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Immunoglobulin levels and nutritional status of children with Down syndrome

Deepa C*, Parkash Chand*, Vishnu Bhat B, Negi VS***, Ramachandra Rao K***

Department of Anatomy*, Pediatrics** and Immunology***, JIPMER, Puducherry, India

Abstract

The present study was conducted to determine the levels of immunoglobulins in Down syndrome and correlate them with nutritional status. There were 30 children with Karyotypically confirmed Down syndrome . Anthropometric measurements were recorded using standard techniques to assess nutritional status. Serum IgG, IgA and IgM concentrations were determined using automated nephelometer. The immunoglobulin levels were correlated with nutritional status of children with Down syndrome. Out of 30 children with Down syndrome, 13 were males and 17 females. Their ages ranged from 1.5 to 9 years. Seventeen children were normally nourished whereas 6 children had grade I malnutrition, 7 cases grade II and III malnutrition. The levels of IgG (13.32± 4.25 to 10.73 ± 2.64 g/l) and IgA (1.345 ± 0.16 to 1.079 ± 0.42 g/l) decreased with increasing grades of malnutrition whereas the levels of IgM (1.084 ± 0.413 to 1.256 ± 0.22 g/l) increased with increasing grades of malnutrition. In the present study, the serum immunoglobulins showed statistically insignificant alterations with various grades of malnutrition.

Key words: Down syndrome, Impaired immunity, Immunoglobulins, Respiratory tract infections, Malnutrition

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Introduction

The immune system protects the host from infectious agents that exist in the environment. To this end, it relies on two functional branches: the innate and the acquired, both involving a diversity of blood-borne factors (complement, antibodies, and cytokines) and cells (macrophages, polymorphonuclear cells, and lymphocytes) [1]. Poor immune response to infection is associated with malnutrition. Therefore infection and malnutrition have always been intricately linked [2]. Children with Down syndrome (DS) are prone for increased incidence of respiratory infections and autoimmune diseases, indicating impaired immunity [3]. Abnormalities of humoral immunity have been described in DS [4]. Therefore this study was aimed to determine the relationship between immunoglobulins and nutritional status in children with Down syndrome.

Material and Methods

The study was carried out on thirty children with Down syndrome. The protocol was approved by Institute Research and Ethics Committee. Karyotyping revealed trisomy - 21 in all cases. All children with DS were free of infection during blood sample collection. Written informed consent was obtained from the parent / guardian to allow his or her child to participate in the study. Anthropometric measurements were recorded using standard techniques to assess nutritional status and two ml of blood was withdrawn for immunoglobulin profile. Serum IgG, IgA and IgM concentrations were determined using automated nephelometer (Dade Behring, BN Prospec). Indian Academy of Pediatrics classification was used for assessing nutritional status [5]. The nutritional status was correlated with immunoglobulin levels. Statistical analysis was done by one way ANOVA using Graphpad Instat version 3.06. $P < 0.05$ was considered significant.

Results

Out of 30 children with Down syndrome, 17 were normally nourished whereas 6 had grade I , 3 grade II and 4 grade III malnutrition. Grade IV malnutrition was not observed in any child.

Down syndrome children with normal nutritional status had higher mean IgG levels (13.32±4.257).

The IgG levels were found to decrease with increasing severity of malnutrition.

The mean serum IgA levels also tend to decrease with increasing severity of malnutrition. The mean serum IgM levels showed a rise with increasing severity of malnutrition when compared with children having normal nutritional status. But the difference in immunoglobulin levels was not statistically significant.

Table 1: *Nutritional status vs immunoglobulin levels*

NUTRITIONAL STATUS	**IgG LEVELS** (g/l) (MEAN ± S.D)	**IgA LEVELS (g/l)** (MEAN ± S.D)	**IgM LEVELS** (g/l) (MEAN ± S.D)
NORMAL (>80%) (n = 17)	13.32±4.257	1.345±0.169	1.084±0.413
GRADE I MALNUTRITION (71-80%) (n = 6)	13.55±4.657	1.237±0.599	1.102±1.094
GRADE II & III (61-70%)& (51–60%) (n = 7)	10.73±2.641	1.079±0.425	1.256±0.2263

P value, P= 0.2; P= 0.7

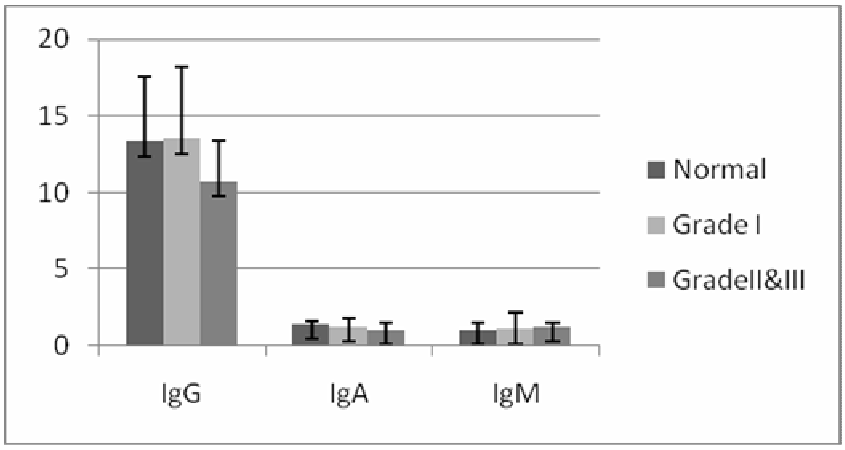


Figure 1. *Nutritional status Vs immunoglobulin levels*

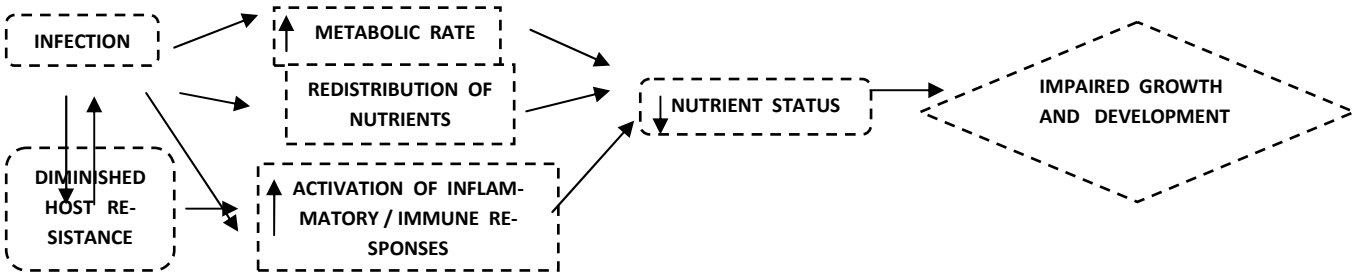
Discussion

Down syndrome is a chromosomal disorder in which extra genetic material causes immunologic disturbances in addition to developmental delay. Two different hypothesis have been proposed to explain the mechanism of gene action in Down syndrome : developmental instability (loss of chromosomal balance) and "gene dosage effect" . According to the gene dosage effect hypothesis, the genes located on chromosome 21 have been over expressed in cells and tissues of Down syndrome patients, and this contributes to the various abnormalities seen in Down syndrome individuals [6]. The gene overdosage results in increased activity of superoxide dismutase (SOD - 1) in cells which is coded on 21 (21q22.1) leading to enhancement of reactive oxygen intermediate generation (specifically H_2O_2 production) in thymocytes [7]. H_20_2 can permeate these cells and inhibit adenosine triphosphate (ATP) synthesis. Lipid peroxidation of immune cell membranes may lead to decreased activity [8]. Thus generation of oxidants owing to increased oxidative stress could damage immune cells leading to impaired function.

The clinical outcome of impaired immunity is an increased incidence of common infections affecting the upper and lower respiratory, urinary and genital tracts(1) of which the respiratory tract is more frequently affected in children with Down syndrome.

Recent observations show a significant decrease of B lymphocytes in Down syndrome. These abnormalities can be due either to an intrinsic B lymphocyte de-

fect or to the consequence of deficient T helper lymphocyte function causing inadequate control of B lymphocyte activation and proliferation. The consequences being oligoclonal or inadequate antibody re sponses to foreign antigens in Down syndrome (9). Infection causes deterioration of nutritional status and malnutrition results in increased susceptibility to infection ushering in a cycle of malnutrition - infection (10). Lowered immunity and mucosal damage are the major mechanisms by which defences are compromised. Under these circumstances, infectious diseases will have increased incidence, severity, and duration. The disease processes itself exacerbates loss of nutrients, both by the host's metabolic response, and by physical loss from the intestine. These factors themselves exacerbate the malnutrition, leading to further possible damage to defence mechanisms



Previous studies reported that children with Down syndrome show multiple abnormalities in humoral immunity. These immunologic abnormalities suggest diminished viral and bacterial clearance in Down syndrome resulting in impaired nutritional status. In the present study, the serum immunoglobulins showed alterations with various grades of malnutrition. IgG and IgA showed decrease with increasing grades of malnutrition whereas the levels of IgM increased with increasing grades of malnutrition. The low levels of IgG and IgA suggested impaired production of B cells in malnutrition.

Therefore it is concluded that poor growth seen in children with Down syndrome could also be due to the consequences of higher incidence of respiratory tract infections owing to their impaired immune system.

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Correspondence to:

B.Vishnu Bhat
Department of Pediatrics and Neonatology
JIPMER, Puducherry -605006.
India
Email: drvishnubhat@yahoo.com