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Short Communication

Obesity predictors in people with chronic spinal cord injury: an analysis by injury related variables

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Abstract

BACKGROUND: Despite an elevated obesity risk in people with spinal cord injury (SCI), investigation on the effects of age, obesity predictors, and injury related factors is yet to be unknown within the SCI population.

METHODS: Obesity predictors were measured in 162 patients.

RESULTS: 27.5% of the participants were overweight and 5.6% of them were obese. Mean BMI was different between patients with tetraplegia and paraplegia ($p < 0.01$). More than 20% of participants had central obesity, significantly patients with higher age and time since injury.

CONCLUSIONS: Significant positive relationship was found between level of injury and BMI. Participants with higher age and time since injury had higher waist circumference.

KEYWORDS: Spinal Cord Injuries, Obesity, Body Mass Index, Iran.

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Cardiovascular disease (CVD) is the most common cause of mortality and morbidity in long-term spinal cord injury (SCI).[1] People with SCI have increased metabolic conditions compared with able-bodied populations.[2] Despite the increased prevalence of obesity-related chronic problems, limited data have documented the obesity predictors of SCI patients and its relationship to disability indexes.[1-3]

A recent study in Iran showed that more than 60% of adults were obese or overweight.[4] However, such data for those Iranian adults with disabilities are not available. On the other hand, results from studies confirm that waist circumference, which is used to evaluate abdominal obesity, may be more sensitive in identifying CHD risk than BMI in the people with SCI. However, according to our knowledge, few studies have assessed the obesity predictors of SCI patients and their relationship to disability indexes. So, the purpose of this study was to assess obesity predictors of people with SCI according to age, time since injury, level and completeness of injury. Because of the importance of obesity in individuals with SCI, we further examined the relationship between obesity predictors with age and

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injury related indicators.

Methods

This cross-sectional study was carried out from May 2008 to June 2009. One-hundred and sixty-two apparently healthy volunteers with chronic, traumatic SCI (> 1 year since injury) and mean age of 34.17 ± 0.69 years (131 men and 31 women) were recruited for the study. Exclusion criteria included: pregnancy, lactation, amputation, non trauma SCI etiology, a history of diabetes, bowel impaction, active decubitus ulcer, thyroid, hepatic or renal disorders and neurological disorders other than spinal cord injury. Participants were heterogeneous with respect to BMI and level and completeness of lesion. This questionnaire also included information on medications, smoking, education, marital status, recent illnesses, bowel and bladder function. The level and completeness of lesion were classified as Edwards et al proposed.[3] Data were collected within the Brain and Spinal Injury Repair Research Center (BASIR) at Tehran University of Medical Sciences (Tehran, Iran) during a one-hour face to face interview. The protocol was approved by the ethics committee at Tehran University of Medical Sciences. Written informed consents were obtained from each patient at the beginning of the study.

Anthropometric Measures

Waist circumference (WC) was measured at the level of the lowest rib and classified based on Standard classification (men > 102 cm, women > 85 cm).[5] All measurements were conducted by the same investigator. Triceps skin fold thickness (TSF) was measured by means of a Holtain LTD caliper. Self-reported height and weight were used to calculate BMA using the formula: BMI (kg/m^2) = Body Weight (kg)/(Body Height)^2 (m^2) and the percentage of overweight and obese subjects were described.

Statistical Analysis

All statistical analyses were completed using SPSS Version 15.0 (SPSS Inc., Chicago IL, USA). Descriptive statistics are presented as mean ± SD for all participants and for each group. P value < 0.05 indicated statistical significance. Pearson correlation analyses were performed to test the relationship of the obesity predictors with age and time since injury.

Results

In this study, 162 patients with chronic spinal cord injury, aged 18 to 62 years, were recruited. There were 131 (80.9%) male patients and 31 (19.1%) female patients. The mean age was 34.17 years (age range 18-62 years). Out of the total number of participants with spinal cord injury, there were 94 (58%) patients with tetraplegia and 68 (42%) with paraplegia. The mean duration of injury was 8 years (range: 2-40 years). In all participants, 114 (70.4%) had incomplete injury, and 48 (29.6%) had complete injury. The patients with paraplegia had a mean BMI of 24.44 kg/m2, while the patients with tetraplegia had a mean BMI of 22.66 kg/m2 and this difference was statistically significant ($p < 0.01$).

The distribution of BMI by level and completeness of injury is shown in table 1. A total of 82 (51.3%) patients had a normal BMI (BMI 18.5-25 kg/m2), 27.5% were overweight (BMI 25-29.9 kg/m2) and 5.6% were obese (BMI ≥ 30), according to the WHO classification. The prevalence of overweight in all age groups was higher than obesity (Table 2). More than 20% of participants (female and male) with spinal cord injury had central obesity. Persons with shorter time since injury tended to have higher prevalence of overweight and obesity compared with those with longer time since injury. There was a trend toward greater waist circumference in patients with higher time since injury and older age.

Discussion

The present study was carried out to investigate the obesity predictors of SCI patients and their relationship to disability indexes. Based on our knowledge, limited data are present on the body composition and injury related factors. Calculated BMI, which is usually used to indirect calculation of body composition, is a useful and low cost screening tool for estimation of obesity related diseases risk.[6] According to the recommended

Table1. Distribution of BMI by type and completeness of injury

Total		Total	Tetra	Para	Complete	Incomplete
Under weight	Number	25	15	10	7	18
	Percent	15.6%	9.4%	6.3%	4.4%	11.3%
Normal weight	Number	82	57	25	21	61
	Percent	51.3%	35.6%	15.6%	13.1%	38.1%
Overweight	Number	44	15	29	15	29
	Percent	27.5%	9.4%	18.1%	9.4%	18.1%
Obese	Number	9	5	4	5	4
	Percent	5.6%	3.1%	2.5%	3.1%	2.5%

guidelines, 33.1% of our participants were overweight or obese. In agreement with previous studies, we found higher average BMI, WC, Biceps and Triceps SF in adults with paraplegia versus tetraplegia.[1,7,8] Ability to use both upper limbs, giving increased independence to eat freely, may be the possible reason for this finding.[8] Similar trend is shown in participants with complete injury versus incomplete injury.

Because significant concern has been expressed for weight gain in people with SCI, age and time since injury were further examined usingby obesity indicators of people with SCI. Older participants had higher BMI and WC compared to younger ones. To our knowledge, only one study has examined the age-specific prevalence rate of overweight and/or obesity in these patients. Gupta et al [8] have reported a high prevalence of overweight and obesity in almost all age groups. In agreement with their study, the present study confirmed that the prevalence of overweight was higher in those with shorter time since injury.

New studies have confirmed that body mass index (BMI) is a poor and inconsistent predictor of CHD and diabetes risk factors and Waist Circumference (WC) may be more sensitive in detecting CHD risk than BMI in the SCI population.9,10 In the present study, the mean WC in the male participants was 86.98 cm. The mean waist circumferences reported by Liang et al 10 and Tomey et al 9 (97 cm and 96.5 cm, respectively) were significantly higher than our male participants; both of these studies excluded women. The mean WC in our female participants was 86.4 cm. In agreement with Bertoli et al,2 the present study found that more than 20% of participants (female and male) with spinal cord injury had central obesity. Furthermore, in our study, participants with higher age and time since injury had higher waist circumference and based on the data, there was no other study about central obesity related to age and time since injury.

Limitations

There are several limitations that should be considered when examining the results of this study before its implementation in community-dwelling with SCI people. First limitation is the use of a cross-sectional design to find the

Table 2. Prevalence of overweight and obesity by age and time since injury

	Prevalence of overweight BMI ≥ 25 (kg/m^2) (%)	Prevalence of Obesity BMI ≥ 29 (kg/m^2) (%)
Age (year):		
18-39	19.4%	3.8%
40-59	10%	1.9%
> 60	5.6%	0.1%
Time since injury (year):		
0-5	13.9%	2.5%
5-10	6.9%	1.8%
10-15	3.8%	1.2%
> 15	3.1%	0.2%

association of body composition with injury related variables. Secondly, there was no direct measurement of the participants' height and weight and self reported heights and weight were used. However, the correlation of BMI and both WC and TSF (which were measured several times by the same expert interviewer) were assessed using correlation coefficient and regression coefficient; and this correlation was significantly high ($p < 0.001$). In spite of the fact that both genders were used in this study along with a greater number of participants, the sample was still fairly small and limited the power to recognize small differences between groups.

Conclusions

Correlation of the injury level (paraplegia versus tetraplegia) or type (complete versus incomplete) or injury duration with obesity has been tested in several studies, but these studies are mostly conducted with BMI as a measurement of obesity. In agreement with previous studies,[1,7,8] the present study found higher average BMI in adults with paraplegia versus tetraplegia. It also confirmed that the prevalence of overweight is higher in those with shorter time since injury. On the other hand, studies have shown that the incidence of cardiovascular diseases and diabetes increases in spinal injured people as the time passes. So, the practical strategies should be implemented to reduce the incidence of general and central obesity in this group of people.

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Conflict of Interests

Authors have no conflict of interests.

Authors' Contributions

HS contributed to the design of the study and was responsible for data collection and analysis and writing the manuscript. AN and HS helped in recruiting the subjects. FS contributed to the design of the study. AR provided statistical consultation and HER obtained ethical approval. Also, MN helped with collecting and analyzing the data and MRV contributed to designing of the study, analyzing the data and edit of the manuscript. All authors have read and approved the content of the manuscript.

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