

Effects of four different permanence times of the static overstretching on the flexibility's young adults

Original Article

Mario Cezar de Souza Costa Conceição^{1,2}

marioceju@uol.com.br

Rodrigo Gomes de Souza Vale^{2,6,7}

vale@redelagos.com.br

Martin Bottaro⁵

martim@unb.br

Estélio Henrique Martin Dantas^{1,2,3,6}

estelio@cobrase.com.br

Jefferson da Silva Novaes^{1,2,4}

jsnovaes@terra.com.br

¹Universidade Castelo Branco - UCB - Rio de Janeiro - RJ - Brazil²Laboratório de Biociências da Motricidade Humana - LABIMH - UCB - Rio de Janeiro - RJ - Brazil³Bolsista de Auxílio à Pesquisa do CNPq - Brazil⁴Universidade Federal do Rio de Janeiro - UFRJ - Rio de Janeiro - RJ - Brazil⁵Universidade Nacional de Brasília - UnB - Brasília - DF - Brazil⁶Grupo de Desenvolvimento Latino Americano para a Maturidade - GDLAM - Rio de Janeiro - RJ - Brazil⁷Programa de Pós-Graduação em Ciências da Saúde - PPGCSa - UFRN - Natal - RN - Brazil

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ABSTRACT: Introduction: The objective of the present study is to verify, among four different times of permanence in the static flexion (10s, 20s, 40s and 60s), which of them represents the most efficient minimum time to increase flexibility in young men, after eight weeks of training. **Materials and Methods:** This study was composed by 49 EPCAR (Preparatory School of Air Cadets) cadets, subdivided into four sample groups, aged between 15 and 19 years old. The sample groups presented homogeneous characteristics regarding age, height, corporal mass and Body Fat Percentage. The index of flexibility was checked through the LABIFIE protocol of goniometry, which verified the maximum amplitude range of motion in six movements. **Results:** The results of this study indicate that all groups had significant ($p \leq 0.05$) gains in flexibility. However, when compared among themselves, they did not present significant difference. **Discussion:** This fact shows that 10s enables the same gain as 20s, 40s and 60s permanence. Based on the results, among the researched times, we can conclude that 10s is the most efficient minimum time to increase flexibility.

Keywords: Range of Motion Articular, Muscle Stretching Exercises, Motor Activity.

Correspondence to:

Rua Antônio Cordeiro, 126 bl 03 apto 302 - Jacarepaguá - Rio de Janeiro - RJ - CEP 22750-310 - Brazil

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RESUMEN

Efectos de cuatro tiempos diferentes de permanencia de flexión estática en la flexibilidad de adultos jóvenes

Introducción: El presente estudio tuvo como objetivo verificar, de entre cuatro diferentes tiempos de permanencia en la flexión estática (10s, 20s, 40s y 60s), cual de ellos representa el tiempo mínimo más eficiente para la obtención del aumento de la flexibilidad de hombres jóvenes, tras ocho semanas de entrenamiento. **Materiales y Métodos:** Habían sido utilizados 49 cadetes de la EPCAR (Escuela Preparatoria de Cadetes del Aire), divididos en cuatro subgrupos de muestra, con franja etaria entre 15 y 19 años. Los grupos de muestra presentaron características homogéneas cuanto a la edad, estatura, masa corporal y porcentual de gordura. Los índices de flexibilidad habían sido contrastados a través del protocolo LABIFIE de goniometría, que verificó las medidas articulares de amplitud máxima en seis movimientos. **Resultados:** Los resultados de este estudio indican que todos los grupos tuvieron ganados significativos ($p=0,05$) de flexibilidad. Sin embargo, cuando comparados entre sí, ellos no presentaron diferencia significativa. **Discusión:** Este hecho demuestra que permanencias de 10s posibilitan la misma ganancia que las permanencias de 20s, 40s y 60s. Siendo así, se concluye que, de entre los tiempos investigados, 10s es el tiempo mínimo más eficiente para el aumento de la flexibilidad.

Palabras clave: Rango del Movimiento Articular, Ejercicios de Estiramiento Muscular, Actividad Motora.

INTRODUCTION

The diverse physical activities exert overload on the locomotor apparatus and the structure of its components (ligament, articulations, muscles and other involved structures), in a way that it can compromise its acting. In this sense, it is necessary to have an optimum level of flexibility to fulfill the exigencies of the prescribed exercises¹. The flexibility training can provide the increase of corporal ability, of the posture and symmetry, the muscle relaxation, occurred because of stress and tension and, especially, the increase of the movement efficiency^{2,3}.

In this way, flexibility has been incorporated to the training programs through many methods. The training of this physical quality can be done in a maximum form (flexioning)^{4,5,6} or in the submaximum form (stretching), with detach to the static flexioning (passive method)⁷. This method seeks to develop the amplitude of the arch of movement over de regular limit and takes, as quantitative parameters for application, the duration and the frequency of the permanencies accomplished in the various articular movements⁸.

The variation of the times of permanency used in scientific studies has been a characteristic in the usage of this method⁹. Researches have been done verifying short times of permanence, located between 5s and 30s^{10,11,12,13,14}. Other studies used protocols with intervention of times of permanence over 30s^{15,16}. Still, other investigations compared short and long times^{17,18,19,20,21}.

Table 1- Characteristics of the sample

	G10 (n = 12)	G20 (n = 12)	G40 (n = 12)	G60 (n = 13)
age (years old)	16.58 ± 1.16	16.58 ± 1,08	16.58 ± 1.24	16.54 ± 0.88
stature(cm)	172.25 ± 7.36	170.17 ± 4.11	176.25 ± 7.91	172.31 ± 5.33
corporal mass (kg)	64.75 ± 5.13	60.88 ± 5.52	64.8 ± 7.53	62.93 ± 5.41
relative fat (%)	12.20 ± 3.79	13.23 ± 5.53	10.51 ± 3.55	11.75 ± 3.81

RESUMO

Efeitos de quatro tempos diferentes de permanência de flexionamento estático na flexibilidade de adultos jovens

Introdução: O presente estudo teve como objetivo verificar, dentre quatro diferentes tempos de permanência no flexionamento estático (10s, 20s, 40s e 60s), qual deles representa o tempo mínimo mais eficiente para a obtenção do aumento da flexibilidade de homens jovens, após oito semanas de treinamento.

Materiais e Métodos: Foram utilizados 49 cadetes da EPCAR (Escola Preparatória de Cadetes do Ar), divididos em quatro subgrupos amostrais, com faixa etária entre 15 e 19 anos. Os grupos amostrais apresentaram características homogêneas quanto à idade, estatura, massa corporal e porcentual de gordura. Os índices de flexibilidade foram aferidos através do protocolo LABIFIE de goniometria, que verificou as medidas articulares de amplitude máxima em seis movimentos. **Resultados:** Os resultados deste estudo indicam que todos os grupos tiveram ganhos significativos ($p\leq 0,05$) de flexibilidade. Contudo, quando comparados entre si, eles não apresentaram diferença significativa. **Discussão:** Este fato demonstra que permanências de 10s possibilitam o mesmo ganho do que as permanências de 20s, 40s e 60s. Sendo assim, conclui-se que, dentre os tempos pesquisados, 10s é o tempo mínimo mais eficiente para o aumento da flexibilidade.

Palavras-chave: Amplitude de Movimento Articular, Exercícios de Alongamento Muscular, Atividade Motora.

The effects of the exercises on the movement's amplitude and the articular rigidity have been targets of scientific investigation throughout the decades, but there is not yet a consensus about the time of permanence in the position using the static flexioning (passive method) for the flexibility's optimization⁸.

Therefore, this study had the aim of verifying the effects of the method of static flexioning in four different times of permanence (10s, 20s, 30s and 60s) on the flexibility of young adults, after eight weeks of training.

MATERIALS AND METHODS

Approval of the study

The study was submitted and approved by the Committee of Ethics in Research of the Castelo Branco University-RJ, under the number 46/03.

Sample

In this sample, 49 male individuals, cadets from the esquadrões da Escola Preparatória de Cadetes do Ar (EPCAR), physically active and between 15 and 19 years old (Table 1). The following criteria were adopted: been outside the indicated age group; been an

athlete or a sedentary person, presenting any visually perceptible pathology, previously declare pain detected during the initial medical exam and not having a frequency equal or superior to 85% in the training sessions. The volunteers were randomly divided into four groups: the first one (G10) used in the intervention, the time of permanence of 10s; the second (G20), 20s; the third group (G40) 40s and the fourth group (G60), 60s.

All the volunteers have signed the informed consent, according to the Helsinki Declaration of 1975 and the resolution 196/96 of the National Health Council.

Procedures

In the first meeting, the body mass and stature measures were collected and the relative fat was calculated by the three folding protocol of Jackson & Pollock²¹, accomplished, respectively, with a digital scale with resolution of 100g (Filizola, model PL 150 Personal Line, Brazil, 1999); a professional estadiometer (Sanny, Brazil) and a cutaneous folding compass (Lange, USA) with 1mm

Figure 1 - Comparisons of the articular movement horizontal flexion of the shoulder (HFS)

*p < 0.05 for G60pre vs. G60post

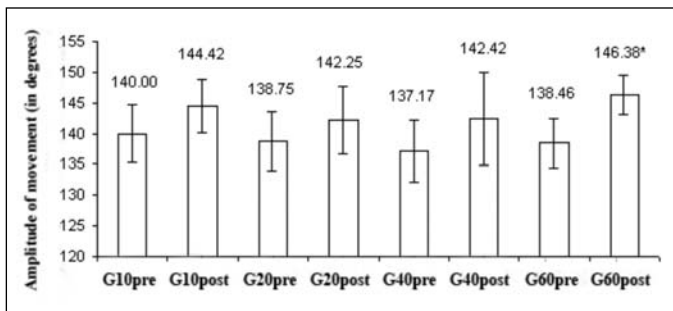


Figure 3 - Comparisons of the articular movement flexion of the shoulder (SF)

*p < 0.05 for G20pre vs. G20post; G40pre vs. G40post; G60pre vs. G60post

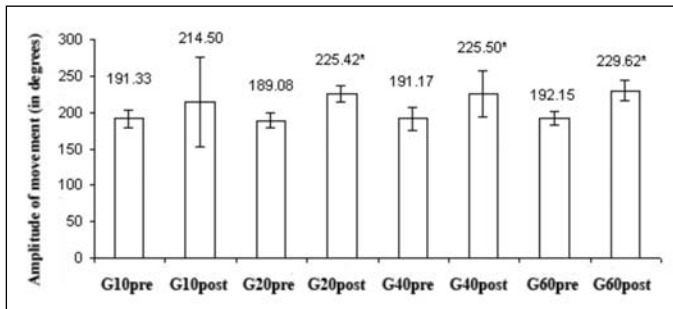
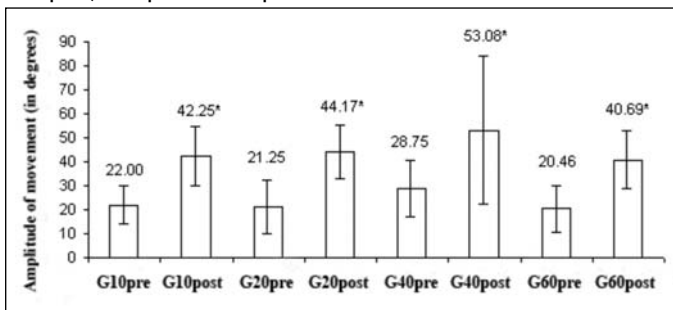


Figure 5 - Comparisons of the articular movement flexion of the lumbar spine (FLS)

*p < 0.05 for G10pre vs. G10post; G20pre vs. G20post; G40pre vs. G40post; G60pre vs. G60post.



of resolution and constant pressure of 10g.mm⁻². The flexibility was measured in the beginning and in the end of the intervention period, by the same experienced evaluator, as the LABIFIE²² protocol previews, through a steel Goniometer 360 (Lafayette Goniometer Set, USA), in the following movements: horizontal flexion of the shoulder (HFS); horizontal extension of the shoulder (HES); flexion of the shoulder (FS); Abduction of the shoulder (AS); flexion of the lumbar spine (FLS) and abduction of the lower limbs (ALL).

The intervention occurred during eight weeks, with a frequency of three sessions per week, with a series of static flexioning exercises (passive method) in a single exercise for each evaluated articular movement. The experimental training happened through a session of flexioning, at the end of warming-up in the regular physical education class of the institution, always at the same time (4:00 p.m.). All the exercises were accomplished in the maximum limit of the articular arch, seeking to reach the discomfort point (subjective sensation of pain)²³ and maintained for the respective times of permanence for each group. After the application of the

Figure 2 - Comparisons of the articular movement horizontal extension of the shoulder (HES)

*p < 0.05 for G10pre vs. G10post; G60pre vs. G60post

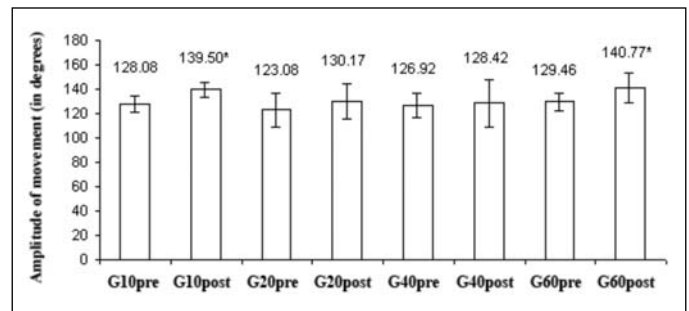


Figure 4 - Comparisons of the articular movement abduction of shoulder (AS)

*p < 0.05 for G10pre vs. G10post; G20pre vs. G20post; G40pre vs. G40post; G60pre vs. G60post

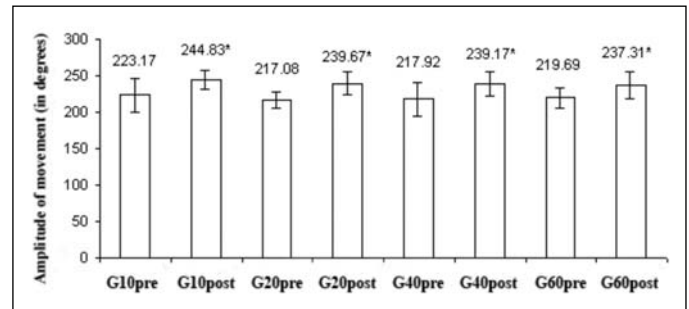
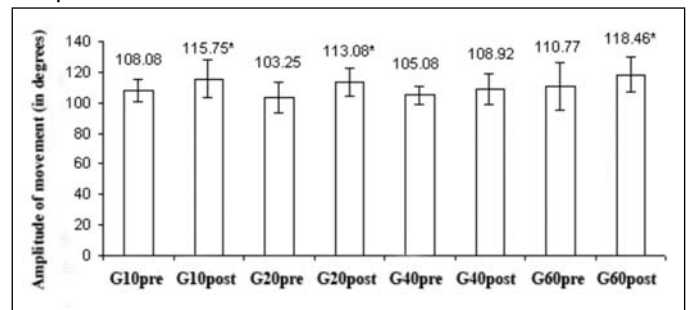


Figure 6 - Comparisons of the articular movement abduction of the lower limbs (ALL)

*p < 0.05 for G10pre vs. G10post; G20pre vs. G20post; G60pre vs. G60post.



static flexioning, all the cadets who were part of this study were released to continue the fixed obligatory program of physical education sessions.

Statistical treatment

The data are presented in mean and standard deviation. The normality of the variables of the articular movements was confirmed by the Shapiro-Wilk test. The test *t* of paired student was applied for intragroup comparisons and the analysis of the variance of repeated measurements (ANOVA) in the factors time and group for the intragroup comparisons, followed by the Scheffe's *post hoc* to identify possible differences. The value $p < 0.05$ was adopted for the statistical significance.

RESULTS

The results of the study have not presented significant differences in the intergroup comparisons of all the evaluated articular movements (Figures 1, 2, 3, 4, 5 and 6). However, the same did not happen in the intragroup comparisons.

In Figure 1, the results of the intragroup comparisons (pre and post test) of the HFS are presented. In this movement, we only found significant difference in group G60. However, if comparing the international normality patterns²⁴, it is verified that the values obtained in the pre-test were a lot higher than the fixed ones, getting close to the limit of the articular movement.

When the movement HES was evaluated, significant intragroup differences were verified in the G10 and G60 (Figure 2).

The SF movement presented significant intragroup differences in G20, G40 and G60 (Figure 3).

In the movements AS and FLS, all the studied groups presented significant intragroup differences (Figures 4 and 5). However, when comparing the evolution levels of these movements, it is possible to notice a higher relative improvement in favor of the FLS movement. Probably, because it is a specific movement little exercised in the regular exercises' routine of the sample groups.

For the ALL movement the G10, G20 and G60 presented significant intragroup differences. However, the G40 did not obtain the same result from the pre to the post test (Figure 6).

After analyzing the results of the intragroup comparisons, it was possible to verify that the time of permanence of 10s was sufficient to promote gains of articular amplitude in the movements HES, AS, FLS and ALL.

DISCUSSION

The results of the comparison of the static method's effect in four different times of permanence (10s, 20s, 40s e 60s) of the present study did not show intragroup significant differences in all of the evaluated articular movements.

These findings corroborate some already accomplished studies, such as the one done by Borms *et al.*⁸, which has compared the flexibility's behavior using the static method with a repetition of 10s, 20s e 30s of permanence, twice a week, in the articulation

of the waist. Regarding the time and duration of the stimulus, all of them were equally effective in the amplitude gains. The authors concluded that the times 20s or 30s are unnecessary and that the ideal time of permanence is 10s.

The same result was found by Madding *et al.*¹⁴, who compared the effects provoked by times of permanence of 15s, 45s e 120s in 72 men, with an average age of 27.1 ± 4.4 years old, divided into four groups with 18 individuals each. One of the groups worked as a controlling group and the other ones used three series as times of permanence of 15s, 45s and 120s. At the end of the training, comparing the effects provoked by the respective times of permanence, the authors verified that there wasn't an advantage in the use of permanencies with more than 15s.

In their study, Roberts & Wilson⁹ verified times of permanence of 5s and 15s, using 19 men and five women, during a five-week training program. They did not find significant differences between the two groups regarding the passive exercises, although both have obtained significant gains when compared to the controlling group. These results might indicate that times inferior to 10s of permanence are sufficient to increase flexibility. However, it is important to highlight that 3 repetitions of the stimulus 5s were accomplished, in order that the absolute time between both of them become equal.

Shrier & Gossal¹⁰ compared the time of permanence of 15s and 30s in a single muscular group, finding that a repetition of 15s was sufficient to produce significant improvement in an articular movement's amplitude.

The study of Cipriani *et al.*¹¹ has also used the statistical method, in which two protocols with durations of 10s and 30s of static stretching were applied in 23 healthy university students, 18 women and five men, with an average age of 22.8 ± 4.7 years old. The stretching was executed twice a day, for six weeks, demonstrating, in both protocols, that there were significant developments of the flexibility and that, when compared between themselves, they didn't present significant differences. However, they had the purpose of comparing two different stretching protocols that had the total daily time of equivalent stretching duration, always trying to reach a total of 2min of incentive at the end of the day. This allowed the authors to deduce that the total time of daily stretching is more important than the duration of a single prolongation.

However, other studies show results that diverge from ours. Bandy & Irion¹⁵ applied times of permanence of 15s, 30s and 60s, five days a week, for six weeks, in 57 individuals (40 men and 17 women), with age between 21 and 37 years. The results indicated the time of permanence of 30s as the effective time of stretching to increase the flexibility and the researchers concluded that a larger time of tension can produce more significant chronic effects in the movement amplitude. They pointed significant improvements of the flexibility in the groups that reached times of 30s and 60s, when compared to those of 15s and to the controlling group. However, some factors can justify the results which were different from ours. The age group and the gender differed from the samples and the authors considered the total time of activity and not only the permanence after reaching the maximum arch of movement.

Later, Bandy *et al.*¹³ compared in 93 volunteers (61 men and 32 women) the effects of permanencies of 30s and of 60s in the

static stretching, with one or three series, for six weeks, not finding significant differences among the results. As no difference was verified between the durations and frequencies of the stretching, the authors suggest that the series with 30s of duration is an effective amount of time to increase the flexibility of the muscle.

On the other hand, Viveiros *et al.*¹⁶ mentioned in his study the relationship between the sharp effects of the flexibility and stretching exercise with times duration of 10s, 60s and 120s in the static method, with one and three series, for the movement of shoulder extension. 70 sedentary individuals with age between 20 and 30 years, sedentary and, because of that, without any previous training of the flexibility took part in this research. The results demonstrated, in the intergroup comparison, that all the experimental groups showed larger values than those of the controlling group, and that the intergroup results suggest that the effects of larger magnitude happened when the time of duration was superior to 60s, independently of the number of series. However, the authors affirmed not to know the successive incentives of long duration would provide larger width in long period, in comparison with stretching realized in a shorter time. It happened because the authors just realized only an intervention that allowed evaluating the sharp effects of the training, unlike the present study, that evaluated the chronic effects of the training.

Feland *et al.*¹⁷ also found different results in relation to the present researches. The authors verified times of permanence of 15s, 30s and 60s with 62 elders with more than 65 years, finding better results with the time of 60s. However, they attribute these discoveries to the physiologic changes related to the age, assuming that the found results cannot repeat in studies with younger populations, as realized in the present investigation.

Ford *et al.*¹² studied the effect of four different times of permanence of the static prolongation in the flexibility of the knee extension movement. In the study participated 35 healthy university students (24 men and 11 women), with an average age of 22.7 ± 2.4 years, that were divided in five groups: one of control and four experimental. The four experimental groups used a single daily extension for five weeks, with times of static sustained stretching during 30s, 60s, 90s and 120s, respectively. The results identified significant improvement of the flexibility for each one of the experimental groups, varying between 1.9° and 3.6° when compared to the controlling groups, but any significant difference of the flexibility improvement didn't exist in the intergroup evaluation. Although the durations of the static prolongation permanence were different, the authors concluded that similar benefits were reached for all the experimental groups, suggesting that it is not necessary to realize interventions with more than 30s.

Bonvicine *et al.*¹⁸ compared, in two groups of the female gender, the amplitude gains with 60s of permanence against two serials of 20s. They concluded that, at the end of four weeks, the amplitude gains tends to be larger in a series of 60s. Though, it is important to consider the absolute values of the two groups, where the first has a larger time than the second.

So, based on the findings of the present study, we can infer that from 10s of permanence on, all the times are able to produce the improvement of flexibility. This way, the study suggests that it is not necessary to use superior times, due to the fact that the results tend to not show statistically significant differences between them.

However, new investigations are recommended, increasing the number of series, working with samples of different characteristics and with a bigger sample's size to look for the confirmation to the results which were shown in this study.

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