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The motor competency level of elderly people measured by Functional Movement Screen-protocol

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim The aim of the study is to determine the level of fundamental skills which consist of motor competence such as balance, mobility, and stability.

Material and Methods The study has been conducted with people living in the elderly home "Jetimat e Ballkanit" who are representative of these people's category living in Kosovo. 10 women and 10 men aged 50-65 were included in the study on a voluntary basis. The height, body mass, and all body composition, such as Body mass index, Body fat percentage, Body water, Muscle mass, Bones, Kilocalories, and Visceral Fat, were measured with medical scales (Tanita BC 545 N Innerscan Segmental Personal Body Analysis). Functional Movement Screen is composed of the Deep Squat, Hurdle Step, Incline Lunge, Shoulder Mobility, Active Straight-Leg Raise, Trunk Stability Push-Up, Rotary Stability, were applied. The SPSS 26 packet was used in the data analysis. Categorization of the participants with pain, low, average, and high ability were made by using frequency statistics. Differences between genders and right/left extremities were made by using Independent-Samples T-Test. Also, a regression Linear model and the Backward Elimination method were applied.

Results Gender and right/left dominancy analysis of the Functional Movement Screen scores has shown that no statistical differences appear in the data analyzed in the study (p>0.05). The frequency analysis has shown that 11.1-22.2% of the people living in the elderly home have pain while applying the movements. 24.06% of them have shown low ability in the Functional Movement Screen protocol, 30.39% seem to have a normal level of functionality. There are just 37.01% of them who resulted to be in good condition based on the Functional Movement Screen protocol.

Conclusions The analysis of the study concludes that the lacking of functionality in the motor competency level of elderly people may occur from their nutrition. That, is reflected in motor competency level through decreases in muscle mass, bone density, and increases in fat percentage, body mass index, and body weight

Keywords: movement deficiency, limitations, asymmetry, body composition, motor skills, Functional Movement Screen

Introduction

As motor competence can be defined as a person's ability to execute a wide range of motor acts in a proficient manner. Coordination of fine and gross motor skills that are necessary to manage everyday tasks, such as walking, running, jumping, catching, throwing, etc [1, 2, 3, 4], are crucial for the elderly people. They help them have an optimal level of the skills which carry out the motor competency such as balance, mobility, stability, coordination, etc. Each person wants to be able to perform fundamental movements without pain and limitations, whether one is an employee, a constructer, a competitive athlete, or a recreational. To detect abnormal movement patterns, range of motion (ROM) limitations, limb asymmetries, pain, proprioceptive deficits, strength, power, core stabilization, and postural control were designed functions of assessments [5]. Particularly in an aging population, but also in any other age group, the results of screenings can be used to counsel participants about functional limitations. Individualized corrective exercise programs that reduce the risk of injury even during work, recreation, and during sports activity can be created [6]. For that, the founders of Functional Movement Screen (FMS) had the intent to provide a better system for sports medicine, strength, fitness, and conditioning professionals. Their aim is to identify movement dysfunction as well as improve communication between the professions [7]. It has been found by the researcher that the FMS was a reliable assessment for elderly people over 50 years old [8]. So, it should be used in conjunction with other quantitative assessments for assessing the functional abilities of the elder.

Based on the statistic, populations throughout the world are aging, and people over 65 years old very soon are expected to outnumber children under five years old [9]. And people in older age, are more likely to suffer from diseases or ill health, including

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chronic disease [10]. The development of chronic diseases are as a consequence of physical inactivity [11], so based on the literature regular physical activity is so important for older adults' quality of life and for their health.

In our country, the Republic of Kosovo, there is a lack of data for the FMS test with the elderly, for this reason, we hope that this research will give us data for this category of the elderly regarding their testing through the FMS test protocol.

After the literature review, and examination of the situation of the old people who live in elderly homes in Kosovo, it has been detected lack of activity. As a result, it is caused low motor competency which is accompanied by a lack of balance, mobility, and stability as the basic skills that are necessary to manage everyday tasks. Many times, these movements are accompanied by back pain or an inability to do the movement. So, in order to improve the health and motor competency of these people, studies like this can be beneficial for creating a new approach to the elderly's health which will always be welcomed.

Based on the previous requirements, the aim of the study is the determination of the level of fundamental skills which consist of motor competence such as balance, mobility, and stability. In order to carry out the study aim, the Functional Movement Screen (FMS) protocol was used. In addition to the purpose of the study, it is intended to create new data on FMS protocol which in the future may be the base of norming of FMS tests for this category of people.

Materials and Methods

To determine the level of motor competency, the existing situation review model, and in order to classify and norm the new data on the FMS protocol, a causal relational research model was used.

Participants

10 women and 10 men aged 50-65 were included in the study on a voluntary basis. The permission for the study has been taken by the directorate of the elderly home "Jetimat e Ballkanit" (Kosovo). All members of the elderly home were informed about the aim of the study's benefits, and risks (even if there is no risk), and information about the test protocol has been given in the presence of the physiotherapist of the elderly home. Based on the physiotherapist criteria and two doctors of sport and movement science, people who have at least minimal ability to move by themselves, and people whose health is not a threat because of the execution of FMS protocol could be part of the study. All participants were allowed to leave the study even without having to explain their reasons for leaving. The study was made according to the Helsinki Declaration which protects the privacy of the volunteers. The study also was approved by the ethics committee of "UBT College" (approval number: 13668/45).

Research Design

Test protocol (FMS tests)

The height of each participant was measured with e stadiometer, and the data was read with an accuracy of 0.1 cm, body mass (kg) and all body composition, such as Body mass index (kg/m^2), Body fat percentage (%), Body water (%), Muscle mass (kg), Bones (kg), Kilocalories, Ages prediction, Visceral Fat (Level), were measured with medical scales (Tanita BC 545 N Innerscan Segmental Personal Body Analysis). During the measurements, participants were instructed to remove their shoes and stand in light clothes. Functional Movement Screen FMS consists of the Deep Squat (DS), Hurdle Step (HS), Incline Lunge (IL), Shoulder Mobility (SHM), Active Straight-Leg Raise (AS-LR), Trunk Stability Push-Up (TS-PU), Rotary Stability (RS). The results were scored on a scale from 0 to 3. (0=pain felt when attempting the movement; 1=unable to complete accurately; 2=completed with compensation; 3=perfect) [7].

Statistical analysis

The SPSS 26 packet was used in the data analysis. A description of the sample was made by using descriptive statistics. Categorization of the participants with pain, low, average, and high ability were made by using frequency statistics. Differences between genders and right/left extremities were made by using Independent-Samples T-Test. The effects of the changes in body composition on the functional movement screen (FMS) variables have been analyzed by using the Regression Linear model, and the Backward Elimination method applied.

Results

Based on the results of table 1 Gender and right/left dominancy analysis of the FMS scores has shown that no statistical differences appear in the data analyzed in the study ($p>0.05$). Based on the similarity of the data the analyses of the study have been without any separation in gender.

In table 2 the descriptive statistics of the body composition tests have been given the percentage values.

In table 3 the descriptive statistics of the functional movement screen (FMS) protocol tests have been given the percentage values.

The frequency analysis has shown that 11.1-22.2% of the people living in the elderly home have pain while applying the movements which are necessary and have a direct impact on daily life such as the deep squat, hurdle steep, and inline lunge (Table 4). Also, 24.06% of them have shown low ability in the FMS protocol, 30.39% seem to have

Table 1. Gender and right/left dominancy analysis of the FMS scores

Variables	R/L	M ± SD	
		Women	Men
Deep Squat (Score)	-	1.30±.823	1.89±1.054
Hurdle Step	R	1.90±.994	2.22±.972
	L	2.10±.738	2.22±.972
Inline Lunge	R	1.10±.568	1.67±1.323
	L	1.10±.568	1.67±1.323
Shoulder Mobility	R	2.50±.707	2.22±.972
	L	2.40±.843	2.22±.667
Active Straight Leg Raise	R	2.40±.699	2.44±.726
	L	2.30±.823	2.33±.707
Trunk Stability Pushup (Score)*	-	1.10±.316	2.00±.707
Rotary Stability*	R	0.80±.422	1.56±.726
	L	0.80±.422	1.56±.726
FMS general score	-	19.80±4.54	24.00±8.12

*Differences between genders ($p<0.05$), Differences between right and left side and extremities (**$p<0.05$), R/L: Right Leg / Left Leg

Table 2. Descriptive statistics of the body composition

	Variables	N	R/L	Range	Min	Max	Mean	SD
Body Composition	Height (cm)	20	-	34.0	146.0	180.0	162.0	10.1
	Weight (kg)			49.4	48.6	98.0	75.43	14.1
	Body mass index (kg/m^2)			25.0	21.3	46.3	29.82	5.8
	Body fat percentage (%)			29.3	16.3	45.6	32.41	9.5
	Body water (%)			20.4	39.8	60.2	49.23	5.9
	Muscle mass (kg)			30.2	35.4	65.6	47.40	9.4
	Bones (kg)			32.1	1.9	34.0	4.22	7.2
	Kilocalories			873	1096	1969	1495.7	271.8
	Ages prediction			42.0	42.0	84.0	66.3	10.8
	Visceral Fat (Level)			14.0	5.0	19.0	12.6	3.7

R/L: Right Leg / Left Leg

Table 3. Descriptive statistics of the functional movement screen (FMS) protocol

	Variables	N	R/L	Range	Min	Max	Mean	SD
FMS	Deep Squat (Score)	20	-	3	0	3	1.58	.961
	Hurdle Step (Score)		R	3	0	3	2.05	.970
			L	3	0	3	2.16	.834
	Inline Lunge (Score)		R	3	0	3	1.37	1.01
			L	3	0	3	1.37	1.01
	Shoulder Mobility (Score)		R	2	1	3	2.37	.831
			L	2	1	3	2.32	.749
	Active Straight Leg Raise (Score)		R	2	1	3	2.42	.692
			L	2	1	3	2.32	.749
	Trunk Stability Pushup (Score)		-	2	1	3	1.53	.697
	Rotary Stability (Score)		R	3	0	3	1.16	.688
			L	3	0	3	1.16	.688
	FMS_General_Score		-	23.0	12.0	35.0	21.7	6.6

R/L: Right Leg / Left Leg

a normal level of functionality, and just 37.01% of them resulted to be in good condition based on the FMS protocol.

The results of table 5 carry out the significant effects of the differences in body composition on the FMS scores (p<0.05). So, for the people whose W, BMI, BF%, MM, B, and KCAL level has been low, the FMS score resulted to be low also and counter wise. These effects' variance has been explained at a level of 59%.

The variables in the previous table 6 have been excluded by the backward method because they did not fit the model. Thus, the regression model has given more accurate effect ratios of dependent variables on dependent ones.

Table 4. Frequency analysis of the FMS scores based on the participants' performance level

Level	DS	HS		IL		SHM		AS-LR		TS-PU	RS		$\bar{X}$
	-	R	L	R	L	R	L	R	L	-	R	L	
Pain	11.1	11.1	11.1	22.2	22.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	6.47*
Low	22.2	00.0	00.0	33.3	33.3	33.3	11.1	11.1	11.1	22.2	55.6	55.6	24.06
Average	33.3	44.4	44.4	00.0	00.0	11.1	55.6	33.3	44.4	55.6	33.3	33.3	32.39
High	33.3	44.4	44.4	44.4	44.4	55.6	33.3	55.6	44.4	22.2	11.1	11.1	37.01

DS: Deep squat, HS: Hurdle steep, IL: Inline Lunge, SHM: Shoulder Mobility, AS-LR: Active Straight Leg Raise, TS-PU: Trunk Stability Push-up, RS: Rotary Stability, *15.54% with pain in DS, HS, and IL. L: Left leg, R: Right leg

Table 5. The effects of the differences in the body composition on the FMS scores

Model	Variables	ANOVA	F	R square	B	Sig.
4	W: Weight (kg)	0.077[e]	2.647	.591	-3.129	.010
	BMI: Body mass index (kg/m^2)				-1.089	.037
	BF%: Body fat percentage (%)				1.779	.013
	MM: Muscle mass (kg)				-7.992	.005
	B: Bones (kg)				-.634	.019
	KCAL: Kilocalories				.438	.005

[a.] Dependent Variable: FMS: General Score
[b.] Predictors: (Constant), Visceral Fat (Level), Body fat percentage (%), Bones (kg), Body mass index (kg/m^2), Muscle mass (kg), Ages prediction, Body water (%), Weight (kg), Kilocalories (KCAL);
[c.] Predictors: (Constant), Body fat percentage (%), Bones (kg), Body mass index (kg/m^2), Muscle mass (kg), Ages prediction, Body water (%), Weight (kg), Kilocalories (KCAL);
[d.] Predictors: (Constant), Body fat percentage (%), Bones (kg), Body mass index (kg/ m^2), Muscle mass (kg), Body water (%), Weight (kg), Kilocalories (KCAL);
[e.] Predictors: (Constant), Body fat percentage (%), Bones (kg), Body mass index (kg/ m^2), Muscle mass (kg), Weight (kg), Kilocalories (KCAL).

Table 6. Excluded variables on the regression analysis backward elimination model

Model	Variables	Sig.
2	Visceral Fat (Level)	.975
3	Visceral Fat (Level)	.757
	Ages prediction	.720
4	Visceral Fat (Level)	.974
	Ages prediction	.882
	Body water (%)	.676

[a.] Dependent Variable: FMS: General Score
[b.] Predictors in the Model: (Constant), Body fat percentage (%), Bones (kg), Body mass index (kg/ m^2), Muscle mass (kg), Ages prediction, Body water (%), Weight (kg), Kilocalories (KCAL)
[c.] Predictors in the Model: (Constant), Body fat percentage (%), Bones (kg), Body mass index (kg/ m^2), Muscle mass (kg), Body water (%), Weight (kg), Kilocalories (KCAL)
[d.] Predictors in the Model: (Constant), Body fat percentage (%), Bones (kg), Body mass index (kg/ m^2), Muscle mass (kg), Weight (kg), Kilocalories (KCAL).

Discussion

Results of the study have shown that besides the 24% of people who have low motor competency level which is under the requirements of the daily need in physical perspective, 15% of them have very low ability to move and movements are accompanied by pain in the certain body part. Unfortunately, the elderly home "Jetimat e Ballkanit" is one of the only four houses in the country, which means the lacking of functionality of people in this category is existent in all elderly homes in Kosovo. Based on the research of Martin, higher DS (Deep squat) scores are associated with higher physical fitness scores, and also people who passed the Back-Leg Strength Dynamometer (LB-MCS) have shown better physical fitness scores [12].

For more details, the findings of the study determine that body composition features such as body mass index, weight, fat percentage, muscle mass, bones, and kilocalories are significantly correlated and effects the motor competency level of elderly people. People who have a higher BMI were found to be more common among those with greater limitations in performing activities on daily living [13]. Many studies have reported a negative association between BMI and performance on the FMSTM in children [14], and adults. Adults who have BMI > 30 had a mean composite FMSTM score that was 2 points less than adults who have a BMI < 30 [15]. Based on the variance explained in the data analysis, the competency level of the elderly people measured by using functional movement screen (FMS) protocol which includes tests such as, is explained around 59% by the body composition status. Fawcett [8] in her research, after the application of Pearson correlations, found a significant negative relationship between age, BMI, body fat percentage (BF), and the total FMS scores. Based on this, when a person was older, he or she had a higher BMI value, or a higher BF percentage, as a consequence the total FMS score for either trial was lower [8].

Davison et al. also found that higher BMI and higher body fat percentage values were associated with greater functional limitations [16]. So, positive changes in body composition features may be the reason for the improvements in motor competency levels, respectively increasing the quality of life in elderly people. Based on the research of Nicolozakes et al. which examined the relationship between FMS scores and BMI and body fat percentage of American football players. They found a negative correlation between body fat percentage and FMS composite score [17].

Our study claims that the improvements in the motor competency level seem to be affected more by the muscle mass and kilocalories accompanied by the fat percentage, bone density and then body weight and body mass index. Based on other studies, older adults are enabled to control and accomplish successfully various physical fitness tests if they increased lower body motor [18, 19]. Similar findings, also have supported other studies which have found an association between various physical tests and muscular strength in older adults [20, 21, 22].

When analyzing the chain of effect and correlation, seems that good nutrition builds muscles and bones [23]. A high level of muscle mass and bones do not let increase the fat percentage and body mass index, and as a result, motor competency level needed for everyday life in elderly people such force, mobility, stability, endurance, etc., increases.

Not surprisingly, visceral fat level and age prediction measured by the digital scale (Tanita BC 545 N Innerscan Segmental Personal Body Analysis) resulted to be no significance in body composition or motor competency level. The reason for this may be considered that the age prediction is an estimation variable based on the body composition and visceral far may be a complicated and not very reliable measurement in the body. However, while we estimated that the body water percentage may be correlated to the motor competency level and body composition the result of the study proved differently. So, the visceral far, age prediction, and body water percentage have been categorized as the variables which do not fit the model and eliminated by the backward elimination method of regression analysis.

Conclusions

The analysis of the study concludes that the lacking of functionality in the motor competency level, may occur from their nutrition which is reflected in motor competency levels through decreases in muscle mass, bone density, and increases in fat percentage, body mass index, and body weight.

This study also was undertaken to describe and confirm the feasibility of performing the FMS in older adults, and to evaluate the relationship between functional movement ability, age, physical activity levels, and body composition.

Conclusion of the study the need arises to check and increase the quality of nutrition in the elderly houses in Kosovo.

In order to see the effects of nutrition and physical activities on health and motor competency levels monitoring the body composition features as well as motor skills is an immediate need.

Besides qualitative nutrition and systematic monitoring of the body composition and motor competency level, the physical activities applied in the elderly houses need an update and need to be applied by experts of movement science instead of physiotherapists or experts who are not specialists in movement science.

Conflicts of Interest

There is not declared conflict of interest by the authors.

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