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ASSESSMENT OF CARDIAC AND ELECTROLYTE PROFILE IN CHILDREN INFESTED WITH ASCARIASIS

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Abstract

Background: Assessment of cardiac and electrolyte profile is of huge medical concerns in children infested with *Ascaris lumbricoides.* As prolonged deviations in these serum constituents can result in serious health hazards. **Methods**: For this random case control investigation, 196 children infected with ascariasis were recruited from Lahore (n=58; urban) and Narowal (n=138; rural) districts of Punjab province. Whereas, 200 healthy control (Lahore, n=92; Narowal, n=108) children were also engaged from both districts. Serum electrolytes and lipid profile of both healthy control and ascariasis infected children were assessed. Biochemical assessment of lipid profile and serum electrolytes was performed using photochemistry analyzer. Independent student "t" test was applied for statistical interpretation using graph Pad prism version 6.0 software. **Results:** There was a significant ($P < 0.001$) decrease in the levels of sodium, chloride and calcium in ascariasis positive children. However, magnesium presented a marked ($P < 0.001$) increase in infected children as compared to control group. While, no significant difference was observed in levels of Potassium. Cholesterol, HDL-C and LDL-C presented a prominent decline in positive children as compared to control. While, Triglycerides and VLDL-C presented prominent elevation in ascariasis positive children as compared to control. **Conclusion:** Due to deranged bio chemical profile overall performance of the children infested with ascariasis is compromised.

Keywords: Ascariasis, serum electrolytes, HDL-C, LDL-C, VLDL-C.

1: Introduction

Parasitic diseases are the cause of major health issues for the people of underdeveloped countries, where it directly affects children's health by causing malnutrition in them. Heavy infestation caused by the parasites can result in severe anaemic condition and also contributes in manifestation of chronic diarrhea, which leave negative impacts on the fitness, growth and learning skills of children (1).

Ascaris lumbricoides, a soil transmitted helminth is one of the most widely occurring organisms on the earth, estimated to cause disease in almost one-sixth population of the world (2). Ascariasis is found to be more crucial in children as compared to adults (3, 4)

Infection can manifest malnourishment, abdominal pain, vomiting, pneumonitis and growth impairment. In case of severe ascariasis infection, pancreatitis, cholangitis, appendicitis or even masses with intestinal obstruction can occur. Ascariasis infections are associated with significant morbidity, largely related to the nutritional effects of a chronically infected state among pre-school and school age children (5). *A. lumbricoides* can lead to respiratory and gastro intestinal issues, growth retardation and reduced physical fitness (6).

Ascaris infections have been known to influence the nutritional status (7). Tripathy et al. (1971) found that ascariasis in children can cause significant nutritional imbalance when less protein intake is made while having heavy worm load (8).

Electrolytes are an important mediator of normal functioning of human body. Electrolyte imbalance and mineral disturbances are the common indications of several infectious diseases (9). Sodium is one of the most important minerals in human body. Sodium is regarded essential for the fluid distribution, regulating blood pressure, cellular work and electrical activity of the body. Variations in Na^+ level in human body can lead to several health issues (10). Sodium is regarded as the most abundant cation in the extracellular fluid. It helps in regulation of the normal distribution of water and osmotic pressure in various body fluids (11).

Potassium (K^+) is regarded as an important electrolyte for proper functioning of all body cells, tissues and organs. It helps in maintaining water levels and blood pH in the human body. It is also equally important in skeletal and smooth muscle contraction.

Calcium (Ca^{+2}) is also considered as another essential nutrient for human body. It provides strength to bones and teeth. It aids in the maintenance of health and nutritional qualities (12). Sometimes different conditions like fever, high pulse rate, sweating and shivering may result in decline in calcium level in human body (13).

Magnesium (Mg^{+2}) is another essential mineral of human body whose importance can be assessed from the thing that it acts as a cofactor of more than 300 enzymes. It regulates protein synthesis, blood pressure, neuromuscular function, blood glucose level and several other biochemical reactions (14).

Hyperlipidemia, a condition characterized by deranged circulating serum lipids is a potent contributor of cardiovascular ailments in adults as well as kids.

Within the cellular mileu, cholesterol contributes towards nerve conduction intracellular transport and cell signaling (15). Furthermore, increased level of Low Density Lipoproteins-Cholesterol (LDL-C) is also considered to be a significant marker of abnormal cardiac health (16). Normal levels of HDL particles not only reduces the chances of atherosclerotic events but it also have anti-inflammaory, anti-oxidative and anti-apoptotic role (17).

Triglycerides are esters formed by combination of glycerol and fatty acids and are supposedly most prevalent and reliable energy reserves in human body (18). Furthermore, evidences suggest that elevated level of TG also plays a significant role in the progression of coronary heart disease (CHD) (19).

Some other risk factors for coronary heart disease may include high levels of triglycerides (TG) and low levels of HDL cholesterol (HDL-C) (20).

The purpose of present investigation is to assess the alterations in serum electrolytes (Na, K, Cl, Ca, and Mg) and lipid profile (Cholesterol, Triglycerides, HDL-C, LDL-C, VLDL-C) in children exposed to ascariasis infection.

2: Materials and Methods

Institutional ethical review committee of University of the Punjab endorsed this study plan vide letter No 6349.dated 10-8-22. The study was conducted in Physiology/Endocrinology Laboratory, Institute of Zoology, University of the Punjab, Lahore. A total of 396 children were recruited for this study from both districts of Lahore (Urban) and Narowal (Rural). Among them 200 children were non-infected and considered as healthy control. While, the remaining 196 kids were infested with

ascariasis and considered as diseased group. Children suffering from any other ailment were excluded from the study as diseased condition would impair the final outcome of our study. For each participant, fecal sample test was carried out to ascertain the positivity of the infection. Children with no remains of ascariasis eggs or larval stages were considered as healthy or normal control.

A comprehensive proforma was designed to note down the demographic characteristics of the recruited children. Age, gender, feeding habit and body weight was also recorded.

As the study was based on human subjects, therefore, all health and precautionary measures were strictly observed. Research grade, genuine and sterilized, disposable syringes of B.D. (Becton and Dickinson Pakistan, Private Limited) were used to draw 6 cc venous blood. Each of the participants was sampled for blood after having 12 hours of fasting.

Following drawl, blood was divided equally into two aliquots. One aliquot was specified for serum collection, there it was allowed to clot for 30 minutes at room temperature. After clot formation, it was centrifuged (Model NF 1215, Nuve, Turkey) at 3000 rpm for 5 minutes to separate serum.

The remaining blood was poured in EDTA coated, pre-cooled and sterile vacuum blood collection tube (BOLTON). Plasma was collected by centrifuging the blood at 3000 rpm for 5 minutes and transferred into a sterilized labeled eppendorf vial. Both serum and plasma were stored at -80°C for further biochemical assessments.

Serum samples taken were analyzed for the estimation of Sodium (Na) (Bioscien: LOT#BSS0120029), Potassium (K) (Bioscien: Egypt), Chloride (Cl) (MONLAB; Spain), Calcium (Ca) (MONLAB; Spain), Magnesium (Mg) (AMP Diagnostics LOT#0253), Cholesterol (Diasys; Germany), Triglycerides (Diasys; Germany), High density lipoprotein-Cholesterol (HDL-C) (Bio Research; Jordan), Low density lipoprotein-Cholesterol (LDL-C) (Diasys; Germany) and very low density lipoprotein-Cholesterol (VLDL-C).

Analysis of study parameters was accomplished by using photochemistry analyzer $5010_{v5+.}$ Analysis of all parameters was performed in Physiology and Endocrinology Laboratory, Institute of Zoology, University of the Punjab, Lahore.

For the statistical interpretation, independent student “t” test was applied using Graph Pad Prism version 6.0 software.

3: Results

Table 1: Presenting Electroyte and Lipid Profile In Control And Children Infected with Ascariasis

Parameters	**Control** (N = 200)	**Ascariasis +ve** (N = 196)	***P*-value**	**%age Difference**
Sodium (m.mol/L)	146.2 ± 0.21	143.9 ± 0.52	< 0.0001	1.57 ↓ ***
Potassium (m.mol/L)	4.87 ± 0.02	4.88 ± 0.02	0.7	0.2↑
Chloride (m.mol/L)	106.8 ± 0.17	103.7 ± 0.26	< 0.0001	2.90↓***
Calcium (mg/dL)	10.04 ± 0.02	9.87 ± 0.07	0.03	1.69↓*
Magnesium (mg/dL)	2.58 ± 0.01	2.93 ± 0.02	< 0.0001	13.5↑***
Cholesterol (mg/dL)	186.0 ± 2.07	147.1 ± 1.68	< 0.0001	20.9↓***
Triglycerides (mg/dL)	186.8 ± 3.41	221.3 ± 5.37	< 0.0001	18.4↑***
HDL-C (mg/dL)	39.11 ± 0.33	36.54 ± 0.34	< 0.0001	6.57↓***
LDL-C (mg/dL)	93.41 ± 1.24	90.35 ± 0.87	0.046	3.27↓*
VLDL (mg/dL)	38.33 ± 0.73	42.21 ± 1.23	0.007	10.12↑**

****,*****significance at $P < 0.01$, and $P < 0.001$; **HDL-C**, High-density lipoprotein-Cholesterol; **LDL-C**, Low-density lipoprotein-Cholesterol; **VLDL**, Very low density lipoprotein-Cholesterol

Among overall infected kids (n=196), 138 (70.4%) were found to be positive in Narowal district. While, 58 (29.59%) children were found to be infected in Lahore region.

Infected children presented a marked ($P < 0.0001$) decrease in Sodium (Na^+) levels as compared to healthy kids. This specifies that the concentration of sodium has been decreased during

ascariasis infection in children. In case of potassium, comparison of control and infected kids demonstrated no significant difference between their concentrations. Comparison of control and infected values depicted a highly significant decline ($P < 0.0001$) in the chloride concentration in children infected with ascariasis. This illustrates that ascariasis in children causes decrease in chloride levels.

Children with ascariasis demonstrated decreased (P=0.03), calcium levels as compared to controls. While, kids with ascariasis demonstrated elevated ($P < 0.0001$) magnesium level as compared to controls.

In lipid profile, children with ascariasis demonstrated significant decline ($P < 0.0001$) in cholesterol levels as compared to healthy kids. Moreover, triglycerides level in children with ascariasis was significantly ($P < 0.001$) increased as compared to controls.

Moreover, children with ascariasis showed a marked ($P < 0.0001$) decrease in HDL-C concentration as compared to healthy kids. Subjects with ascariasis demonstrated pronounced ($P < 0.0001$) decrease in LDL-C level as compared to that of controls.

The level of VLDL in children with ascariasis was significantly ($P < 0.0001$) increased as compared to controls.

4: Discussion

In our study, the levels of serum electrolytes *viz,* sodium, chloride and calcium were observed to be significantly decreased in case of ascariasis positive kids as compared to controls. While, the level of Potassium and Magnesium was found to be increased in children exposed to ascariasis.

Similar trend of low serum electrolytes was observed by Scott (2008) (21). Mbanga et al. (2019) found electrolyte imbalance during a case study in a 4-year-old black African boy from the Menchum Division in the Northwest Region of Cameroon, having ascariasis (22).

Intestinal helminths like ascariasis are lipophilic and absorb lipids either from their host's gut contents or blood stream, either of which could reduce their host's circulating lipids and thereby minimize accumulation of plaques in vasculature (23).

Intestinal helminths are known to reduce energy intake and to be associated with anemia, poor nutritional status and micro-nutrient malabsorption (24, 25, 26). In addition to interfering with host nutrition through altering consumption and absorption, helminths can also affect blood glucose and lipid levels directly. Many pathogens rely on blood glucose for energy (27). Increasing evidence suggests that host lipids are consumed by pathogens. Helminths may regulate host lipid metabolism by stimulating a decrease in total cholesterol levels particularly low-density lipoprotein (LDL) (28). Several mechanisms may account for these decreases. Lipids mediates and are used by innate immune responses (29) helminths like *Ascaris lumbricoides* cannot synthesize their own lipids, and so consume and metabolize host lipids to generate phospholipid membranes (30), exploiting the host lipidome for their own survival and reproduction (31, 32)

During larval ascariasis the metabolism of lipids is significantly disturbed. Decreased levels of total cholesterol, HDL cholesterol and triglycerides were observed in guinea pigs (29) which is also observed during our study.

The changes are due to the break in liver function and, presumably, changes in hormone secretion, which are provoked by the presence of the parasite. It has also been seen that cholesterol enhanced larval survival and growth (33).

In a study conducted by Biaduń (1990), levels of total lipids, total cholesterol and HDL cholesterol and triglycerides were determined. During the invasion, the decrease in all studied indicators was observed. Only in case of triglycerides a slight increase was found. The similar trend of lipid parameters was observed in our investigation.

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