The Egyptian Journal of Medical Human Genetics xxx (2017) xxx–xxx

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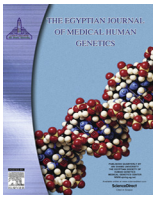
Contents lists available at ScienceDirect

The Egyptian Journal of Medical Human Genetics

journal homepage: www.sciencedirect.com



Original article

Correlation between cognitive function, gross motor skills and health – Related quality of life in children with Down syndrome

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ARTICLE INFO

Article history:
Received 19 June 2017
Accepted 6 July 2017
Available online xxxx

Keywords:
Cognitive function
Gross motor skills
Health – related quality of life
Down syndrome children

ABSTRACT

Background: Children with Down syndrome (DS) have delayed motor and cognitive development and have problems in health related quality of life (HRQOL).
Purpose: To evaluate the correlation between cognitive function; attention/concentration, gross motor skills; standing and walking, running, jumping domains and HRQOL in children with DS.
Subjects and methods: Seventy children with DS of both sexes (37 boys and 33 girls) were selected from El Tarbia El Fekria School for children with Special Needs and Education and National Institute of neuro motor system. They were selected to be ranged in age from 8 to 12 years and to be free from visual, hearing or perceptual problems. They were divided into two age groups; group A (8–10 years), and group B (10–12 years). The Rehacom was used to evaluate the cognitive function (attention/concentration), the Gross Motor Function Measure-88 (GMFM-88) was used to evaluate the gross motor skills and the Pediatric quality of life inventory parent-proxy report (PedsQL TM) was used to evaluate the HRQOL.

1. Introduction

Down syndrome (DS) or trisomy 21 is the most common genetic cause of intellectual disability. It occurs in an estimated 9.0–11.8 per 10,000 live births in Europe. The syndrome is caused by an extra copy of chromosome 21 which is represented as trisomy or part of a third copy of chromosome 21 that is called translocations [1]. Children with DS have various problems, such as delays in gross motor skill development, cognitive limitations, neurological disorders, sensorimotor integration impairments, obesity, psychosocial functioning and health impairments, delays in speech and language skill development [2,3].

Cognition is the ability of the child to acquire, organize and use knowledge. It is a general term involving multiple classes of mental capacities. DS is characterized by disorders in various cognitive abilities, including impairment in attention and concentration, learning, memory and language that can result in mild to profound disorders in overall intellectual functioning. Cognitive delay in addition to delayed motor skills may further limit the child's ability to interact with the environment, explore the space and manipulate objects .The cognitive limitations of individuals with DS have an important influence on the level of functioning attained. Cognitive deficit is considered one of the major problems affecting activities of daily living in children with DS [4].

Children with DS have problems in attention which is a major component of cognitive function. Attention is the basis on which all the cognitive functions are built. Attention and concentration restrict various motor tasks. So, the use of cognitive assessment has an important value in children with DS [5,6]. Cognitive assessment is a performance based assessment of various cognitive skills. It helps to identify children's strength and difficulties in intellectual development and lead to intervention that optimizes that development. Assessment of children's cognitive abilities constitutes a major part in the field of physical therapy due to its importance in gathering information for diagnosis of behavioral problems in children [7,8].

Down syndrome affects physical, cognitive, sensory and adaptive functions during the developmental process. These disabilities cause limitations in activities and participation in adolescence and adulthood and affect health related quality of life (HRQOL) and wellbeing in negative ways [9]. Children with DS usually suffer from overall muscle weakness, slow postural reactions, and response time, in addition to hyper flexible joints that interfere with the child's daily activities and result in lower quality of life. Most studies emphasize primary motor and sensory impairment and fail to address functional outcomes [10,11].

The concept of HRQOL is the assessment of the state of the individuals in terms of their own value system and culture. It is

Peer review under responsibility of Ain Shams University.
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http://dx.doi.org/10.1016/j.ejmhg.2017.07.006
1110-8630/

reported that HRQOL is affected by chronic and frequent conditions such as mental retardation. Social participation and HRQOL are emerging areas of research, as they are essential for children with physical dysfunction to enjoy leisure activities at home and in the community [12]. Therefore, the aim of the present study is to investigate the correlation between cognitive function; attention/-concentrations, gross motor skills; standing and walking, running, jumping domains and HRQOL in children with DS.

2. Subjects and methods

2.1. Patients

A group of 70 children with DS from both sexes (37 boys and 33girls), their ages ranged from 8 to 12 years. They were selected from El Tarbia El Fekria School for children with Special Needs and Education in Dokii, Giza and National Institute of neuro motor system, Giza, Egypt. Children were classified into two age groups; (A) from 8 to 10 years with a mean age 8.72 ± 0.82 years, and (B) from 10 to 12 years with a mean age 11.6 ± 0.55 years. They were selected according to the following criteria: they are able to walk independently, their IQ level ranges from 50 to 70 and they are able to understand and follow instructions given during assessment. Exclusion criteria included children who have some musculoskeletal problems that restricted the interaction with the Rehacom, sever visual, hearing or perceptual problems that interfere with the task performance.

2.2. Rehacom system

Rehacom system, version 5 was used to assess cognitive function which is a software computer – assisted therapy system. It is composed of special input panel, computer keyboard, mouse and central processing unit (CPU). In the current study, we assessed the attention and concentration in which the child selects from many pictures the one that is identical with a pattern. The program is composed of 24 ascending difficulty levels. There were eight stages, each starting with a low similarity of the objects (easy task) up to high resemblance (hard task). Each stage consisted of three levels of difficulty with the matrix containing three, six or nine pictures [13]. The environment is a closed one with the least possible distraction, suitable light and temperature. The child sat in a comfortable sitting position in front of the screen. The child's mother attended the evaluation session to enhance the child cooperation. Each child was given explanatory instructions before the evaluation. The authors described to the child every task and allow him to practice the task to ensure his understanding of the testing procedures.

2.3. Gross motor function measure-88 (GMFM-88)

Gross motor skills; standing and walking running, jumping domains were assessed using GMFM-88. It has been validated for use with children who have DS. The GMFM-88 is a reliable scale to evaluate gross motor function in a quantitative manner regardless the quality of motor performance. It can be used for children from birth to 16 years of age. In the present study, each child was assessed in standing (13 items) and walking, running, jumping domains (24 items) as reflection of some activities of daily living. The evaluation environment should be suitable, comfortable, closed warm for the child and the floor should have a smooth, firm surface, large enough to hold necessary equipment and allows the child to move freely. The items of the GMFM are measured by observation of the child and scored on a 4 – point ordinal scale (0 = does not initiate, 1 = initiate, 2 = partially completes, 3 = completes activity. Determine the goal total score, only the dimensions identified as goal areas by the clinician were included [14].

2.4. Pediatric quality of life inventory (PedsQL™)

Health-related Quality of life for children with DS was assessed using The PedsQL™ parent-proxy report Generic Core Scale [29]. We used the parent proxy study as the children with DS could not fill out the inventory by themselves due to their cognitive impairment. It is a brief, 23-item multidimensional instrument designed for measuring pediatric HRQOL in chronic health conditions and healthy children. It consists of four generic core scales which are physical functioning (8 items), emotional functioning (5 items), social functioning (5 items) and school functioning (5 items). The PedsQL™ has been shown to be both reliable and valid with internal consistency reliability coefficients. The 3 summary scores include total scale score (all subscales), physical health summary score (physical functioning scale only), and psychosocial health summary (emotional, social, and school functioning scales combined). Items are rated on a 5-point ordinary scale to indicate how much the child has problems with various areas of functioning, ranging from 0 (never a problem) 1 (almost never a problem), 2 (if it is sometimes a problem), 3 (often a problem) to 4 (almost always a problem). The 5-point scale (0–5) is transformed to a 0–100 scale as follows: 0 = 100, 1 = 75, 2 = 50, 3 = 25, and 4 = 0, so that the higher scores indicate better HRQOL [15].

2.5. Statistical analysis

All statistical measures were performed through the statistical package for social studies (SPSS) version 19 for windows. The level of significance for all statistical tests was set at $p < 0.05$. Person Correlation Coefficient was conducted to determine the correlation between cognitive items; minimum and maximum reaction time and GMFM; standing and walking, running, jumping domains and HRQOL; physical, psychosocial and total sores. Spearman Correlation Coefficient was conducted to determine the correlation between cognitive item; difficulty level and HRQOL and GMFM.

3. Results

3.1. Clinical characteristics of the study participants

Group A (8–10 years) includes 35 children with DS (15 girls and 20 boys), with a mean age 8.72 ± 0.82 years. Group B (10–12 years) includes 35 children with DS (17 girls and 18 boys) with a mean age 11.6 ± 0.55 years. There was no statistically significant difference in the mean age value between boys and girls with p value = 0.81.

3.2. The relationship between cognitive function and gross motor function measure in both age groups

There was a weak correlation between cognitive function in minimum and maximum reaction time and GMFM; standing, walking, running, jumping domains and goal total score in both age groups. However, there was a weak correlation between the difficulty level of cognitive function and GMFM; standing domain in age group A and a moderate correlation in age group B. In the present study, a moderate correlation was found between the difficulty level of cognitive function and GMFM; walking, running, jumping domain and goal total score in both age groups (Table 1).

Please cite this article in press as: Abd El-Hady SS et al. . Egypt J Med Hum Genet (2017), http://dx.doi.org/10.1016/j.ejmhg.2017.07.006