134 - DETERMINATION OF FLEXIBILITY IN ELDERLY WOMEN FROM THREE DIFFERENT PROTOCOLS

MARESSA PRISCILA KRAUSE, SERGIO GREGORIO DA SILVA
Projeto Terceira Idade Independente Centro de Pesquisa em Exercício e Esporte
Universidade Federal do Paraná, Curitiba, Paraná, Brasil.
maressakrause@yahoo.com.br

INTRODUCTION

The structural and functional modifications that occur through the aging process are, in their majority, more pronounced in the elderly population. The modifications that occur at the conjunctive tissue can be classified as an important structural alteration from aging, because it affects many other body tissues, consequently interfering in its functionality, as this tissue participates significantly in their dynamic properties (SHEPHARD, 1997).

The performance of many daily living activities depends on joint range of motion. The modifications on these structures can be observed through the restriction of the extension of the hips, plantar flexion of the ankle (KERRINGAN, et al., 1998) and on the extension of the knees (OSTROSKY et al., 1994). The decrease on walking speed could be associated to the decrease of range of motion (CROMWELL et al., 2001, 2002; KERRIGAN et al., 1998; OSTROSKY et al., 1994; POTTER et al., 1995 and WINTER et al., 1990). Elderly women experience a 50% decrease of ankle range of motion (VANDERVOORT et al., 1992). Flexibility is a complex capacity to measure because it is rather difficult to establish the body borderlines as well as the pain the subjects can support while performing the movements (SPIRDUSO, 1995).

The purpose of this study was (a) to determine the levels of flexibility from three different protocols, (b) to verify the relationship between left and right hemi-bodies; (c) analyze the degree of association of the hip flexion movement using three tests and; (d) to present the flexibility values in the form of percentiles from the distinguished protocols.

METHODS

Study Design

The present study data was collected from March to September 2005, in the city of Curitiba, Brazil, being part of the Projeto Terceira Idade Independente (Centro de Pesquisa em Exercício e Esporte Universidade Federal do Paraná). Participants of the study were recruited from a random sample of elderly groups through a partnership that was established with various governmental institutions of the city of Curitiba witch premise the inclusion of all regions of this city.

Sample

The sample of this study was composed by 957 non institutionalized elderly women, all aged above 60 years old. For the data analyses, the sample was divided in five groups: AG 1 (6064 years; n = 286), AG 2 (6569 years; n = 293), AG 3 (7074 years; n = 206), AG 4 (7579 years; n = 120) and AG 5 (>80 years, n= 52).

Procedures

Flexibility

Flexibility was measured through three different tests: Sit-and-Reach Test (SR, centimeters) proposed by Wells and Dillon (1952); Chair Sit-and-Reach Test (CSR, centimeters) according to Rikli and Jones (1999); and the movements of shoulder adduction (SA), hip flexion (HF) and hip abduction (HA) were accessed according to the norms of utilization of the Inclinometer - measured in degrees.

Statistical Analyses

For the determination of the descriptive values, central tendency measures were applied (mean and standard deviation). ANOVA one-way was used to verify the differences among investigated groups, and *Tukey post hoc* comparisons were used to identify these specific differences. The pareated *T test* was utilized to verify the relationship between right and left hemi-bodies. The correlation coefficient of Pearson was utilized to determine the degree of association among the tests that evaluate the movement of hip flexion ($p<0.05$). All analyses of the present study were performed using *Statistical Package for the Social Sciences* (SPSS) version 13.0 *for Windows*.

Results and Discussion

The flexibility values obtained through the tests Sit-and-Reach (SR), Chair Sit-and-Reach (CSR), Shoulder Abduction (SA), Hip Flexion (HF), and Hip Abduction (HA) are shown in table 2.

The flexibility demonstrated a tendency to decline with aging as shown in all tests. The SR showed differences among younger women and the older women (> 75 years). However, the CSR differ from the first age group to the rest. The right shoulder abduction movement declined significantly from the first age group to the others, and also from the second age group to the last ones. The hip flexion decrease from the first age groups to the age group of 75-79 years. The hip abduction declined from the age group of 60-64 years when compared with the older women (> 70 years old), and from the age group of 65-69 years to the last, and from the 70-74 age group to age group of >80 years old. The abduction of the shoulder, hip flexion and hip abduction were measured on the right and left side of the body with the intention to verify if the flexibility alterations that may occur in women aged above 60 years old could result on more pronounced differences on an specific hemi-body. However, there were not observed differences among the movement evaluated on both hemi-bodies independently of age.

Table 2. The mean values and standard deviation of flexibility Sit-and-Reach test (SR), Chair Sit-and-Reach Test (CSR), and the movements of Shoulder Adduction (SA), Hip Flexion (HF) and Hip Abduction (HA), divided in age groups.

Faixa Etária	60 – 64 (n=277)	65 – 69 (n=283)	70 – 74 (n=202)	75 – 79 (n=114)	> 80 (n=51)
SR (cm)	24.4 ± 8.6	22.8 ± 8.8	22.4 ± 8.9	21.1 ± 9.2[a]	19.9 ± 9.4[a]
CSR (cm)	5.4 ± 10.6	3.3 ± 11.6[a]	2.0 ± 10.1[a]	0.5 ± 12.0[a]	-0.8 ± 10.5[a]
SA (degrees)					
Right	177.8 ±16.6	172.5±19.6[a]	171.4±19.9[a]	166.7±19.4[ab]	164.8±21.5[ab]
Left	177.9 ±16.5	173.6 ± 20.5	170.8±20.4[a]	168.7±19.8[a]	161.5±28.1[abc]
HF (degrees)					
Right	90.7 ± 14.7	88.3 ± 16.5	87.3 ± 16.8	83.5 ± 15.9[ab]	86.0 ± 16.7
Left	90.1 ± 13.5	87.9 ± 16.7	87.0 ± 18.4	85.0 ± 13.9[a]	86.4 ± 15.3
HA (degrees)					
Right	48,3 ± 13,5	45,3 ± 14,4	42,5 ± 14,3[a]	38,7±12,2[ab]	36,9±11,7[abc]
Left	47,6 ± 13,3	45,4 ± 14,1	42,6 ± 13,9[a]	39,1 ±12,2[ab]	37,9±11,9[ab]

a. different from 60-64 age group, $p > 0.05$
b. different from 65-69 age group, $p > 0.05$
c. different from 70-74 age group, $p > 0.05$

The Pearson correlation shown on Table 3 demonstrated a strong degree of association among all tests that evaluated the hip flexion. Those results suggest that any of the protocols can be used to measure the flexibility of the hip joint in women older than 60 years.

Table 3. Pearson correlation values among the tests of Hip Flexion (HF), Sit-and-Reach test (SR), Chair Sit-and-Reach Test (CSR), divided in age groups.

Faixa Etária	60 – 64 (n=277)	65 – 69 (n=283)	70 – 74 (n=202)	75 – 79 (n=114)	> 80 (n=51)
HF x SR	0,621**	0,578**	0,409**	0,540**	0,533**
HR x CSR	0,556**	0,456**	0,367**	0,496**	0,519**
SR x CSR	0,697**	0,742**	0,725**	0,809**	0,729

** p < 0,01

The percentile division is shown in Table 4. Since there were no differences between hemi-bodies for SA, HF and HA it was considered only the data of the right side. The gradual decrease of flexibility with age was observed in all tests. The Hip Abduction had a mean decrease of 23.6%. The Shoulder Abduction movement and the Hip Flexion movement reduced 7.3% and 5.2% respectively. The percentile values gave similar information when compared to the mean percentage decline results of those variables, as it could be verified in the values for 60-64 age group which represented 5% of the sample and if this same values are compared with the >80 age group there were different increments for the percentile values, where the lowest value was for HF that represented 10% of the sample, while the others represented about 25% of the sample.

Table 4. Percentile values for the Sit-and-Reach test (SR), Chair Sit-and-Reach Test (CSR), and the movements of Shoulder Adduction - Right (SAR), Hip Flexion - Right (HFR) and Hip Abduction - Right (HAR), divided in age groups.

	n	5	10	25	50	75	90	95
SR								
60-64	284	9	14	19	25	31	35	38
65-69	296	7	11	17	23	30	34	36
70-74	207	6.4	10	16	24	30	34	36.6
75-79	119	2	8	16	23	28	31	35
> 80	51	1.8	7	13	22	27	31.6	36.4
CSR								
60-64	279	-12	-7	0	4.9	12	20	23
65-69	288	-17	-12	-3	3	11	18.1	23
70-74	203	-16.4	-10.9	-2	2	7	15	20.8
75-79	118	-24	-17.1	-4	1	7.2	14.1	20
> 80	52	-23	-13.7	-6	0	5	13.7	17.4
AS R								
60-64	285	148	158	170	180	190	196	200
65-69	296	139.4	146	160	176	186	192	196
70-74	207	134.8	147.2	160	174	186	192	196
75-79	119	132	142	154	170	182	190	194
> 80	52	121.8	136	150.5	165	182	190	196
HF R								
60-64	284	64	70	82	92	100.0	108	111.5
65-69	295	60	68	80	90	98.0	107.4	114.4
70-74	206	62	68	76	86	98.0	108	114.6
75-79	115	60	64	74	83	94.0	104	110.0
> 80	52	57.2	64	76	87	97.5	108.5	115.4
HÁ R								
60-64	283	28	32.0	40	48	58.0	67.2	70.0
65-69	294	26	30.0	36	44	52.0	62.0	76.5
70-74	206	22	26.0	32	40	50.0	64.0	68.0
75-79	115	20	23.2	30	38	48.0	54.0	62.0
> 80	51	18	22.4	30	36	46.0	51.6	52.8

The functional declines occurred with aging cannot be only attributed to the aging process, but also to the disuse (DALEY AND SPINKS, 2000). The functional limitations can be seen in the reduced of daily living activities. Locomotion is classified as one of the six basic activities of daily living (KATZ, 1963), interfering in walking performance.

Flexibility modifications can alter the walking movement by reducing the length, the velocity and consequently the frequency of steps (GUIMARãES e ISAACS, 1980; WOLFSON et al., 1990; VISSER, 1983). Those modifications could be seen through the hip range of motion decreases and measured by the Hip Flexion movement, which showed the least percentage decrement. Based on Daley and Spinks (2000) functional reduction is affected by the aging process and the disuse, so the most recruited joints for the daily living activity tend suffer the least reduction of range of motion besides the aging process. This concept could explain the least reduction shown for the Hip Flexion movement in the SR, SRC and HF tests measured in this study, such movement is part of the walking movement.

Conclusion

The results demonstrate the decline on flexibility in women, as a consequence of the aging process, with similar decreases between right and left hemi-bodies. The evaluation of the Hip Flexion movement can be done using any of the proposed tests as their association has been stated. The Hip Flexion movement showed the least percentage reduction, possibly due to its association with walking. The flexibility percentile values can be used as reference for elderly women.

References

ACHOUR, AA. **Exercícios de Alongamento Anatomia e Fisiologia**. São Paulo: Manole, 2002.

CROMWELL, R.L.; NEWTON, R.A.; GRISSO, J.A.; e EDWARDS, W.F. **Relationship between select balance measures and a gait stability ratio in individuals who are known fallers**. Paper presented at the Control of Posture an Gait. Maastricht, The Netherlands, 2001.

CROMWELL, R.L.; NEWTON, R.A.; e FORE REST, G. **Influence of vision on head stabilization strategies in older adults during walking**. Journal of Gerontology, p.M443 M448, 2002.

DALEY, M.J.; SPINKS, W.L. **Exercise, Mobility and Aging**. Sports Medicine, v.29, p.1-12, 2000.

GUIMARãES, R.M. e ISAACS, B. **Characteristics of the Gait in old people who fall**. Int Rehabil Med, v.2, p.177 80, 1980.

KATZ, S.; FORD, A.B.; MOSKOWITZ, R.W.; JACKSON, B.A.; e JAFFE, M.W. STUDIES OF ILLNESS IN THE AGED. THE INDEX OF ADL: A STANDARDIZED MEASURE OF BIOLOGICAL AND PSYCHOSOCIAL FUNCTION. **Journal of the American Medical Association, v.185, p.914-919, 1963.**

KERRIGAN, D.C.; TODD, M.K.; CROCE, U.D.; LIPSITZ, L.A.; e COLLINS, J.J. **Biomechanical gait alterations independent of speed in the healthy elderly: Evidence for specific limiting impairments**. Archives of Physical Medicine and Rehabilitation, v.79, p.317-322, 1998.

OSTROSKY, K.; VANSWEARINGEN, J.M.; BURDETT, R.G.; e GEE, Z. **A comparison of gait characteristics in young and old subjects.** Physical Therapy, v.74, p.637-646, 1994.
POTTER, J.M.; EVANS, A.L.; e DUNCAN, G. **Gait speed and activities of daily living function in geriatric patients.** Archives of Physical Medicine Rehabilitation, v.76, p.997-999, 1995.
RIKLI, R.G. e JONES, C.J. Development and validation of a functional fitness test for community-residing older adults. **Journal of Aging and Physical Activity, v.7, p.129-161, 1999.**
SHEPHAR, R.J. **Aging, Phisical Activity, and Health.** Champaign, IL: Human Kinetics, 1997.
SPIRDUSO, W. **Physical Dimensions of Aging**. Champaign: Human Kinetics, 1995.
VANDERVOORT, A.A.; CHESWORTH; B.M.; CUNNINGHAM, D.A.; PATERSON, D.H.; RECHNITZER, P.A. e KOVAL, J.J. **Age and sex effects on mobility of the human ankle**. Journal of Gerontology: Medical Sciences, v.47, p.M17-M21, 1992.
VISSER, H. Gait and balance in senile dementia of Alzheimer's type**. Age Ageing, v.12, p.296301, 1983.**
WELLS, K.F. e DILLON, E.K. The sit and Reach, a test of back and leg flexibility**. Research Quarterly, v. 23, p.115-18, 1952.**
WINTER, D.A.; PATLA, A.E.; FRANK, J.S. e WALT, S.E. **Biomechanical walking pattern changes in the fit and healthy elderly.** Physical Therapy, v.70, n.6, p.340-347, 1990.
WOLFSON, L.; Whipple, R.; Amerman, P; et al. **Gait assessment in the elderly: a gait abnormality rating scale and its relation to falls.** J. Gerontol, v.45, p.129, 1990

Maressa P. Krause F.: 41. 3360-4331 Coordenadora do Projeto Terceira Idade Independente
Endereço: Rua José Rodrigues Pinheiro, 949 - Capão Raso 81.130-200 - Curitiba, Paraná, Brasil.

DETERMINATION OF FLEXIBILITY IN ELDERLY WOMEN FROM THREE DIFFERENT PROTOCOLS

Abstract

The aging process is associated with a number of morphological and functional, including the decrease in many important components of physical fitness, such as flexibility. This functional reduction compromises the realization of a number of daily living activities. The objective of this study was to determine the levels of flexibility from three distinguish flexibility protocols. Participated of this study 927 women, non-institutionalized, older than 60 years, divided in five age groups AG 1 (6064 years; n = 277), AG 2 (6569 years; n = 283), AG 3 (7074 years; n = 202), AG 4 (7579 years; n = 114) and AG 5 (>80 years, n= 51). Flexibility was measured using the Sit-and-Reach Test (SR) (WELLS and DILLON,1952); Chair Sit-and-Reach Test (CSR) (RIKLI and JONES,1999); and the movements of shoulder adduction (SA), hip flexion (HF) and hip abduction (HA) were accessed according to the norms of utilization of the instrument inclinometer (INC) (ACHOUR, 2004). The gradual decrease of flexibility was observed in all tests. The Shoulder Abduction movement and the Hip Flexion movement reduced 7.3% and 5.2% respectively and this reduction was more pronounced on the Hip Abduction which declined 23.6%. There were no differences in changes of flexibility between right and left hemi-bodies. There was an association among all age groups and the tests that measured hip mobility, being r=0.621, 0.556 and 0.697 for the 60-64 age group; r=0.578, 0.456 and 0,742 for the 65-69 age group; r=0.409, 0.367 and 0.725 for the 70-74 age group, r=0.540, 0.496 and 0.809 for the 75-79 age group and, r=0.533, 0.519 and 0.729 for the >80 age group among HF and SR, HF and CSR, and SR and CSR, respectively ($p<0.05$). The percentile values showed similarity with the mean percentage declines. The evaluation of the Hip Flexion can be done using any of the proposed tests. The Hip Flexion movement showed the least percentage reduction, possibly due to its association with walking. The flexibility percentile values can be used as reference for elderly women.

Key words: aging, flexibility.

DÉTERMINATION DE LA FLEXIBILITÉ DE FEMMES ÂGÉES À PARTIR DE TROIS PROTOCOLES DISTINCTS

Résumé

Le processus de vieillissement implique un ensemble de modifications structurelles et fonctionelles y compris la diminution dans importantes composants de l´aptitude fonctionnelle, comme la flexibilité.Cette réduction fonctionnelle compromet la réalization d´innombrables activités de la vie quotidienne.Donc, l´objectif du présent étude a été déterminer les niveaux de flexibilité dans les femmes âgées en utilisant trois protocoles de mesure de flexibilité.Ont participé de cet étude 927 femmes, non-institutionnalisées,avec âge supérieur a 60 ans, divisés dans cinq bandes étaires: F1 (60-64 ans ; n=277), F2 (65-69 ans ; n=283), F3 (70-74 ans ; n=202), F4 (75-79 ans ; n=114) et F5 (>80 ans ; n=51). La flexibilité a été évaluée en s´utilisant le test d´asseoir et atteindre (SA) (WELLS et DILLON, 1952) asseoir et atteindre de la chaise (SAC) (RIKLI et JONES, 1999) et flexion de hanche en s´utilisant le clinomètre (INC) (AHOUR, 2002). La flexibilité, évaluée à travers le clinomètre à decliné 7,3% dans le mouvement de l´abduction de l´épaule (AO), 5,2% dans le mouvement de flexion de la hanche (FQ), et dans l´abduction de hanche (AQ) a présenté la plus grande diminution 23,6%. Les modifications de la flexibilité ne présentent pas de différences entre les demicorps droit et gauche.S´est arrivée une association dans toutes les bandes étaires entre les tests qu´ont évalué la mobilité de la anche, en étant r=0,621, 0,556, 0,697 dans la bande 60-64 ans, r=0,578, 0,456 et 0,742 dans la bande 65-69 ans, r=0,409, 0,367 et 0,725 dans la bande 70-74 ans, r=0,540, 0,496 et 0,809 dans la bande 75-79 ans et r=0,533, 0,519 et 0,729 dans la bande >80 ans entre FQ et SA, FQ et SAC et SA et SAC, respectivement ($p<0,05$). Les valeurs de pourcentage ont démontré des similitudes avec les déclins moyens de pourcentages. L´évaluation du mouvement de flexion de la hanche peut être realisé pour quelconque un des tests proposés. Le mouvement de flexion de hanche a présenté la plus petite réduction de pourcentage, possiblement dû à son association avec la marche. Se conseille l´utilisation des valeurs de percentile comme référentiel pour les femmes âgées.

Mots-clés: vieillissement , flexibilité

DETERMINACIÓN DE LA FLEXIBILIDAD DE MUJERES ANCIANAS A PARTIR DE LOS TRÉS PROTOCOLOS DISTINCTOS

Resumen

El proceso de envejecimiento envuelve un conjunto de modificaciones estructurales y funcionales, incluyendo la diminuición en importantes componentes de la aptitud funcional, como la flexibilidad. Esa redución funcional compromete la realización de innumerables actividades diarias. Por tanto,el objetivo del presente estudio fue determinar los niveis de flexibilidad en mujeres ancianas utilizando trés protocolos de medidas de flexibilidad. Participaron de eso estudio 927 mujeres, non-institucionalizadas, con edad superior a 60 años, divididas en cinco tiras etarias: F1(60-64años; n=277), F2(65-69años; n=283), F3(70-74años; n=202), F4(75-79años; n=114) y F5(>80años, n=51años). La flexibilidad fue evaluada utilizandose el test de sentar y alcanzar (SA) (WELLS y DILLON, 1952), sentar y alcanzar de la silla (SAC) (RIKLI y JONES,1999) y flexión de cuadril utilizandose el inclinómetro (INC) (ACHOUR, 2004). La flexibilidad, evaluada por medio del inclinómetro, declinó 7,3% en el movimiento de abdución de hombro (AO), 5,2% en el movimiento de flexión de cuadril (FQ) y en la abdución de cuadril (AQ) presentó una mayor disminución 23,6%. Las alteraciones de la flexibilidad no presentaron diferencias entre los hemicorpos derecho e izquierdo. Ocurrió una asociación en todas las tiras etarias entre los testes que evaluaron la mobilidad del cuadril, siendo r=0,621, 0,556 y 0,697 en latira 60-64años; r=0,578, 0,456 y 0,742 en la tira 65-

69años; r=0,409, 0,367 y 0,725 en la tira 70-74años; r=0,540, 0,496 y 0,809 en la tira 75-79años y r=0,533, 0,519 y 0,729 en la tira >80años entre FQ y SA, FQ y SAC, y SA y SAC, respectivamente (p<0,05). Los valores percentílicos demostraron similaridad con los declínios medios percentuales. La evaluación del movimiento de flexión de cuadril puede ser realizada por cualquier de los testes propuestos. El movimiento de flexión de cuadril presentó la menor redución percentuale, posiblemente devido a su asociación con la caminada. Se aconceja la utilización de los valores de percentile como lo referenciale para mujeres ancianas.

Palabras-clave: envejecimiento, flexibilidad.

DETERMINAÇÃO DA FLEXIBILIDADE DE MULHERES IDOSAS A PARTIR DE TRÊS PROTOCOLOS DISTINTOS

Resumo

O processo de envelhecimento envolve um conjunto de modificações estruturais e funcionais, incluindo a diminuição em importantes componentes da aptidão funcional, como a flexibilidade. Essa redução funcional compromete a realização de inúmeras atividades da vida diária. Portanto, o objetivo do presente estudo foi determinar os níveis de flexibilidade em mulheres idosas utilizando três protocolos de medidas da flexibilidade. Participaram deste estudo 927 mulheres, não-institucionalizados, com idade superior a 60 anos, divididas em cinco faixas etárias: F1(6064anos; n=277), F2(6569anos; n=283), F3(7074anos; n=202), F4(7579anos; n=114) e F5(>80anos, n=51). A flexibilidade foi avaliada utilizando-se o teste de sentar e alcançar (SA) (WELLS e DILLON, 1952), sentar e alcançar da cadeira (SAC) (RIKLI e JONES, 1999) e flexão de quadril utilizando-se o inclinômetro (INC) (ACHOUR, 2002). A flexibilidade, avaliada através do inclinômetro, declinou 7,3% no movimento de abdução de ombro (AO), 5,2% no movimento de flexão de quadril (FQ) e na abdução de quadril (AQ) apresentou a maior diminuição 23,6%. As alterações da flexibilidade não apresentaram diferenças entre os hemicorpos direito e esquerdo. Ocorreu uma associação em todas as faixas etárias entre os testes que avaliaram a mobilidade do quadril, sendo r=0,621, 0,556, 0,697 na faixa 60-64anos; r=0,578, 0,456 e 0,742 na faixa 65-69anos; r=0,409, 0,367 e 0,725 na faixa 70-74anos, r=0,540, 0,496 e 0,809 da faixa 75-79anos e, r=0,533, 0,519 e 0,729 na faixa >80anos entre FQ e SA, FQ e SAC, e SA e SAC, respectivamente (p<0,05). Os valores percentílicos demonstraram similaridades com os declínios médios percentuais. A avaliação do movimento de flexão de quadril pode ser realizada por qualquer um dos testes propostos. O movimento de flexão de quadril apresentou a menor redução percentual, possivelmente devido à sua associação com a caminhada. Aconselha-se a utilização dos valores de percentil como referencial para mulheres idosas.

Palavras-chave: envelhecimento, flexibilidade.