

Impact of Apoe4 Genes on Cognitive Function and Development in Giardia-Infected Children

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Background: Parasitic worms have largely been over looked by medicine, but attitudes are changing with the realization that they can seriously affect child development and cognition while the treatment is easy and cheap.

Subjects & Methods: The aim of this study is to elucidate ApoE and neurodevelopment in Giardiasis patients and the role of ApoE isoforms in childhood cognition and infant development.

Results: The present study was performed on 75 Giardia-infected child (1-9 years) divided into 2 groups, 40 patients aged and below 4 years (1-4 y) and 35 patients above age of 4 years (5-9 y). All patients suffered from sole Giardia infection with normal blood pictures. They were subjected to anthropometric measurements, lipid profile, determination of APOE allelic forms, also cognitive function assessment for children above 4 years and developmental assessment for children below 4 years. APOE genotypes in the studied children

were 5, 6, 2, 30, 18 and 14 for E2/2, E2/3, E2/4, E3/3, E3/4 and E4/4, respectively. There were no significant differences in the different genotypes regarding lipid profiles. There were also no significant differences regarding demographic and anthropometric measurement. However, there were higher scores without statistical significant difference on performance part of WISC and its subtests among APOE4 carriers in comparison to non carriers, among children above 4 years. While highly significant differences were observed between ApoE4 carriers and non carriers regarding developmental assay, in children below 4 years.

Conclusion: The ApoE4 isoforms have a protective role on development in children below 4 years suffering from sole Giardia infection and on certain domains of the cognitive function in children above 4 years. So, children with ApoE4 negative are advised to be treated and protected from any diarrheal disease.

Keywords: Apolipoprotein E4, Giardia, Cognitive function, Development.

Abbreviations:

APOE4: Apolipoprotein E4
TC: Plasma Total Cholesterol
TG: Triacylglycerols

HDL-C: High Density Lipoprotein-Cholesterol
IQ: Intelligence Quotient
LDL-C: Low Density Lipoprotein-Cholesterol

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INTRODUCTION

Parasitic worms have largely been over looked by medicine, but attitudes are changing with the realization that they can seriously affect child development and cognition while the treatment is easy and cheap (Watkins and Pollitt, 1997). Indeed, a child growing up in an endemic community can expect be infected soon after weaning and constantly reinfected for the rest of his life. It has been estimated that for children of school age in low income countries, intestinal worms account for 12% of the total disease burden (Awasthi, et al. 2003). Given the prevalence of high intensity infection in school children, it is particularly worrying that these infections can adversely affect cognition and educational achievement 6 to 9 years later (Lorntz, et al. 2006). Giardia is a well known parasite causing fat malabsorption and fatty diarrhea (Stevens, et al. 1997). Diarrhea-induced malnutrition impairs brain development (Morgane, et al. 2002) and its effect may be profound when nutritional deprivation occurs between birth and the 3rd year of life (Rice and Barone, 2000). Recently, it was found that, cognitive

function in children is affected by environment, genetic determinants and health related factors (Oria, et al. 2005). Also they reported that genetic marker (ApoE4) appears to be important for cognitive development under the stress of heavy diarrhea.

ApoE encodes apolipoprotein E (glycoprotein, containing 299 amino acids, with a relative molecular mass of 34200 Da.) which plays a basic role in the binding and transport of lipids through the bloodstream and their delivery to the appropriate organs and tissues for processing and use (Weisgraber, 1994). This function includes the removal of excess cholesterol from the blood (Mahley, 1988 and Weisgraber, et al. 1994). There are three major isoforms of ApoE (E2, E3 and E4) that are the products of three allelic forms (e2, e3 and e4) of this single gene, which is located on the long arm of chromosome 19 (Reiss, 2005). The various combinations of these alleles give rise to six different genotypes, of which the most common is ApoE E3/3 (Hallman, et al. 1991). Being the richest organ in lipid,