

Relationship between physical, mental fitness and associated factors: a cross-sectional study on parents of children suffering from cerebral palsy

A.R. SHAIK

Department of Physical Therapy and Health Rehabilitation, College of Applied Medical Sciences, Majmaah University, Al-Majmaah, Saudi Arabia

Abstract. – OBJECTIVE: The workload of parents multiplies exponentially while nurturing and raising their child suffering from cerebral palsy (CP), adding to their physical and mental exhaustion. Literature review suggests very few studies have tried to assess the health condition of such parents including factors associated that might affect the outcome. The aim of the present study is to evaluate the health status of parents with respect to their physical and mental condition as well as associated factors that have a bearing on the same.

SUBJECTS AND METHODS: A cross-sectional survey was conducted on 157 parents (38 fathers and 119 mothers) of CP children from special schools identified in the Dakshina Kannada district, Karnataka, India. Standard tests were used to evaluate physical and mental fitness. Analysis was done using standardized statistical tools, including the Karl Pearson correlation test to evaluate the correlation between physical and mental fitness with reference to other associated factors in such cases.

RESULTS: It was observed that cardiac, muscular, and endurance were significantly weaker in mothers as compared to fathers. Among socio-economic factors, education level, economic security, income level, and duration of caregiving are significantly correlated with mental health irrespective of the parent. 35% of the mothers suffered from moderate depression, whereas 46% of the fathers suffered from volatile mood swings.

CONCLUSIONS: Mothers of special-needs children have poor cardiac and musculoskeletal fitness and are likely to develop chronic diseases in the long term. Moreover, among all education levels, economic security and duration of caregiving are significant precursors, adversely affecting mental health among both parents. A family guidelines book based on the needs of such parents could be suggested to address the key issues of concern, including their physical and mental fitness, which might help in tackling several critical issues while raising such children.

Key Words:

Cerebral Palsy children, Parents, Physical fitness, Mental health.

Introduction

The hardships and challenges for parents to raise a CP child are much difficult compared to their counterparts. Literature review suggests that such parents and families are more likely to experience emotional stress, mental despair, financial constraints, interpersonal difficulties, etc¹⁻³. Since a CP child is at increased risk of delayed milestones, including several physical, mental, and emotional challenges to battle, reviewing the care plan for their child gives parents a timeline of the decisions they've made, the actions they've done, the knowledge they've gained, for creating an appropriate environment for their children. Taking holistic care of CP children is not only physically challenging but also mentally straining for the parents since such children deserve more attention, especially in their early developmental year⁴⁻⁶.

It is often observed that parents, mothers in particular, undergo tremendous mental and physical stress as the child grows in age, and often such parents neglect their own health in terms of neglecting personal care, suffering from insomnia, depression, non-conformity to daily exercises etc^{7,8}. Moreover, mobilization of these differently abled children, especially in a developing country like India can also be quite challenging due to the non-conformity of public spaces for disabled people. Thus, carrying, transferring, lifting, pushing and other maneuvering activities can take a severe toll on the physical health of

parents, which can lead to debilitating disorders if done repeatedly throughout the day. Literature review suggests that such parents have reported more cases of low back pain and other musculo-skeletal ailments than the parents of other normal children^{6,9}.

Similarly, other factors including socio-economic conditions, support from partner and other family members, can impact the parent's physical and mental health quite adversely. Studies⁹⁻¹¹ recently have showcased numerous mental issues with the mothers of such children. Moreover, it has also resulted in non-harmonious family environment in some of such cases¹². To the best of our knowledge, no studies have been conducted ever to evaluate the impact of various socio-economic factors on physical and mental health of parents of CP children, especially from the perspective of a state like Karnataka located in India.

Subjects and Methods

This is a cross-sectional study and was approved by the Ethical Committee of Highland Hospital Research and Diagnostic Center (HHRDC), Mangalore, India (Reference No. HHRDC-EC/25/22). Out of the total of 47 special schools that have been identified in Mangalore and other parts of the Dakshina Kannada district of Karnataka, India, 12 schools were selected using convenience sampling method using the formula, $n=Z^2 \times \sigma^2 / e^2$. Based on the calculation, a total of 147 samples were required. The author contacted the special schools to explain them the study setting, and formal consent was taken from the compliant school heads, as well as from the parents of the CP children.

A total of 203 parents were screened based on the inclusion and exclusion criteria, out of which 179 satisfied the inclusion criteria. In the end, a total of 157 parents (119 mothers and 38 fathers) agreed to participate in the study. However, by the end of the study, 7 parents dropped out.

The inclusion criteria include either male or female parent, age ranging from 23-40 years, taking care of their CP children, with age ranging from 2 years to 14 years with duration of care of child > 6 months. Those parents having chronic diseases, including diabetes mellitus, hypertension, or other neurological problem that can affect the compliance of respondents to participate in the study, were excluded. Different outcome measures for measuring physical health included

Chester step test for assessing physical fitness, repeated sit-up test for muscle endurance, hand grip dynamometry for assessing muscle strength, and Schober's test for assessing lumbar flexibility¹³⁻¹⁵. Likewise, mental health was assessed using the Hospital Anxiety and Depression Scale (HADS) for measurement of anxiety and depression among parents of CP children¹⁶. The data was compared to a control group to identify selected physical and mental health predictors.

The respondent parents were assessed for their socio-economic characteristics. The demographic data included educational status, occupation, family type as well as details of the child (gender, age, duration of rehabilitation). Their economic status was assessed based on their income level as well as assessing their response by rating their family's economic security as good, average and poor.

The mental health was assessed using HADS questionnaire which consists of 14 questions, 7 each for assessing anxiety and depression respectively. Each item on a scale is scored from 0 to 3, with scores in each subscale ranging from 0 to 21 points, with score over 10, referring to anxiety or depression¹⁶.

Procedure

To assess each respondent physical health, BMI was assessed using stadiometer and classifying their body type as underweight, normal, overweight or obese depending on results observed. This is followed by assessment of overall physical health of the respondent parents using the various outcome measures suggested earlier. To avoid muscle fatigue, all tests are separated by a 5-minute rest period between them.

The Chester step test is a submaximal, multi-stage test for measuring physical/aerobic fitness. To perform the test, various equipment was used including a low step (platform of approx., 20 inches), heart rate monitor, instructional CD with stepping beat rhythms, chart for assessing perceived effort (RPE), and CST software calculator.

The participants were instructed to step onto and off a low step at predetermined times. The tester is instructed to record the subject's exercise heart rate and RPE every two minutes, after which the stepping timing is gradually increased. The test was conducted in this manner until the participants reached 80% of their maximum heart rate (HRMax), indicating a moderately strenuous level of exercise (RPE = 14). The specialized CST software is then used to calculate aerobic

capacity (or $VO_{2\text{Max}}$) using the exercise heart rates. The test can last up to 10 minutes. Physical fitness was graded from poor to excellent based on scores of the Chester step test. Muscle strength was calculated using a portable dynamometer. The participating parents were instructed to sit in a neutral position with their shoulders abducted, elbows bent at a 90° , and forearms in a neutral position with wrists held between 0 and 5 degrees of ulnar deviation. The dynamometer was held perpendicular to the forearm while the arm was not supported by the examiner or an armrest. The subjects were instructed to press the bar firmly with an average of three being measured. Depending on the results obtained using the grading criteria, grip strength was rated from poor to above average¹⁷.

Abdominal muscle endurance was measured with a sit-up test. The subject was instructed to lie on their backs with their knees flexed to 90° , heels flat on the ground, and hands interlocked behind their heads. The feet were held on the ground by a partner. The subjects, when instructed to begin, raised their shoulders from the ground while keeping their hands interlocked behind their heads and touching the elbows to the knees. The subject then descended back down to the ground. They had to complete as many repetitions as possible in the 60 s¹⁸.

Muscle flexibility was determined with sit and reach test. Participants were tested individually under supervision. Each participant was required to sit with the feet approximately hip-wide apart against a wooden testing box (length of box 53.3 cm and height 32.5 cm), with their knees in extension. Then, the participant kept their hand right and over the left hand, and slowly reached forward as far as possible by sliding their hands along the measuring rule. Three tests were conducted, and the best score was recorded to represent the participant's flexibility¹⁹. The scores graded from "needs improvement" to "excellent" based on standard criteria.

Statistical Analysis

The descriptive and inferential statistics of the respondents was analyzed using SPSS Statistics version 24 (IBM Corp., Armonk, NY, USA). Karl Pearson's correlation was used to explore relationship between physical health, mental health, as well as associated socio-demographic factors related to the parents of CP children. The level of significance for p -value was ≤ 0.05 .

Results

A total number of 157 parents (38 fathers and 119 mothers) participated in the study. The average age of mothers was 32 years while the average age of fathers was 34. Descriptive statistics of the scores obtained for BMI, cardiorespiratory fitness, grip strength, flexibility, muscle endurance, and mental health are shown in Table I and II. All of the fathers were workers, on the other hand, only the 77% of mothers had a job. Educational status showed that 71% of the fathers and 70% of the mothers were graduates. In terms of family structure, a high percentage of respondent parents (86% for fathers and 85% for mothers) lived in nuclear families. Most of the fathers had an average annual income between 25,000-49,999 while the mothers had an average annual income of 50,000-75,999.

Karl Pearson's correlation coefficient was used to evaluate the relationship of mental health (depression) and fitness components and other associated factors. For the fathers, results showed inverse and significant relationship between BMI ($r = -0.166$; p -value = 0.041) and cardiac fitness ($r = -0.249$; p -value = 0.025) while musculoskeletal physical fitness components, i.e., muscular endurance and strength, were also inversely and significantly related with depression. For the mothers, results showed inverse and significant relationships between BMI ($r = -0.178$; p -value = 0.033) while musculoskeletal physical fitness components, i.e.,

Table I. Fitness scores of different components for male and female parent.

Parameters	Male (38)	Female (119)
BMI	31.6 \pm 4.12	28.2 \pm 4.83
Cardiac Fitness	52.42 \pm 5.12	45.37 \pm 7.43
Muscular Strength	65.37 \pm 4.12	53.18 \pm 5.73
Muscular Endurance (Sit-ups test)	4.83 \pm 3.25	3.742 \pm 2.38
Flexibility (Sit and Reach Test)	21.57 \pm 2.33	24.32 \pm 1.48
Mental Health (HADS)	14.31 \pm 3.57	15.13 \pm 4.83

Table II. Physical and mental fitness parameters for both male and female parents.

Parameter	Category	Value (in %)	
		Male (38)	Female (119)
BMI	Normal	11 (29%)	37 (32%)
	Overweight	9 (24%)	31 (26%)
	Obese	18 (47%)	51 (42%)
Cardiac Fitness	Poor (< 54)	5 (14%)	56 (47%)
	Low Average (> 54 and < 67)	33 (86%)	63 (53%)
Muscular Endurance	Very Poor (< 7)	0 (0%)	34 (29%)
	Poor (7-14)	4 (11%)	53 (45%)
	Average (> 14)	34 (89%)	32 (26%)
Muscular Strength	Very Poor	0 (0%)	39 (38%)
	Poor	2 (5%)	42 (35%)
	Average	36 (95%)	38 (27%)
Muscular Flexibility	Fair (7-0 cms)	15 (39%)	73 (61%)
	Average (1-10 cms)	23 (61%)	46 (39%)
	Normal (1-10)	6 (16%)	22 (18%)
Mental health	Mild Mood Disturbance (11-16)	14 (37%)	41 (34%)
	Borderline Clinical Depression (17-20)	12 (32%)	34 (29%)
	Moderate Depression (21-30)	6 (15%)	22 (19%)

muscular endurance ($r = -0.241$; p -value = 0.031) and strength ($r = -0.198$; p -value = 0.029), were also inversely and significantly related with depression. However, no significant correlation was found between muscular flexibility and depression for the respondent parents (Table III).

Results showed a negative and significant correlation between depression and education levels for fathers ($r = -0.147$; p -value = 0.049) and mothers ($r = -0.357$; p -value = 0.026). A significant and negative correlation was found for occupation status ($r = -0.271$; p -value = 0.032) and family

type ($r = -0.245$; p -value = 0.036) for the mothers. Economic security for fathers ($r = -0.244$; p -value = 0.036) and mothers ($r = -0.452$; p -value = 0.013) was also negatively correlated. The relationship between reported family income and depression was found to be negative and significant for both fathers ($r = -0.379$; $p = 0.022$) and mothers ($r = -0.705$; p -value = 0.06). According to obtained results, period of caregiving is negatively and significantly related to depression for fathers ($r = -0.231$; p -value = 0.031) and mothers ($r = -0.256$; p -value = 0.02) (Table IV).

Table III. Correlation between mental health and physical fitness.

Gender Parameters	Male Pearson's Correlation (p -value)	Female Pearson's Correlation (p -value)
BMI	Normal	11 (29%)
	Overweight	9 (24%)
	Obese	18 (47%)
Cardiac Fitness	Poor (< 54)	5 (14%)
	Low Average (> 54 and < 67)	33 (86%)
Muscular Endurance	Very Poor (< 7)	0 (0%)
	Poor (7-14)	4 (11%)
	Average (> 14)	34 (89%)
Muscular Strength	Very Poor	0 (0%)
	Poor	2 (5%)
	Average	36 (95%)
Muscular Flexibility	Fair (7-0 cms)	15 (39%)
	Average (1-10 cms)	23 (61%)
	Normal (1-10)	6 (16%)
Mental health	Mild Mood Disturbance (11-16)	14 (37%)
	Borderline Clinical Depression (17-20)	12 (32%)
	Moderate Depression (21-30)	6 (15%)

Table IV. Correlation between mental health and sociodemographic factors.

Gender Parameters	Male Pearson's Correlation (<i>p</i> -value)	Female Pearson's Correlation (<i>p</i> -value)
Age	0.123 (0.132)	0.145 (0.129)
Education Level	-0.147 (0.049*)	-0.357 (0.026**)
Occupation Status	0.322 (0.0258)	-0.271 (0.032*)
Family Type	-0.196 (0.053)	-0.245 (0.036*)
Economic security	-0.244 (0.036*)	-0.452 (0.013**)
Income level	-0.379 (0.022**)	-0.705 (0.06***)
Duration of Caregiving	-0.231 (0.031*)	-0.256 (0.02*)
Daily Caregiving	-0.134 (0.29)	-0.187 (0.35)
Moderate Depression (21-30)	6 (15%)	22 (19%)

Discussion

The results of the present study showed that mental health can adversely affect the physical health of CP child's parents. It was observed that musculoskeletal physical fitness components i.e., muscular endurance and strength were inversely and significantly related with depression. Likewise, similar results were observed for the association between depression and BMI, but only among mothers ($r = -0.178$; $p = 0.033$). However, no significant correlation was found between muscular flexibility and depression for the respondent parents.

Nurturing and caregiving are two of most important responsibilities of a parent. Both mothers and fathers play a major role while raising their children. While caring for a child is a rewarding experience, it can also be challenging. A number of factors can influence when a child is born with special needs. Their happiness contains an element of stress, and their physical, mental, social, and emotional health has declined significantly. The study was aimed to assesses the fitness component of such parents and how they are affected by the underlying factors.

It was observed that average age of parents who participated in the study were 34 and 32 years for fathers and mothers, respectively. The average BMI for fathers was 31.6 and 28.2 for mothers, placing 47% and 42% of fathers and mothers, respectively, in the obese category according to WHO criteria.

It is well known that regular physical activity is critical in order to enhance functional ability and to reduce morbidity and mortality. The ability to perform everyday activities with rigor, agility, and without extreme fatigue, along with enough energy to participate in recreational ac-

tivities without meeting unexpected emergencies, is known as physical fitness⁵. Its subdivision includes the cardiac component, the musculoskeletal fitness collectively responsible for strength, endurance, flexibility, power, and the body composition (BMI). Similarly, mental health refers to cognitive, behavioral, and emotional well-being and is about how people think, feel, and behave²⁰.

According to Harvard Step test criteria for cardiac fitness, 47% of mothers and 14% of fathers had poor cardiac fitness, with 53% and 86% respectively scoring below average range²¹. This can be attributed to the fact that they have spent most of their time in the child caregiving consequently ignoring their own health, as shown in the results (p -value $< 0.02^*$) (Table IV). Contrary to it, two previous studies by Zawada et al²² and Ribeiro et al²³ found no significant differences between health of male and female CP child's caregivers. However, in both studies the sample size was too small, being done on 40 and 65 parents, respectively. Moreover, the study by Zawada et al²² was conducted in Poland with a good social security ecosystem, with better institutional care for the children. Significant difference between the parents of CP children was also observed in both muscular strength and muscular endurance. In particular, 73% of the females had poor muscular strength against 5% male population (p -value=0.029*). Similarly, 74% of the female population had poor to very poor muscular endurance compared to 11% of the male population (p -value = 0.03*). Physical health among female parents has been observed to be quite poor, which could be attributed to a variety of factors such as neglecting their own health and both physical and mental stress related to caring for the challenged child. The findings of our study could be correlated to the findings of Kaya et al⁵ in which female

parents were found to have poor state of health too. In addition, lifting, carrying, and transferring of CP child for long period of time often lead to bad posture as well as fatigue which also might contribute to the existing problem.

Similarly with relation to impact of sociodemographic factors on mental health, it was observed that education level, occupation, economic security, income as well duration of caregiving contribute to significant mental stress among both male and female parent (p -value $< 0.05^*$) (Table IV). It was also revealed that, while family type contributed to mental stress in female parents, it was insignificant in males (p -value = 0.053). This could be possibly due to the fact that family perception and support system with respect to female might be more demanding in comparison to their male counterpart. They could be judgmental, demanding, and expect female to perform all roles of a home maker along with additional burden of taking care of the child. Prolonged stress along with the fear of failing to meet everyone's expectation might be a contributing factor for depression, as observed in both male and female parent (Table II). Nevertheless, the reasons for depression in both segments might be different and beyond the purview of this study. In a study by Ribeiro et al²³ it was found that mothers are more prone to depression on account of the fact that they feel powerless and helpless in meeting both ends and feel not able to provide optimal care and environment to their challenged child. On the contrary, a study by Ketelaar et al²⁴ on male guardians emphasized low income as a major precursor for stress.

Limitations

There are some limitations in the study. The study was limited to a particular area of Karnataka in the population of Dakshinak Kannada district. Moreover, additional factors like quality of life, dietary patterns etc., too were not taken into consideration.

Thus, the study concludes that both male and female parents of special CP children have poor health, with females being more vulnerable than males. Poor cardiac and musculoskeletal fitness often work as precursors and thus are more likely to develop chronic diseases in the long term. Mental health also has been found to significantly affect certain socio-economic demographic components, including education level, occupational status, family type, economics security, income level and duration of caregiving.

Thus, comparing both parents, it was observed that combined effect of these challenges are more detrimental to female's parent physical and psychological well-being as compared to their male counterparts. Thus, better care of the special child and adherence to treatment are required to ensure better physical and psychological health of caregivers.

Conclusions

The results obtained from this study conclude that mothers of special needs children have poor cardiac and musculoskeletal fitness and are likely to develop chronic diseases in long term. The psychological health of mothers should also be an area of clinical attention. This study indicates that there are many challenges to caregivers of a child with disability and the combined effect of these challenges can be detrimental to maternal physical and psychological well-being. It is also concluded that caring for a disabled child requires the highest level of organization, endurance, and overall well-being of the caregivers. Improved physical and psychological health of the caregivers would ensure better care of the special child and better adherence to the treatment.

Conflict of Interest

The Author declares that he has no conflict of interest.

Acknowledgements

The author acknowledges the support provided by the special school heads as well as parents who participated in the study.

Funding

The author extends his appreciation to the Deputyship for Research & Innovation, Ministry of Education in Saudi Arabia, for funding this research work through the project No. IFP-2020-76.

Informed Consent

Written consent was obtained from all the participants.

Ethics Approval

The ethics approval for this study was released by the Ethical committee at HHRDC, Mangalore, India (Reference No. HHRDC-EC/25/22).

Authors' Contribution

Conceptualization, data collection, analysis, and manuscript writing were done by Abdul Rahim Shaik.

Data Availability

Data will be made available upon reasonable request to the corresponding author.

ORCID ID

Abdul Rahim Shaik: 0000-0003-4407-6333.

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