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The Investigation Relation Between Body Mass Index and Physical Activity Level in Adult Patients with Chronic Stroke

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Abstract

The aim of this study was to investigate body weight changes and the correlation between body mass index and physical activity level in adult hemiplejic patients after stroke. The study included 70 adults suffered from stroke (with hemiplegia) at least 1 year ago and 70 healthy volunteered people who accompanied them. The social-demographic informations of the participants were recorded. Body weight chages of the patients were asked and recorded. According to the height and weight measurements, body mass index (BMI) was calculated. Physical activity level was measured with International Physical Activity Questionnaire (IPAQ). The ratio of overweight/obese subjects were 34.3% and 30% in hemiplegic and healthy subjects, respectively. In the statistical analyses there was no statistically difference between the groups in respect to BMI (p>0.05). It was found that 55.7% of the hemiplegic patients have weight gain. In correlations analyses, there was negative correlations between BMI and physical activity level (IPAQ) (p<0.05). Physical activity level was lower in overweight/obese patients (p<0.05). In post-stroke chronic phase, patients with hemiplegia tent to gain weight. Decrease in physical activity level and sedantary lifestyle can result with negative weight change. Physical activity level should be increase in patients with hemiplagia after stroke.

***Key words**: Stroke, obesity, physical fitness, physical activity*

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Introduction

Stroke is a major clinical event that is the second leading cause of death in people over 60 years of age and causes disability in adults. The World Health Organization reports that globally, a new stroke occurs every 2 seconds and a death or disability from stroke occurs every 6 seconds (1).

Overweight and obesity are among the modifiable risk factors of stroke and in recent years, it has become an important health problem that needs to be combated because of its increasing incidence and increasing mortality and morbidity rates (2,3). Obesity is among the important risk factors of ischemic stroke and especially affects young individuals. Studies have shown that each unit increase in body mass index (BMI) increases the likelihood of ischemic stroke by 6%, regardless of gender (4-6).

Weight gain, increases the risk of stroke, but cerebrovascular events such as stroke may also affect weight change. Stroke can alter nutritional status and body composition by affecting feeding difficulties and mobility. Although underweight is a problem that can be observed in the acute and chronic period after stroke, information on the change in body composition is quite limited (7,8). Although cachexia and weight loss are among the problems encountered as an important problem after stroke, weight gain and obesity can also be seen significantly as negative effects of physical activity level and dietary habits (9,10). In studies, it has been reported that patients experience weight loss after stroke and this is due to conditions such as malnutrition, inactivity and paralysis (11,12). Malnutrition and inadequate protein intake cause weight loss, decreased muscle mass and sarcopenia in stroke patients over time (13). These changes that occur over time seriously affect the mortality rate in patients with stroke. On the other hand, being physically inactive, being of advanced age and poor eating habits may result in body fat and weight gain in the post-stroke period (14,15). In the literature, it is emphasized that there is a need for studies on weight and body composition changes occurring in acute and chronic periods after stroke in patients with stroke (7-9). This study, which was planned based on previous studies, had 2 aims. The first one is to examine the change in body weight in adult hemiplegic patients after stroke and the second one is to examine the relationship between body mass index and physical activity level.

Material and method

The study was conducted with hemiplegic individuals aged 18 years and older with a diagnosis of hemiplegia for more than 1 year who applied to Tire State Hospital Physical Therapy and Rehabilitation Outpatient Clinic and received outpatient or inpatient treatment, and healthy volunteers. The healthy volunteers who participated in the study were the relatives of the patients who accompanied the hemiplegic individuals and met the inclusion criteria. The inclusion criteria were as follows: having a diagnosis of hemiplegia for more than one year, being 18 years of age or older, being able to walk at least 10 meters with or without assistance, and being cooperative enough to answer the questions appropriately. Inclusion criteria for healthy individuals were to volunteer, not to have any neurological and/or orthopedic problems, and to be cooperative. Exclusion criteria for healthy volunteers were defined as having other neurologic disorders accompanying hemiplegia and having cognitive communication problems. In this study, hemiplegic patients were defined as group 1 and healthy individuals as group 2.

In the power analysis performed to determine the total number of participants, when calculated with an effect size of 0.25 (Cohen's d), 80% power and a margin of error of 0.05, the total number of participants was determined as 100 individuals, 50 for each group. However, it was aimed to increase this number considering the possibility of individuals who did not want to complete the evaluation programs or who wanted to drop out of the study at the last moment. The study included 70 hemiplegic individuals and 70 healthy volunteers who met the inclusion criteria. In this study, hemiplegic individuals were defined as group 1 and healthy volunteers as group 2. The evaluations were performed by the researcher physiotherapist working in the Physical Therapy and Rehabilitation Department of Tire State Hospital. The evaluation forms used in the study were completed by face-to-face interview method.

Individuals who voluntarily agreed to participate in the study were explained in detail about the evaluation to be performed and signed an informed consent form. Dokuz Eylül University Faculty of Medicine Ethics Committee was applied for this study and the necessary ethics committee permission was obtained (decision 2013/32-15 with protocol number 1118-GOA).

In the study, height was determined with a standard tape measure and body weight was determined with a Fakir Hercules scale and body mass index (BMI) values were calculated. Height was assessed with a barefoot wall tape. BMI was obtained by dividing body weight by the square of the height in meters (kg/m2). As a result of the measurements obtained, individuals with a BMI value < 18.5 kg/m2 were considered underweight, those with a BMI of $18.5 \leq$ BMI < 25 kg/m2 were considered normal, those with a BMI of 25 kg/m2 $\leq$ BMI >30 kg/m2 were considered overweight and those with a BMI of 30 kg/m2 $\leq$ BMI were considered obese (16).

The general descriptive characteristics (socio-demographic), clinical characteristics and the dates of the stroke event, whether they gained weight after the stroke, and if so, how much weight they gained were asked and recorded on the evaluation form.

The physical activity level of the individuals was evaluated with the International Physical Activity Questionnaire (IPAQ). The Turkish validity and reliability study of the scale was conducted by Öztürk et al. (17). The questionnaire has eight forms, four short and four long forms. IPAQ questionnaire scoring and score: The short form (7 questions) provides information about the time spent in sitting, walking, moderate and vigorous activities in the last 7 days. The calculation of the total score of the short form includes the sum of duration (minutes) and frequency (days) of walking, moderately vigorous activity and vigorous activity. The sitting score (level of sedentary behavior) is calculated separately. The energy required for the activities is calculated as MET-minutes score. Standard MET values have been established for these activities. Walking = 3.3 METs; moderate physical activity = 4.0 METs and vigorous physical activity = 8.0 METs. Daily and weekly physical activity scores are calculated using these values (16). The IPAQ score was determined according to the data obtained from the individuals (walking times, physical activities, sedentary life span).

Statistical analysis

In the study, variables determined by measurement were expressed as arithmetic mean ± standard deviation (X±SD). Distributions (%) were calculated for variables determined by counting. Comparison of the numerical data of the groups that did not show normal distribution was performed using the Mann-Whitney U test. Comparisons were expressed as median (med-min-max) and SD values were presented as descriptive in the tables. In addition, Spearman correlation analysis was used to examine the relationship between variables.

Statistical analyses of the study were performed with Statistical Package for Social Science for Windows (SPSS) version 20.0 Statistical Program. p<0.05 was considered statistically significant (18).

Results

The duration of hemiplegia (post-stroke period) was 44.1±34.1 (12-180 months) months in hemiplegic individuals who participated in the study. 28 (40%) of the patients were diagnosed with ischemic stroke and 42 (60%) with hemorrhagic stroke. There was no statistical difference between healthy individuals and hemiplegic individuals in terms of age and gender (p>0.05), but there was a statistical difference in terms of occupation, marital status and education level (p<0.05).

The socio-demographic characteristics of the individuals are shown in Table 1. Among the hemiplegic individuals, 40 (57.1%) could walk independently and 30 (42.9%) used a walking aid for ambulation.

Of the 70 hemiplegic individuals who participated in the study, 22 (31.4%) were normal weight, 24 (34.3%) were overweight, 17 (24.3%) were mildly obese, 5 (7.1%) were moderately obese, and 2 (2.9%) were morbidly obese. In the control group, 28 (40.0%) were normal weight, 21 (30.0%) were overweight, 15 (21.4%) were mildly obese, 3 (4.3%) were moderately obese, and 3 (4.3%) were morbidly obese. Statistically, there was no difference between the two groups (p>0.05, Table 2).

It was determined that 39 (55.7%) of hemiplegic individuals gained weight after having a stroke and 31 (44.3%) did not gain weight. Of those who gained weight, 17 (43.5%) gained 0-5 kg, 14 (35.8%) gained 5-10 kg, 7 (17.8%) gained 10-20 kg, and 1 (2.5%) gained 20 kg or more.

Table 1. Comparison of socio-demographic characteristics of the individuals

	Group 1, n=70	Group 2, n=70	t,χ^2	p
Age (years), (X±SD)	61.0±15.4	56.3±11.8	2.015	0.082
Gender, n (%)				
Women	33 (47.1)	36 (51.4)	0.257	0.612
Man	37 (52.9)	34 (48.6)		
Occupation, n (%)				
Working	10 (14.3)	28 (40.0)	11.703	0.001*
Not working	60 (85.7)	42 (60.0)		
Marital status, n (%)				
Married	47 (67.1)	62 (88.6)		
Single	23 (32.9)	8 (11.4)	9.322	0.002*
Education level, n (%)				
Primary	26 (37.1)	10 (14.3)		
Secondary	31 (44.3)	32 (45.7)		
High school	6 (8.6)	6 (8.6)	20.377	0.000*
Undergraduate and above	7 (10.0)	9 (12.9)		
	0 (0.0)	13 (18.6)		

*p<0.05, t: t test, χ^2 =chi square test

Table 2. BMI values of the individuals

BKİ value (kg/m^2)	Group 1 n=70 (%)	Group 2 n=70 (%)	χ^2	p
Normal	22 (31.4)	28 (40.0)	1.745	0.475
Overweight	24 (34.3)	21 (30.0)		
Mildly obese	17 (24.3)	15 (21.4)		
Moderately obese	5 (7.1)	3 (4.3)		
Morbid obese	2 (2.9)	3 (4.3)		

$p>0.05$, χ^2 =chi square test, BKİ=Bady mass index

In the statistical analysis, a statistical difference was found between the groups in terms of IPAQ subscales (physical activity level, MET value and level) ($p<0.05$, Table 3). However, no difference was found in terms of sitting time ($p>0.05$, Table 3).

In the statistical analysis performed to determine whether there was a difference between the IPAQ values of normal weight and overweight/obese individuals in hemiplegic patients, a statistical difference was found in terms of MET value, level and sitting time ($p<0.05$, Table 4).

In the statistical analysis performed to evaluate the relationship between BMI and physical activity level, a negative relationship was observed between BMI and physical activity level in healthy and hemiplegic individuals ($p<0.05$, Table 5).

Table 3. Difference in physical activity level between the groups

IPAQ subsscales		Min-Max	X±SS	z	p
Level	Group 1	1.0-2.0	1.4±0.4	-4.8	0.009*
	Group 2	1.0-3.0	1.9±0.5		
MET	Group 1	0.0-1710.0	451.3±417.6	-5.0	0.000*
	Group 2	33.0-9198.0	1399.2±168.9		
Duration of sitting position (dk)	Group 1	120.0-600.0	413.4±144.0	-5.4	0.605
	Group 2	90.0-600.0	271.8±135.3		

*p<0,05, z=Mann-Whitney U test, IPAQ= International Physical Activity Assessment Form

Table 4. Difference in physical activity levels (IPAQ) between overweight/obese (a) and normal weight (b) in hemiplegic individuals

IPAQ subsscales		Min-Max	X±SS	z	p
MET	a, (n=48)	0.0-1350.0	300.9±344.6	-4.5	0,000*
	b, (n=22)	66.0-1710.0	779.3±377.9		
Level	a, (n=48)	1.0-2.0	1.2±0.4	-4.4	0,000*
	b, (n=22)	1.0-2.0	1.8±0.3		
Duration of sitting position (dk)	a, (n=48)	150.0-600.0	460.4±128.5	-4.0	0.000*
	b, (n=22)	120.0-600.0	310.9±123.0		

*p<0,05, z=Mann-Whitney U test, a=overweight/obese, b= Normal, IPAQ= International Physical Activity Assessment Form

Table 5. The relationship between BMI and physical activity level

IPAQ subscale			BMI
Level	Group 1	r	-0.426
		p	0.000*
	Group 2	r	-0.002
		p	0.000*
MET	Group 1	r	0.390
		p	0.001*
	Group 2	r	0.279
		p	0.019*
Duration of sitting position (dk)	Group 1	r	-0.533
		p	0.000*
	Group 2	r	0.006
		p	0.966

r: Spearman correlation, p<0.05, BMI: Body mass index, IPAQ: = International Physical Activity Assessment Form

Discussion

The results of our study showed that stroke patients tended to gain weight in the chronic post-stroke period (after 12 months), had lower physical activity levels compared to healthy individuals, and that body mass index and physical activity level were related.

In the literature, increased body fat or malnutrition after stroke are mentioned. Vahlberg et al. reported that one third of the stroke patients included in the study gained weight within 1 to 3 years after stroke and the rate of obesity increased. The authors stated that most of the individuals participating in the study were mildly hemiparetic and their walking capacity was negatively affected. The researchers emphasized that they did not evaluate the past diet and nutritional history of the individuals in their study and therefore it was difficult to distinguish whether the weight gain and obesity increase was due to excessive calorie consumption or physical inactivity, but they emphasized that affecting the walking capacity of individuals may have been an important factor in the occurrence of sarcopenia and increase in body fat ratio (15).

In some studies, it has been emphasized that low BMI value, excessive weight loss and cachexia are associated with low functional capacity after stroke, and the activities of daily living, clinical and functional capacity of individuals are negatively affected (7,18). In the study by Scherbakov et al., the changes of patients in the 12-month period after stroke were evaluated and it was determined that 63% of the patients remained at a constant weight and/or gained weight, 16% experienced moderate weight loss and 21% became cachexic, and cachexic patients had lower functional and physical capacity values (7).

Although obesity is known to be a risk factor for stroke, excessive weight loss after stroke (especially for normal weight individuals) also significantly increases mortality. For this reason, weight management programs are recommended especially for individuals with weight problems. In the study by Dearborn et al, obese stroke patients were followed up for 2 years and weight change graphs were evaluated. At the end of the study, the researchers observed that only 25% of the individuals lost weight and 19% gained weight at the end of 2 years. The rate of weight gain was evaluated as 5% of the initial weight. The researchers also observed that 5% of the patients with obesity reached the limits of morbid obesity. In the same study, it was found that compared to patients who did not lose weight, patients who lost weight had higher levels of education and those who gained weight were younger (8). In the study by Homer et al. it was observed that hemiplegic patients tended to gain weight in the long term after stroke due to disturbances in eating and activity habits and social isolation. At the end of their study, the authors emphasized that individuals with hemiplegia need advice on controlling diet programs, lifestyle changes and healthy living and that they should definitely be followed up and informed about these issues (9). Weight change in stroke patients after stroke was also observed in the individuals included in our study. It was determined that 55.7% of the individuals included in the study gained weight after stroke, 43.5% of those who gained weight gained up to 5 kg, and the rest gained 5 kg or more. Moreover, 68.6% of the individuals were categorized as overweight and/or obese. Compared to healthy individuals, it was observed that hemiplegic individuals had lower levels of education and more individuals were not employed. These results were consistent with the results of Dearborn et al. It was determined that the individuals who participated in our study were able to perform walking function, 57.1% walked independently and the remaining 42.9% walked with an assistive device. Affected gait function may significantly affect the level of physical activity. As a matter of fact, in our study, it was found that the amount of energy expended per day and the level of physical activity were lower in hemiplegic individuals compared to healthy individuals, and the sitting time during the day was higher. Difficulties in ambulation and walking function were thought to contribute significantly to weight change rates. When evaluated in this respect, it was interpreted that supporting hemiplegic individuals in physical activity and exercise participation in the post-stroke period and including them in weight management programs would contribute significantly to maintaining a healthy life and function.

In the study by Rist et al. it was emphasized that physical activity level was an important cause of disability in pre- and post-stroke periods when compared with BMI and that individuals should be physically active in order to regain and maintain their independence after stroke (19). The level of physical activity can also significantly decrease the likelihood of re-stroke in individuals who have had a stroke (20,21).

In a study conducted by Paul et al. to determine the physical activity profiles of patients 4.2 years post-stroke, it was observed that patients with hemiplegia took fewer steps, walked at a slower pace and spent more time sedentary during the day compared to healthy controls. It was determined that hemiplegic individuals took 4035 ± 2830 steps during the day and were sedentary for 20.4 ± 2.7 hours (including sleep time), whereas these values were 8394 ± 2941 steps and 17.5 ± 3.8 hours in healthy individuals, respectively (22). Decrease in the number of steps per day and decrease in the activity level of hemiplegic patients after discharge have also been shown in other studies (23-25). In their study, Paul et al. also evaluated the sit-to-stand activity of hemiplegic patients and found that although the mean age of the healthy control group was higher (56.1± 9.5 years for healthy individuals and 55.9±9.9 years for hemiplegics), the healthy control group performed more sit-to-stand activities during the day and were more active than hemiplegic patients (22). The results of our study, as in the studies mentioned above, showed that hemiplegic individuals were more sedentary than healthy individuals. These results can be understood from the fact that the MET value, which is the energy level spent for daily walking and physical activities, is lower and the daily sitting time is higher. Individuals are less active during the day and have lower energy expenditure, despite having the potential to walk (with or without an assistive device). Likewise, the duration of sitting during the day was also higher (413.4±144.0 min (mean 6.8 hours) in hemiplegic individuals and 271.8±135.3 min (mean 4.5 hours) in healthy individuals). An important result obtained from our study is that the number of individuals working in any job is significantly higher in healthy individuals. The occupation performed within the scope of the study was not questioned in detail. However, it was thought that some of the healthy individuals may have done more sitting activities during the day due to work. When evaluated from this aspect, the sedentary life of hemiplegic individuals during the day may be more prominent.

Another important result obtained from our study is that individuals with hemiplegia who have weight problems have much lower physical activity levels compared to normal weight individuals. In the correlation analysis, a negative correlation was observed between BMI and physical activity level and sedentary life. This suggests that high weight and/or obesity significantly limit the physical activity level of hemiplegic patients in the chronic period after stroke. Although it is known that high weight, which is among the modifiable risk factors, is a risk factor for stroke, some studies have emphasized that physical activity level compared with BMI is an important factor in the regulation of blood pressure, weight control and stroke risk after stroke and that activity level should be maintained (19,26). In addition, since decreased physical activity level and sedentary lifestyle result in weight gain, it was emphasized that the physical activity level of individuals should be increased and plans and programs in this regard should be planned and patients should be ensured to comply. This will be very important in terms of preventing recurrence of stroke and improving the quality of life of individuals. Long-term comparative studies on the level of physical activity before and after stroke in patients with hemiplegia will be helpful in preventing stroke and reducing the risk factors that may develop due to stroke.

Limitations of our study; the diet program and eating habits of the patients were not questioned. Therefore, no clear explanation could be made as to whether weight gain was due to inadequate energy expenditure (e.g., overeating) or excess calorie intake. In future studies, it is recommended that the dietary habits of the patients should also be questioned and the differences before and after stroke should be questioned in more detail. Another limitation of our study is that the physical activity level of the patients before hemiplegia was not questioned in detail. Long-term planning of future studies on this subject will be important in terms of results. It is thought that more studies with detailed evaluations on the subject are needed.

The results of our study showed that patients who developed hemiplegia after stroke had a tendency for physical inactivity and weight gain in the long term after stroke, that negative developments in weight change triggered sedentary life and that patients moved less and the longest activity they performed during the day was sitting activity. It is thought that guiding patients with hemiplegia for appropriate physical activities in the chronic period, ensuring their follow-up and ensuring that they adopt physical activity participation as a lifestyle will be important in terms of maintaining quality of life and general health status. In this study, it was also determined that there is a need for further studies to investigate weight change in the chronic period after stroke and the relationship between this change and physical activity level.

Conflict of interest: There is no conflict of interest between the authors.

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