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Identifying Mobility Deficiencies in Young Adults Using the Mobility Assessment Protocol of the National Academy of Sports Medicine (NASM)

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ABSTRACT

Purpose: Identify Mobility Deficiencies in Young Adults Using NASM's Mobility Assessment Protocol.

Design: One hundred twenty subjects, 81 males (23.4 + 7.7 yrs) and 39 (25.3 + 10.1 yrs) females, were administered the NASM corrective exercise mobility assessment protocol.

Analysis: IBM Statistical Program for Social Sciences (SPSS) Version 29 was utilized and two non-parametric mean ranking tests, Fieldman and Kendall's W, were applied to the data set of the 20 mobility assessments of the 120 participants. A Wilcox Signed Rank Test was then used to compare the highest-ranking mobility assessment, Elbow Flexibility and Extension, to the lowest-ranking mobility assessment, Seated Thoracic Rotation.

Results: The Wilcox Signed Rank Test found significant differences between the Elbow Flexibility and Extension assessment and the Seated Thoracic Rotation assessment, indicating a mobility deficiency in the Seated Thoracic Rotation. The Wicoxon Z = -8.775, $p < 0.001$ with significance set at $p < 0.05$.

Keywords: Balance; Mobility; Corrective Exercise; Dynamic Balance

Introduction

The need for mobility while maintaining stability is essential in everyday life. Programs have been developed to improve a subject's stability and mobility through balance exercise programs that provide physical conditioning to major muscles used in specific movements and also condition their associated stabilizing muscles [1]. A subject's balance can be improved no matter the current status of the subject [2]. As is the case for any conditioning program, assessments must be administered before a suitable program can be developed for the subject in question [3]. The ability to maintain control of body movement or to stay upright is called balance. There is static balance, and there is dynamic balance. Static balance is maintaining equilibrium when stationary while dynamic balance is maintaining equilibrium when moving. Eyes, ears, physical conditioning, and proprioception are used to help sustain balance [4]. Mobility sustains dynamic balance [5]. Mobility is a factor in maintaining the dynamic balance of subjects and is dependent upon the muscles involved in a specific movement, the range of motion of the articulations in this respective movement, along with the coordinated timing of these articulations. If areas of mobility deficiencies can be identified, then the dynamic balance of the subjects can be improved by addressing these deficiencies [6]. The National Academy of Sports Medicine (NASM) in its Corrective Exercise certification has developed a protocol consisting of 20 unique anatomical mobility assessments that encompasses the entire body. Use of this protocol provides for the identification of mobility deficiencies. By applying this protocol to a group of subjects, common deficiencies of this group may become

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apparent by analyzing the results of the data, and a common exercise prescription can be adopted to improve the group's overall mobility and dynamic balance. The purpose of this study is to identify common mobility deficiencies in young adults using NASM's corrective exercise mobility assessment protocol [7,8].

Design

One hundred twenty subjects, 81 males and 39 females, were administered a battery of 20 National Academy of Sports Medicine (NASM) mobility tests. See (Table 1) for the subjects' physical characteristics.

Table 1: Physical Characteristics

	N	Age (m+sd yrs)	Hgt (m+sd m)	Wgt (m+sd kg)	BMI
Males	81	23.4±7.7	1.75 ±0.09	79.6 ±16.6	26
Females	39	25.3±10.1	1.63 ± 0.08	65.7± 7.5	24.7
Total	120	24.0 ± 8.5	1.71 ± 0.10	75.8 ± 15.3	25.5

The IRB approved study consisted of a convenience sample of 120 subjects. Prior to administering the battery of tests, the subjects were informed of the battery of tests that were to be performed, the description of the tests, and that the subjects could stop at any time during the tests. The subjects signed a consent form prior to the beginning of testing. The tests were conducted by University of New Orleans exercise physiology undergraduate students who were certified by the Collaborative Institutional Training Initiative (CITI-certified) for Human Subjects Testing and trained to administer the battery of mobility tests. The administration of the protocol assessments of the participants was observed by one or both of the co-authors who are both NASM certified to insure that the assessments were done properly. The protocol was administered on campus in the University of New Orleans' Human Performance and Health Promotion exercise science laboratory.

The battery of tests administered to the subjects consisted of the following 20 assessments of the protocol, including its components7:

1. Ankle Dorsiflexion (Left, Right) – 2
2. First MTP (Big Toe) Extension (Left, Right) – 2
3. Active Knee Flexion (Left, Right) – 2
4. Active Knee Extension (Left, Right) - 2
5. Lumbar Flexion & Extension (Flex, Ext) - 2
6. Hip Extension and Adduction (Left, Right) - 2
7. Hip Adduction and External Rotation (Add Left, Add Right, Ext Left, Ext Right) - 4
8. Passive Hip Internal Rotation (Left, Right) - 2
9. Seated Hip Internal & External Rotation (Int, Ext) - 2
10. Shoulder Flexion (Left, Right) - 2
11. Shoulder Retraction (Left, Right) - 2
12. Shoulder Extraction (Left, Right) -2
13. Shoulder Internal & External Rotation (Int Left, Int Right, Ext Left, Ext Right) - 4
14. Elbow Flexion and Extension (Flex Left, Flex Right, Ext left, Ext Right) - 4
15. Wrist Flexion and Extension (Flex left, Flex Right, Ext Left, Ext Right) - 4
16. Cervical Flexion and Extension (Flex, Ext) - 2
17. Cervical Rotation (Left, Right) - 2
18. Cervical Lateral Flexion (Left, Right) - 2
19. Thoracic Extension (Flex, Ext) - 2
20. Seated Thoracic Rotation (Left, Right) -2

Total Components - 48

Scoring assessments – When an assessment component is performed successfully the participant's grade is "1", if not done properly the participant's grade is "0". If a participant's performance is perfect then the total score is "48".

Analysis

IBM Statistical Program for Social Sciences (SPSS) Version 29 was utilized and two non-parametric mean ranking tests, Fieldman and Kendall's W, were applied to the data set of the 20 mobility assessments of the 120 participants. A Wilcox Signed Rank Test was then used to compare the highest ranking mobility assessment, Elbow Flexibility and Extension, to the lowest ranking mobility assessment, Seated Thoracic Rotation. Statistical significance was set at ($p < 0.05$).

Results

After the testing was completed the average successful performance score for the 120 participants was 89.6% (43/48: [m+sd = 42.9 + 3.92]). There were 8 participants (6.7%) who attained a perfect score (48/48), and the lowest performance score was 39.6% (19/48). Following is a table that summarizes the successful performance rate for each assessment test of the NASM Mobility Protocol of the 120 participants. There were 14 assessment tests that were significantly lower than the most successful assessment test, the Elbow Flexion and Extension test. The study indicates the strongest mobility area where 115 out of 120 participants successfully performed the Elbow Flexibility & Extension assessment. That assessment also scored the highest mean ranking (Mean ranking = 26.86) in both the Fieldman and Kendall W non-parametric tests.

Table 2: Non-Parametric Ranks of NASM Mobility Assessments.

#	Area	Test	Successful Performances	% Correct	Fieldman Ranking	Kendall W Ranking
1	Feet	Ankle Dorsiflexion	76	63.3	19.62	19.62
2		First MTP Extension	102	85.0	24.17	24.17
3	Knee	Active Knee Flexion	112	93.0	22.31	22.31
4		Active Knee Extension	92	77.0	22.93	22.93
5	Lumbar, Pelvic, Hip	Lumbar Flex & Ext	103	85.0	25.41	25.41
6		Hip Ext & Adduction	108	90.0	20.65	20.65
7		Hip Adduc & Ext Rot	87	72.5	24.79	24.79
8		Passive Hip Int Rot	104	87.0	25.41	25.41
9		Seated Hip Int & Ext Rot	111	92.0	26.03	26.03
10	Shoulder	Shoulder Flexion	111	92.5	26.44	26.44
11		Shoulder Retraction	112	93.3	23.96	23.96
12		Shoulder Extraction	112	93.3	26.24	26.24
13		Shoulder Int-Ext Rotation	112	93.3	26.24	26.24
14	Elbow	Elbow Flex & Ext	115	95.8	26.86*	26.86*
15	Wrist	Wrist Flex & Ext	104	87.0	24.79	24.79
16	Cervical	Cervical Flex & Ext	107	89.2	26.03	26.03
17		Cervical Rotation	112	89.5	26.24	26.24
18		Cervical Lateral Flexion	105	89.1	24.79	24.79
19	Thoracic	Thoracic Extension	106	90.8	25.00	25.00
20		Seated Thoracic Rotation	38	32.0	11.34^	11.34^

* Highest ranking assessment

^ Lowest ranking assessment

Of the 120 participants there was one mobility assessment where 68% of the participants were unable to successfully perform the movement – the Seated Thoracic Rotation. The assessment also scored the lowest mean ranking (Mean ranking = 11.34) in both of the non-parametric tests. A Wilcox Signed Rank Test was used to compare the lowest-ranking assessment to the highest-ranking assessment. The test indicates significant differences of the comparison. Listed below are the Wilcoxon test statistics The following are the actual performance results of the lowest ranking assessment, the description of the assessment, and the possible overactive muscles that may affect that mobility deficiency:

Table 3.

Wilcox Test Statistics	
Seated Thoracic Rotation vs Elbow Flexibility & Extension	
Z - Value	-8.775*
Asymp Sig (2-tailed)	p < 0.001
Significance p < 0.05	
*Based on positive ranks	

Seated Thoracic Rotation

Scored (38/120). Only 32% of Participants Successfully Performed this Assessment:

Client is seated with hands and arms crossed across chest, or crossed holding a dowel, or holding a dowel on the shoulders behind the head. Place a medicine ball of foam roller between the knees to stabilize the lower body. Shoulder blades (scapulae) are depressed and retracted, and spine is neutral. The client rotates the upper body left and then right as far as possible. The sternum or dowel should rotate at least 45 degrees in both directions w/o compensations, such as shoulder protraction, lateral flexion of the spine, leaning forward or backward. Possible overactive muscles: Rectus abdominis, Internal and External obliques, Erector spinae on opposite side of restriction.

Discussion

Mobility or dynamic balance are not significantly dependent upon basic anthropomorphic variables alone [9]. The 2021 study revealed weak Pearson associations between balance results and weight, height, and body mass index (BMI). It also suggested that as subjects age mobility and balance will begin to wane. This implies that conditioning programs can be employed to improve mobility and balance. In fact, studies indicate that corrective exercise programs have been successfully employed to condition special populations of athletes and groups [10-11]. Had the current study been large enough to be representative of the young adults in the analysis, a general conditioning program for that age group could be developed to counteract any overactivity of the rectus abdominis, the internal and external obliques, and the erector spinae muscles. The mobility deficiency was so prevalent in the current representative group that addressing this deficiency in a general program for this group could improve that specific deficiency in that representative group. Wilcox Ranking tests could have been employed in the current study to compare the highest-ranking assessment to the other 18 assessments to determine if additional assessments were significantly different, indicating a level of mobility deficiencies. The NASM mobility assessment protocol is an excellent method for identifying a participant's mobility deficiencies. Normally the mobility protocol is not administered entirely on an individual. Usually specific NASM mobility assessments are applied to problem areas of individuals to determine if and what deficiency is prevalent. The current study indicates that the entire protocol can be utilized to identify mobility deficiencies of specific groups as well as individuals. If the data base is large enough it can be an excellent alternative to initiate conditioning for specific groups by identifying mobility deficiencies that are characteristic to that group whether it be an athletic, an occupational, or an age group. Currently, many mobility and balance programs have been developed utilizing the Functional Movement System (FMS) [12-14]. While the FMS protocols are very effective using its 7 motor patterns15, the NASM mobility assessment protocol utilizing its 20 mobility assessments are much more detailed and could possibly be more effective by identifying more deficiencies of specific groups if the data base is sufficiently large enough.

Conclusion

The study does not definitively demonstrate common mobility deficiencies of young adults because of the size of the study, but the resultant data sufficiently warrants the need for further investigation. The authors recommend additional testing to verify the results obtained from the study; and to secure larger samples that would include the parametric analyses of all 20 mobility assessments used in the current study for a deeper insight into the dynamic balance skills and deficiencies in young adults. A more detailed analysis would verify if the group mobility deficiencies generated by the NASM protocol are equivalent or more effective than the FMS programs, and if the NASM protocol is a legitimate alternative. Further analysis should also be conducted to determine if gender differences significantly affect mobility deficiencies.

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