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Research Article

Sport Practices Effects on Quality of Life, Mental Behavior and Self-Esteem in Cerebral Palsy Hemiplegia

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Abstract

Despite the known health benefits of regular participation in physical activity, people with Hemiplegic Cerebral Palsy (HCP) tend to participate less than their typically developing peers.

The purpose of this study is to highlight the effect of sport practice on general health quality of life, mental behavior and self-esteem in hemiplegics group practicing regular sports (TRAINED) compared to a control group (CONTROL). Forty subjects (20 males and 20 females) with spastic hemiplegia completed the SF-36 survey (SF-36 Medical Outcome Study Short-Form Health Survey). The results showed significant differences in most of the Quality of Life (QoL) criteria including "limitations in physical activities due to health problems, restrictions on usual activities because of physical health problems, general mental health, vitality, limitations in social activities due to physical or emotional problems, and perception of general health" with positive results for TRAINED compared with CONTROL.

Introduction

Cerebral palsy hemiplegia (CP) results from early brain damage (from conception to 2 years) [1], with heterogeneous causes, including; timing, location, and extent of the brain damage [2]. The different forms of lesions may influence the development of hemiplegia, as well as the likely response to treatment. Indeed, the lesions may be characterized as [3]; non-hereditary, stabilized (non-progressive), which is considered responsible for exclusive motor deficiencies, or, predominant, sequential motor disability, which is associated with varying degrees of posture and movement disorders [4].

Generally, less specific services are available for people with CP. Moreover, clinical and scientific evidence suggests that adults with CP do report progressive impairments and functional loss [5, 6]. These complaints include musculoskeletal problems (e.g., loss of muscle function, increase of joint contractures, pain), which often coincide with progressive limitations in everyday physical activities (e.g., walking) [6].

Despite the known health benefits of regular participation in physical activity, people with CP tend to participate less than their typically developing peers [7,8, 9]. On the other hand, Van den Berg-Emons *et al.* [10] compared activity levels between 10 children with spastic diplegia and 10 healthy comparison subjects using the doubly-labelled water method and a respiration chamber (total energy expenditure and sleeping metabolic rate, respectively); they found that the children with CP were severely hypoactive. Bandini *et al.* [9] demonstrated hypoactivity in adolescent wheelchair users with CP. While these aforementioned studies have examined energy expenditure and physical activity, key behavioural determinants of this behaviour, such as self-esteem and health related quality of life have been neglected. Such information is key in understanding how physical activity and sport participation in youth with HCP might be influenced by such behavioural determinants.

To the author's knowledge, no study has compared quality of life in sportive and non-sportive persons with CP. Therefore, the purpose of this study was to highlight the effect of sports practice on general health quality of life, mental behaviour and self-esteem in CP.

Materials and Methods

Criteria for selecting subjects to participate in our study, and to hold their attention, we have established a list of levels of gross motor skills with specific activities and a range of recreational and functional activities

in which to participate in a given day. Activities are age-appropriate and can all be done unanimously. Specific activities are selected taking into account: (1) articular movements with pronounced deficits; (2) joint movements that, in our opinion, have the greatest potential for improvement; and (3) preference for activities with the same potential to improve identified movements [11], we have used the criteria of class TF37 hemiplegics as has been described in the scientific work conducted by the international paralympic committee and used as official manual in the classification of athletes during their participation in different disciplines such as CP football, and athletics with the world para-athletics either during the Olympic Games or World Championships, or any official competition organized under the aegis of the WPA or the CP-ISRA specialized international organization of adapted sports for the CP from light to deep [12].

To investigate the effects of sports on our subjects, we used the SF-36 survey, SF-36 Medical Outcome Study Short-Form Health Survey [13]. The SF-36 is a standardized quality of life measurement test that has been validated in the French version, conducted and published since the start of the project [14]. Translation in Arabic, adaptation and validation for use in Tunisia by Guermazi M *et al* [15].

Subjects

Fourty subjects (20 males and 20 females) with spastic hemiplegia were studied with local ethical committee approval and informed consent. The criteria initially considered for participant selections was the classification described by The Gross Motor Function Classification System (GMFCS), the GMFCS is a five-level classification system that focuses on the voluntary movements of children with cerebral palsy (CP), with specialized focus on walking and sitting. The higher the level in GMFCS, the more severe the classification of CP. The GMFCS applies to all types of CP and all levels of severity [16]. All were ambulant and had spastic hemiplegia of varying severity with some increase in tone and reduction of movement on the affected side as showen in book rules for IPC athlete classification [12]. The hemiplegia was right sided in 22 (52%) and left sided in 18 (48%) subjects. Twenty subjects (10 males/10 females) practice sports, and twenty (10 males/10 females) are sedentary without any activities, we excluded subject whose receiving treatment for epilepsy. The CNS damage was congenital in all subjects, with damage occurring prenatally or before the end of the neonatal period (28 days). Anthropometrics details of each subject are given in the Appendix.

Our study focuses on two populations: sports and non-sports:

Inclusion Criteria

- TF 37: athletes with spastic paresis hemiplegia; walks and runs with lameness without support or help.
- Sedentary hemiplegic cerebral palsy having the same criteria as TF 37.
- Age varies between 17 years and 28 years.

Exclusion Criteria

- Deep cerebral palsy which has different criteria compared to TF 37, with poor balance, using a walking orthosis and crutch or wheelchair, or requiring a third person to walk around.

• Age <17 or >28 years.

• The hemiplegic following a cerebrovascular stroke or other reasons (so the non CP).

Spastic quadriplegic athletes (or similar)

Spastic triplegic athletes (or similar)

Spastic diplegic athletes who may be in a wheelchair (or similar)

Spastic diplegic athletes (or similar)

Dystonia athetoid or ataxic athletes (or similar)

Mild hypertonia, athetoid or "minimal" ataxic athletes (or similar)

Control Population

This study was conducted on two groups.

The first group is an experimental group consisting of a population of athletes practicing differents sports (Parataekwendo n=3); (Pararowing n=4); (Paraathletics n=5); (FootCP n=8). The second group is a control group of sedentary cerebral palsy (n = 20). The mean and standard deviation for age (see Appendix).

In this study we will focus on patients who are in the C7 (TF37) class. As for sportsmen, they are already classified by IPC classifiers familiar with sport among people with disabilities.

For sedentary patients, physiotherapist assessments should be made with the same IPC classifier. Taking into account the same criteria as that of the IPC, the joint assessment makes it possible to evaluate the articular amplitudes to quantify the articular deflection, the orthopedic deformations but also to observe the pain phenomena and the sensations of end of race. It is therefore of a qualitative and quantitative nature.

The muscle assessment evaluates the strength of a muscle or a muscle group on the 5-point Ashworth scale. The spasticity assessment evaluates the degree of spasticity from 0 to 4 according to the Ashworth scale [17,18]:

Grade 0: No increase tone.

Grade 1: Slight increase in tone giving a "catch" when the limb is flexed or extended.

Grade 2: More marked increase in tone, but limb is easily flexed or extended.

Grade 3: Considerable increase in tone with passive movement difficult.

Grade 4: Limb rigid in flexion or extension.

These assessments were performed on patients with hemiplegic cerebral palsy to select those who are in the C7 class (TF37) as described by Tweedy and Bourke [12] and used in classification rules in world para athletics.

Class C 7 (TF37)

Ambulant hemiplegics athletes in this class have Grade 2 to 3 spasticity in one side of the body. They walk without help, but spasticity of the lower limb often causes lameness. Good functional value on the dominant side of the body. The control of the arm and the hand is affected in the most impaired part. There is good functional control on the least weathered side.

Legs

Hemiplegia with spasticity of degree 2 to 3. Better development and good follow-up of movement on the dominant side during walking and running. Minimal moderate athetoïde do not fit into this class.

Upper Limbs

Control of the arm and hand is affected only on the non-dominant side. Good functional control dominant.

Race

During the walk, athletes in class 7 have a limp on the affected side. During the race, the lameness tends to disappear almost completely. The reason is that during the race, the leg is supported on the anterior part of the foot, while when walking, the support is mainly on the heels. Hence, the difficulties demonstrated by people with spastic paresis. During walking, the affected arm is almost all the time in extension, while in the race, the two arms are in flexion of the elbow. Thus, during the race, there is a difference in the position of the arms relative to a normal individual. For all these reasons, the hemiplegic athlete presents in the race an almost normal movement. However, the experience shows that these athletes have restrictions caused by spasticity during rapid movements, as well as disorders of coordination during trunk movements.

Throws and Jumps

In throwing events, the hemiplegic athlete often has hip flexion on the affected side instead of the usual hyper-extension, so some rotation of the trunk implying a loss of ease in casting.

During the javelin throw, the transition from the running race to the pitching phase shows obvious difficulties.

Materials

Survey Instrument: Questionnaire (in Appendix).

The SF-36 test (The Short Form (36) Health Survey) is a standardized test for measuring quality of life. He comes from the “medical outcome study”.

It is well documented and described in nearly 4,000 publications and citations published since 1988 [13,19]. In short, it includes 36 items divided into 8 dimensions that measure eight health concepts: limitations in

physical activities due to health problems, limitations in social activities due to physical or emotional problems, restrictions on usual activities in because of physical health problems, physical pains, general mental health (psychological distress and well-being), vitality (energy / fatigue), restrictions on usual activities due to emotional problems, perception of general health.

These eight concepts were also summarized in two scales: a physical component (CP) and a mental component (CM) [20]. This questionnaire was supplemented by questions aimed at clarifying the age of participants and their profession in order to refine my work.

The SF-36 questionnaire was used in a cross-sectional study to collect and analyze the effect of high-performance sport practice not only on the quality of life of C7 cerebral palsy (TF 37) but also on perception of abilities, bodily and self-esteem. We analyzed a representative sample of 40 people: 20 C7 (TF37) athletes and 20 sedentary cerebral palsy patients of the same class C7 (TF 37) (questionnaires in Appendix). Measuring health status in a population is important for evaluating interventions and predicting health and social services needs. Quality of life studies are an essential complement to medical assessment, but most of the tools available in this area are in English. In order to assess the quality of life of sedentary cerebral palsy and those engaged in high performance sport, the short form 36 health survey (SF-36) has been adapted into French and Arabic, to ensure a better understanding of questionnaire by the respondents.

Data Analysis

Each of the eight dimensions of the questionnaire observed for each group was compared using non-parametric statistics (Mann-Whitney test). In view of the number of variables measured and possible comparisons that could be made from them, a conservative significance level was established; that is, a null hypothesis associated with a p value was rejected if the p value was less than 0.006 (Bonferroni corrected).

A chi-square test (X2) of independence was performed to examine the relation between experimental/control group and each of the eight questionnaire dimensions. In addition, Cramer's V (equation 1) was subsequently used to compute the accompanying effect size. Per Cohen (1988), the effect size was calculated by dividing traditional effect size thresholds (i.e. small = 0.1, moderate = 0.3, large = 0.5) by degrees of freedom.

$$V = \sqrt{\frac{\chi^2}{n \cdot df}}$$

Eq.1. V = Cramer's V, χ^2 = chi-square statistic, n = number of observations, df = degrees of freedom.

For all inferential tests, alpha was set at 0.05, a priori, unless otherwise stated, data were presented as median and lower and upper quartiles (LQ and UQ, respectively), and computed using Statistical Package for the Social Sciences (SPSS; IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

Results

Significant differences, in favor of the experimental group, were found for 1) limitations in physical activities due to health problems, 2) restrictions on usual activities because of physical health problems, 3) general mental health, 4) vitality, 5) limitations in social activities due to physical or emotional problems, and, 6) perception of general health. Median, LQ, UQ and p-statistics are detailed in Table 1.

Table 1

Dimension	Median	LQ, UQ	p-value
Limitations in physical activities due to health problems			
EXP	2	1.25,2	
CON	1	1,1	<0.0001*
Limitations in social activities due to physical or emotional problems			
EXP	3	3,4	
CON	1	1,1	<0.0001*
Restrictions on usual activities because of physical health problems			
EXP	2	1.25,2	
CON	1	1,1	<0.0001*
General mental health			
EXP	4	3,4	
CON	1	1,1	<0.0001*
Vitality			
EXP	2	1,3	
CON	5	4,5	<0.0001*
Restrictions on usual activities due to emotional problems			
EXP	2	1,2	
CON	1	1,1	=0.014 (NS)
Perception of general health			
EXP	4	4,4	
CON	5	5,5	<0.0001*
Physical pains			
EXP	3	2,3	
CON	3	2.25,4	=0.174 (NS)

Chi-square test for independence with effect size (Cramer's V)

A Chi-square test of independence, and Cramer's V effect size, was computed to examine the relation between EXP/CON group and each of the eight dimensions. The relation between EXP/CON group and 1) *limitations in physical activities due to health problems*, χ^2 (2, N=40) = 24, p <.0001, V =0.76, 2) *limitations in social activities due to physical or emotional problems*, χ^2 (4, N=40) = 31.42, p <.0001, V =0.87, 3) *restrictions on usual activities in because of physical health problems*, χ^2 (1, N=40) = 24, p <.0001, V =0.78, 4) *general mental health* (psychological distress and well-being), χ^2 (4, N=40) = 33.54, p <.0001, V =0.92; 5) *vitality* (energy / fatigue), χ^2 (4, N=40) = 36.44, p <.0001, V =0.96; 6) *restrictions on usual activities due to emotional problems*, χ^2 (4, N=40) = 8.64, p =.003, V =0.47; and 7) *perception of general health*, χ^2 (4, N=40) = 27.2, p <.0001, V =0.83, was significant, all with large effect sizes (Cramer's V). Whilst the Chi-square test of independence for physical pains yielded no significant association (p >0.05).

Discussion

The current study examined the possible effects of regular sport practice on quality of life in patients with cerebral palsy hemiplegia. This is the first study to date to examine this issue and, as such, presents original data. It is clear that cerebral palsy and hemiplegia can have negative effects on the physical, psychological and social life of the patients and their family. The results of the present study demonstrate a clear significant poor quality of life in patients who do not practice sport compared with experimental group.

Significant differences were found for the following criteria: limitations in physical activities due to health problems, restrictions on usual activities because of physical health problems, general mental health, vitality, limitations in social activities due to physical or emotional problems, and perception of general health. It is well known that regular physical activity can confer significant and multiple positive effects [21], including physical fitness, and psychological effects, such as self-esteem and emotion and quality of life [22]. Currently, regular sport and physical activity practice is specifically recommended for the people who have physical and psychological challenges, such as CP, in order to facilitate their rehabilitation results and maintain their independence level [22]. To our knowledge, few studies have been conducted in people with CP regarding quality of life and sport practices [23]. It has been shown that for example that sports activity can improve the psychological status in both tetraplegics and paraplegics with spinal cord injury, and the psychological benefits are emphasized by sports activity at high frequency [24].

The present results are in parallel with several studies that showed a positive relationship between physical activity and both QL and psychosocial functioning [25]. Furthermore, it has been shown that children with hemiplegic CP who carried out 12 weeks of upper limb Wii training, plus usual care, experienced a decrease in spasticity and an increase in grip strength and hand function compared with usual care alone [26].

Despite this, it has been shown in previous work that six to seven weeks of balance training results in positive results in displacement in forward and backward directions in quiet stance [27]. In the same context, nine-months of physical training four times per week on top of the normal school sport activities and therapy program had a positive effect on peak aerobic power and improved weight control as compared to a control group [28]. Recently, it has also been shown also that isokinetic peak torque, as well as other rotator cuff

parameters, from wheelchair basketball athletes were higher than the non-athletic group at all angular velocities [29]. The positive effects can be explained by the fact that task-related or other intense upper-limb training paradigms, such as constraint-induced movement therapy, have been shown to be effective in the management of CP and other central nervous system (CNS) disorders [30,31].

Our study is not without limitations. The heterogeneity of our population (male and female subjects, different sport practices) may represent a limitation of the present results. Thus, studies with more homogeneous samples are needed. Examination of a wider range of behavioural determinants of physical activity and sport than those presented here would also be welcome in extending understanding of the role of exercise and sport in hemiplegic cerebral palsy.

Conclusion

The present study adds to the literature regarding the positive effect of regular physical activity and sports practice in HL persons. Positive results were found for health-related quality of life, specifically relating to such as limitations in physical activities due to health problems, restrictions on usual activities because of physical health problems, general mental health, vitality, limitations in social activities due to physical or emotional problems, and perception of general health. It is evident that the participation of people with disabilities in sports is desirable, because it has a positive impact on social, psychological, and physical aspects, and it is considered as a complementary strategy for physical emotional rehabilitation. Future longitudinal research is required to reinforce current knowledge and to elucidate long-term benefits of physical activity in this population.

Conflicts of Interest

The authors have no conflict of interest

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