

Factors associated with sports participation amongst people with spinal cord injury in a Malaysian tertiary hospital

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Objective: To identify factors that are associated with sports participation following spinal cord injury (SCI).

Study Design: Case-control study.

Setting: Spinal Rehabilitation outpatient clinic in a tertiary hospital in Kuala Lumpur, Malaysia.

Participants: Thirty-one sports participants (SP) and thirty-four non-sports participants (NSP) ($N = 65$) met the following inclusion criteria; chronic SCI more than one year, age between 18 and 50 years, both traumatic and non-traumatic SCI at C5 level and below, complete or incomplete SCI (AIS A-D) and mobilizing with either manual or motorized wheelchair independently.

Methods: Face-to-face interviews were performed with a 22-item self-constructed questionnaire which contained four domains of variables; socio-demographic, SCI-related, environmental and sports-related factors. Data collection was done between June 2017 and May 2018.

Results: Traumatic SCI, pre-injury interest in sports, pre-injury sports participation, ability to drive own vehicles, and being employed were significantly associated with sports participation post-SCI ($p < 0.05$). Multiple logistic regression revealed traumatic SCI ($p = 0.012$, OR 34.70, CI 2.21–545.90) and pre-injury interest in sports ($p = 0.046$, OR 29.10, CI 1.06–798.95) to be independent predictors of sports participation post-SCI.

Conclusion: Traumatic SCI and pre-injury interest in sports were predictors of sports participation post-SCI. Pre-injury sports participation, being employed, and the ability to drive own vehicles were positively associated with sports participation. Findings from this study suggest a few crucial differences in facilitators and barriers to sports participation in Malaysia compared to other countries.

Keywords: Sports, Participation, Spinal cord injury, Factors

Introduction

Spinal Cord Injury (SCI) may lead to temporary or permanent loss of function. It can be broadly classified into traumatic and non-traumatic SCI based on its etiologies. The worldwide incidence varies by regions or countries. The reported incidence of SCI lies between 10.4 and 83 per million people per year, while the mean age of patients sustaining injury was reported at 33 years old, with men being affected nearly four times more than women.¹ A cross-sectional study on the epidemiology of SCI in Kuala Lumpur General Hospital between the year 2006 and 2009 revealed more than half of the injuries (57%) were traumatic in origin, involving mainly young males between age 16 and 30 years of age (31%).²

SCI results in a variable loss of physical and functional capacity. In addition to the decreased level of activity, persons with SCI may also have ongoing body composition changes associated with insulin resistance and disorders of carbohydrate and lipid metabolism, which predispose them to premature cardiovascular disease.³ They are also at risk of developing long-term medical complications such as pressure ulcers, autonomic dysreflexia, pulmonary diseases, deep vein thrombosis, and fracture.^{4–6} Overall, the mortality rates are elevated by 47%, and much of the excess mortality is related to potentially treatable factors.⁷ Furthermore, ordinary daily activities of persons with SCI alone are usually not adequate to maintain cardiovascular fitness.⁸ Long-term secondary medical complications following SCI incur a great burden to the healthcare system, and in a developing nation like Malaysia, the financial burden often jeopardizes the quality of rehabilitation services provided.

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Physical activities such as sports have been shown to be beneficial to health. Regular physical activity, sports participation, and active recreation are essential behaviors for preventing disease, promoting health, and maintaining functional independence.⁹ Engagement in sports leads to improvement in strength, coordination, balance, endurance, pulmonary function, and weight control.¹⁰ Regular physical activity can have substantial social benefits, providing a means of establishing new friendships, sharing experiences, developing social support networks, and reducing handicap.¹¹ Sports participation after SCI was also found to be associated with increased community integration as well as the quality of life (QOL).^{12,13} A study conducted by Gioia *et al.* on the psychological impact of sports activity in SCI patients demonstrated that sports activity is associated with better psychological status, irrespective of tetraplegia and paraplegia. SCI patients who did not practice sports showed higher anxiety and depression scores and lower extraversion scores than sports participants.¹⁴

Nevertheless, few studies have found that there is a decrease in sports participation following SCI.^{15,16} Upon returning to the community following rehabilitation, people with SCI are less likely to be physically active when compared to the able-bodied population.¹⁷ Many studies have highlighted the facilitators and barriers to physical activity following SCI. Among the common facilitators are strong social support, the presence of role models, and environmental stimulation.^{18–20} Problems with self-care, inaccessibility of facilities, lack of equipment suited to needs, and negative societal attitudes are among the barriers identified.^{16,18–21} Meanwhile, two North American studies reported self-efficacy, which is the belief in one's ability to produce a particular level of performance as a predictor of sports participation post SCI.^{22,23} A local study by Rosly *et al.* reported that seventy-three percent of the study participant did not participate in moderate or vigorous leisure time physical activities (LTPA) post-SCI and the commonest barriers to undertaking LTPA were identified as expensive exercise equipment, pain, and inaccessible facilities.²⁴

The objective of this study was to determine the associated factors of sports participation following SCI in a Malaysian sample. The impact of multiple socio-demographic factors, SCI-related variables, environmental and sports-related variables on sports participation was investigated. There is still a dearth of evidence on this subject locally. To the authors' knowledge, the study by Rosly *et al.* is the only study in Malaysia that has addressed the issue of sporting

activities participation following a major disabling condition such as SCI. However, the study focused on barriers to LTPA, which excluded competitive sports participants, and the facilitators or enablers of sports participation were not investigated. Distinguishing facilitators from barriers in the local setting is vital as they may differ from other countries with different socio-demographic and economic backgrounds. The findings of this study may provide some direction to policymakers and local interventionists in their effort to promote sports participation and maximize community reintegration among individuals with SCI and physical disabilities at large.

Methods

Study design and sample size

This is a case-control study conducted between June 2017 and May 2018 at a Spinal Cord Injury Rehabilitation outpatient clinic in a tertiary hospital in Kuala Lumpur, Malaysia. The reported frequency of sporting activities fell from 42% to 20% following SCI.¹⁶ In this study, the prevalence was assumed to be lower in Malaysia (10%) based on clinical observation. Therefore, based on the sample size calculation, a minimum of 34 samples per group were required, with a two-sided confidence interval $Z_{1-\alpha} = 95\%$, power of 80%, and ratio control: case, 1:1.

Participants and recruitment

The recruitment process was conducted in the aforementioned SCI rehabilitation outpatient clinic. Patients attending the clinic were screened according to the inclusion and exclusion criteria. A total of 93 clinic attendees were approached and invited into the study. 65 patients consented to participate and were interviewed face-to-face by the principal investigator. The use of a single interviewer was to eliminate inter-rater bias. Data collection was done over one year period between June 2017 and May 2018.

Inclusion criteria for both SP and NSP include chronic SCI more than one year, age between 18 and 50 years, both traumatic and non-traumatic SCI at C5 level and below, complete or incomplete SCI (AIS A-D), and mobilizing with either manual or motorized wheelchair independently. Those with associated traumatic brain injury, acute psychiatric illness, or total carer-dependent were excluded from the study.

Questionnaire development

This study utilized a self-constructed questionnaire. Over 200 facilitators and barriers to LTPA have been identified in people with disabilities from various

literature in the past.²⁵ The questionnaire was designed by careful selection of factors, taking into consideration their relevance to the Malaysian context. It consisted of four domains of variables; socio-demographic (8 items), SCI-related (5 items), environmental (5 items), and sports-related (4 items) factors.

Case definition

Sports participant (SP) was defined as a person with SCI who participated in a recreational (non-organized sports specifically for personal enjoyment), organized (organized league regularly against other teams or individuals) or elite/professional (competing at national/international level) sports activity at least once a month at the time of interview.¹²

Analysis

Statistical analysis was performed using SPSS version 23.0. Descriptive statistics for all variables were analyzed categorically, expressed in frequencies and percentages. Inferential analysis by Pearson's Chi-squared test was performed to investigate the association between variables and sports participation as well as to assess comparability between the case and the control group demographically. Lastly, all variables with significant association from the Chi-squared test were analyzed with multiple logistic regression to determine the independent predictors of sports participation following SCI. Statistically significant results were set at a p-value of <0.05.

Results

Participant characteristics

A total of 31 sports participants (SP) and 34 non-sports participants (NSP) were recruited in this study. Demographically, the majority of participants were males (SP 90.32%, NSP 76.47%) and between the age of 31 and 40 years old (SP 54.84%, NSP 47.06%) in both groups. In terms of education level, the majority of the SP and NSP completed secondary school education with 74.19% and 58.82%, respectively. NSP had a higher number of those who completed tertiary education (38.24%) compared to SP (16.14%). At the time of the interview, 87.09% SP were still employed compared to NSP with only 47.06%. Nevertheless, most of them who were still working earned a monthly income of <RM3000 or <USD700 (SP 88.88%, NSP 81.25%), which fell into the low-income group category. The chi-squared test revealed no statistically significant difference between the case and control group in terms of socio-demographic

characteristics indicating homogeneity of study participants in both groups. This is illustrated in Table 1.

Factors associated with sports participation post-SCI

Univariate analysis revealed positive associations between sports participation post-SCI with etiology of injury, pre-injury interest in sports, pre-injury sports participation, main mode of transportation, employment status, and monthly income (Table 1).

Predictors for sports participation post-SCI

Further inferential analysis with multiple logistic regression revealed that the etiology of injury, which is traumatic SCI ($p = 0.012$, OR 34.71, CI 2.21–545.90), as well as pre-injury interest in sports ($p = 0.046$, OR 29.10, CI 1.06–798.95), were the independent predictors for sports participation post-SCI (Table 2).

Discussion

In this study, the etiology of injury, which was traumatic in nature, was found to be one of two factors that increased the likelihood of sports participation post-SCI in comparison to non-traumatic SCI. This finding was independent of other socio-demographic, environmental, sports-related, and SCI-related factors. It was in contrast to a study in Switzerland that revealed no correlation between etiology of injury and sports participation.²⁶ Other than that, very few studies have directly investigated the association between the etiology of SCI and sports participation. Traumatic SCI, given its nature of the injury, primarily affects the younger population.^{27–30} This worldwide trend is consistent with local data that revealed traumatic injury as the more common cause of SCI, affecting younger age groups.² Being relatively young, persons with traumatic SCI may have greater potential to be physically active again with optimum rehabilitation. Therefore, it is essential to provide them with all the support needed to encourage and promote sports participation, facilitate their return to the community, and ultimately achieve better health outcomes overall.

The other factor that was found to increase the likelihood of sports participation following SCI was pre-injury interest in sports. 40 out of 41 study participants who expressed interest in sports prior to sustaining SCI had participated in some sort of sports activity before the injury. This suggests that those with pre-injury interest in sports may already understand the importance and benefit of sports. It also may be easier to motivate them into joining sports activities. One way to nurture and amplify the interest in sports is to integrate sports

Table 1 Table showing descriptive and univariate analysis of all variables categorized into four domains.

Variables	Category	NSP (n = 34)	SP (n = 31)	P*
Socio-demographics				
Age	18–30	9 (26.47)	7 (22.58)	0.822
	31–40	16 (47.06)	17 (54.84)	
	41–50	9 (26.47)	7 (22.58)	
Sex	Male	26 (76.47)	28 (90.32)	0.137
	Female	8 (23.53)	3 (9.68)	
Race	Malay	17 (50.00)	18 (58.06)	0.752
	Chinese	12 (35.29)	9 (29.04)	
	Indian	4 (11.76)	2 (6.45)	
	Others	1 (2.95)	2 (6.45)	
Marital status	Married	14 (41.18)	9 (29.03)	0.712
	Single	19 (55.88)	21 (67.74)	
	Others	1 (2.94)	1 (3.23)	
Education level	Primary	1 (2.94)	3 (9.67)	0.117
	Secondary	20 (58.82)	23 (74.19)	
	Higher education	13 (38.24)	5 (16.14)	
Primary mode of wheelchair mobility	Manual wheelchair	30 (88.26)	29 (93.55)	0.674
	Motorized wheelchair	4 (11.74)	2 (6.45)	
Employment status	Employed	16 (47.06)	27 (87.09)	0.001
	Unemployed	18 (52.94)	4 (12.91)	
Monthly income (for employed participant)	<MYR3000 (<USD 700)	13 (38.24)	24 (77.42)	0.02
	≥MYR3000 (≥USD 700)	3 (8.82)	3 (9.68)	
SCI-related				
Level/severity of injury	Complete tetraplegia	8 (23.53)	3 (9.67)	0.286
	Incomplete tetraplegia	3 (8.82)	2 (6.45)	
	Complete paraplegia	14 (41.18)	20 (64.52)	
	Incomplete paraplegia	9 (26.47)	6 (19.36)	
Etiology of injury	Traumatic	25 (73.53)	29 (93.55)	0.032
	Non-traumatic	9 (26.47)	2 (6.45)	
Concomitant injuries (for traumatic SCI)	Long bone fracture	2 (8.00)	4 (13.79)	0.121
	Chest injury	0 (0.00)	2 (6.89)	
	Intra-abdominal injury	2 (8.00)	2 (6.89)	
	Others	0 (0.00)	1 (3.46)	
Underlying chronic disease	Nil	21 (84.00)	20 (68.97)	0.615
	Cardiac disease	0 (0.00)	0 (0.00)	
	Chronic kidney disease	0 (0.00)	1 (3.23)	
	Diabetes mellitus	1 (2.94)	0	
	Hypertension	0 (0.00)	0 (0.00)	
	Others	3 (8.82)	1 (3.23)	
Environmental				
Place of residence	Urban	24 (70.59)	19 (61.29)	0.429
	Rural	10 (29.41)	12 (38.71)	
Availability of sport facility	Available	2 (5.88)	6 (19.35)	0.138
	Not available	32 (94.12)	25 (80.65)	
Accessibility to sport facility (if present)	Easily accessible	1 (50.00)	5 (83.33)	0.190
	Not accessible	1 (50.00)	1 (16.67)	
Main mode of transportation	Drives own vehicles	10 (29.41)	23 (74.19)	0.000
	Others (relies on others or public transport)	24 (70.59)	8 (25.81)	
Sport-related				
Pre-injury sports participation	Yes	16 (47.06)	26 (83.87)	0.002
	No	18 (52.94)	5 (16.13)	
Duration between injury and first sports participation post injury (sports participant only)	<5 years	N/A	17 (54.84)	
	5–10 years	N/A	4 (12.90)	
	> 10 years	N/A	10 (32.26)	
Pre-injury interest in sport	Yes	14 (41.18)	27 (87.09)	0.000
	No	20 (58.82)	4 (12.91)	
Post injury interest in sport	Yes	10 (29.42)	31 (100)	
	No	24 (70.58)	(0.00)	

Abbreviations: NSP, non-sports participant; SP, sports participants; N/A, not applicable.

Values given are number (%).

*P-values obtained from χ^2 -statistics are considered significant, if <0.05.

Table 2 Multiple logistic regression.

Variables	P	OR	95% confidence interval
Etiology of Injury	0.012	34.70	2.21–545.90
Pre-injury interest in sport	0.046	29.10	1.06–798.95
Employment status	0.797	0.67	0.03–14.87
Pre-injury sports participation	0.549	1.83	2.55–13.06
Main mode of transportation	0.785	0.71	0.06–8.32
Monthly income	0.109	11.37	0.58–221.67

activity into the rehabilitation process whenever possible. Making full use of sports resources available might prove useful in achieving this goal. Interestingly, to the authors' knowledge, the association between pre-injury interest in sports and sports participation post-SCI was not investigated in previous studies. Regardless, it is worth exploring a person's interest in sports either pre or post-SCI to gauge their commitment to sports participation.

Several other variables were found to be positively associated with sports participation. Pre-injury sports participation has been found to be significantly associated with sports participation post-injury. There were mixed findings on this factor from previous studies. McVeigh *et al.* found that individuals who participated in sports pre-SCI were more likely to continue participating in sports post-SCI.¹² On the contrary, Robert *et al.* reported that the tendency for an individual with SCI to be involved in wheelchair sports was not related to the pre-injury history of sports involvement.¹⁵ Although findings from this study concur with that of McVeigh *et al.*, all three studies are cross-sectional in design. It is not possible to infer causation from these studies. Regardless, similar to pre-injury interest in sports, those with a history of sports involvement prior to SCI should be identified and encouraged to join sports activities. Measures to promote the return to sports should be integrated into the rehabilitation process where appropriate.

Being employed was significantly associated with sports participation which was congruent with various studies in the past.^{13,31,32} Two other studies indicated that SP with SCI reported higher incomes in comparison to NSP.^{12,33} This is in contrast to studies by Tasiemski *et al.* and Foreman *et al.*, which found no significant correlation between sports participation and the likelihood of employment.^{16,33} The finding of this study has to be interpreted with caution to avoid over-emphasis. Firstly, all of the cited studies were from developed countries where the study sample may not

be directly comparable with a Malaysia-based sample of distinct socioeconomic backgrounds. Secondly, this study did not separate professional athletes whose primary income comes from sporting activities with recreational SP, whose income may not be related to sports. Thirdly, the study sample came from an urbanized region of Malaysia where factors such as job opportunity, road accessibility, and public transportation are more readily available than less developed or rural areas.

Nonetheless, the positive influence of sports on employment-related issues has also been discussed in various studies. Kerr *et al.* reported that LTPA was effective at reducing stressors experienced with unemployment in people with disabilities.³⁴ LTPA has also been shown to support inclusion in various life domains, including employment, as reported by Labbé *et al.*³⁵ The reciprocal relationship between employment and sports participation should be used to good advantage to achieve community reintegration. Among the efforts made by the local government is the establishment of a Paralympic training complex in Kuala Lumpur by the Ministry of Youth and Sports. This establishment, which is under the direct supervision of the National Sports Institute (NSI) of Malaysia has provided persons with disabilities (PWDs) an opportunity to pursue an interest in competitive sports, and a source of income from the incentives offered. In a way, joining sports might open a door of opportunity for future employment for SCI survivors. Recreational SP should also be encouraged and be given the opportunity to transition to more competitive sports.

The ability to drive own vehicles as a main mode of transportation was also associated with sports participation. This may suggest that independent commuting without relying on others provides bigger opportunities for activity participation and community reintegration. This also eliminates the barrier of inaccessible public transportation systems. Kiyono *et al.* explored the association between car-driving ability and social activity and found that half of the participants who drove were also involved in sports activities.³⁶ Furthermore, many studies have found an association between return to drive and employment. A Malaysian study on return to work after SCI found that the ability to drive a modified vehicle was associated with positive employment outcome after SCI.³⁷ Jang *et al.* of Taiwan reported that independence in terms of using public transport or private transport was associated with a higher rate of return to work after SCI.³⁸ A local study examined the prevalence of

driving post-SCI and reported that only 37% of persons with SCI drive vehicles.³⁹ Unfortunately, this is much lower than the reported prevalence rate in the developed countries.^{36,40}

The interplay between employment, the ability to drive a vehicle, and sports participation is an exciting observation as promoting one factor may positively influence the other factors. Efforts should be channeled into promoting these facilitating factors to enhance sports participation and community reintegration. Likewise, removing barriers to employment and driving in the SCI population deserves equal attention. At the moment, vehicle modification options in Malaysia are limited to only hand-controlled cars and three-wheeled motorcycles.^{37,39} These need to be improved to promote independence in driving. Car features such as power steering, vehicle lift system, and adapted seating have long been available in the western market.^{41,42} Those features should be made available in the Malaysian market as they may improve the rate of driving amongst SCI individuals in Malaysia.

This study indicates that basic demographic details such as age, sex, race, marital status, and education level do not determine the predilection for sports participation following SCI. However, the number of female subjects was too small to show any significant association. Rauch *et al.* conducted a secondary data analysis of a questionnaire-based, cross-sectional survey in persons with SCI in Switzerland and found that decrease in sports participation was exceptionally high in women, from 74.9% pre-injury to 47.3% post-injury.²⁶ This merits further investigation to determine the role of sex in influencing sports participation in the Malaysian sample. In terms of race, the Malays represented the majority of respondents, which is likely reflecting the country's main ethnic group.

This study also found that sports participation following SCI was not related to the level and severity of the injury as well as concomitant injuries (in traumatic cases), contrary to the finding by Rauch *et al.* where persons with tetraplegia participated significantly less often than persons with paraplegia.²⁶ A relatively small number of participants with tetraplegia compared to participants with paraplegia in this study may have contributed to this finding.

One finding of particular concern was the lack of availability of sports facilities that cater to disabled individuals, as reported by most study participants in both the SP and NSP group (80.65% and 94.12%, respectively). The number of available sports facilities was too small to produce a significant association between

accessibility and sports participation. This is in stark contrast to many previous studies that highlight poor accessibility as a barrier to participation in physical activities.^{16,19,21} Rosly *et al.* also found inaccessible facilities as one of the most common barriers to undertaking LTPA in Malaysia.²⁴ Nevertheless, results in our study have shown that the availability of sports facilities itself is still insufficient. In 2008, the Parliament of Malaysia passed the Persons with Disabilities Act (PWDA) to ensure access for disabled individuals to public facilities, transportation, recreation, leisure, and sports services. Enforcement of this policy is improving locally, and the importance of having universal designs for accessibility is starting to increase in priority amongst PWDs stakeholders. Improving the availability of and accessibility to sports facilities may potentially enhance sports participation, especially among those who depend on public transportation or rely on others as their mode of transportation.

There are a few limitations acknowledged in this study, small sample size being the most salient. In our setting, highly independent and physically active persons (such as sports participants) usually have less frequent hospital follow-ups (six months to yearly). This could be one of the reasons why they were not captured and recruited into the study during the one-year study recruitment period. A few factors were affected by the relatively small sample size, such as female sex, accessibility to sports facilities, and level of injury. Many variables had to be merged for statistical analysis due to the small sample size as well. The small sample size in both case and control group also affected the inferential analysis where it resulted in a wide range of confidence intervals in the identified predictors.⁴³ The SP varies in their level of sports involvement, from recreational to competitive sports. These differences which, were not explored in this study, may affect the study outcome. The cross-sectional design only represents correlation and precludes any causal relationship between the variables. Therefore, it is not possible to prove that factors such as etiology of injury and pre-injury interest in sports have a causal effect on sports participation. The use of a self-constructed questionnaire itself is a limitation, where the factors explored were mainly related to intrapersonal and interpersonal factors, and very few related to institutional and community-level factors. A systematic review by Martin G. *et al.*, which addressed factors related to LTPA participation among children and adults with physical disabilities, had grouped all the factors into five common themes where it covers from the personal level to the institutional, community, and

policy level.²⁵ It is essential to explore all factors in the themes mentioned above, as the information acquired may guide in developing and delivering interventions at different levels to improve sports participation or LTPA, rather than merely describing barriers and facilitators.²⁵ Being a single-center study, the results do not represent the whole Malaysian SCI population. To obtain more generalizable data, the scope of this study should be expanded nationwide. This can be achieved by including the National Rehabilitation Centre, which is currently the only tertiary rehabilitation hospital in the country, sports training center such as the NSI as well as other secondary hospitals that offer rehabilitation services. The control: case ratio should be increased as well in order to improve the strength of the study outcome. Finally, it is also worth examining the impact of sports participation on the Malaysian SCI population from a psychological aspect, in which case a qualitative study method would be more appropriate.

Conclusion

Traumatic SCI and pre-injury interest in sports were predictors of sports participation post-SCI. Pre-injury sports participation, being employed, and the ability to drive own vehicles were positively associated with sports participation. Findings from this study have shed some light on a few crucial differences in facilitators and barriers to sports participation in Malaysia compared to other countries. More efforts are needed to promote and facilitate sports participation post-SCI in Malaysia. This goal necessitates collaborative work between academic researchers, clinical practitioners, local interventionists, and the community sector to devise and deliver strategies to increase sports participation in people with SCI in Malaysia.

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