold) cases with respect to their controls ( $P < 0.01$ ).

The alarming level of increase of BUN, calcium, sodium and potassium are indicative of renal damage and enhanced level of liver diagnostic parameters like LDH, ALP, AST, ALT and bilirubin (total) indicates liver abnormalities in our filarial and elephantoid subjects. However, it should be further confirmed with large scale studies.

## **Conclusion**

The enhanced levels of certain vital biomarkers exposed the liver and kidney function abnormalities in filarial and elephantoid victims. Therefore, biomarkers are giving warning

signals to the patients about the disease state and its related effects as well as it usurps the diseased ones to opt better medical strategies to restore the deteriorating health.

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