128 - THE EFFICACY OF STRETCHING IN PHYSICAL ACTIVITY: A SYSTEMATIC LITERATURE REVIEW

CARLOS ALBERTO DA SILVA
Instituto de Educação Física e Esportes – IEFES
Universidade Federal do Ceará – UFC

doi: 10.16887/85.a1.128

1- INTRODUCTION

Physical activity is being incorporated in people`s life from all ages, as part of life style changes, with the primary objective of improving health and beauty. In competitive sports, the importance of a training plan, composed by all physical variables, is necessary to improve athletic performance. Physical education teachers and technicians, almost universally, recommend the practice of pre-exercise stretching (before initiating a general or sportive physical activity) in their routines. Their intention, according to past studies, is to prevent sport-related injuries and improve performance (1).

For decades, the belief of using stretching before practicing sports has been the rule for both competitive sports and physical activity for health and esthetics (2). On the opposite site there are literature reviews and clinical trials demonstrating that pre-exercise stretching do not reduce the probability of injury (3-7), as well as do not improve athletic performance (1,8,9).

The aim of this study was to identify and justify the development of quality physical flexibility through stretching exercises and its use during physical education classes or training sessions, based on scientific evidence, regarding its characterization, types of techniques and methods to develop flexibility, application in pre-exercise stretching to prevent injury and its use to improve athletic performance.

Methodologically, we accessed the Medline and SportDiscus databases searching for scientific reviews and experimental studies, all in English, published between 1999 and 2010. In the SportDiscus database the search key words were “stretching exercises”, “flexibility” and “joints range of motion”, anywhere in the text, and we found 49 studies. In the Medline database, we used the terms “stretching” or “flexibility” in the title, “muscular”, “exercises” or 'fitness”, anywhere in the text, and we found 50 results. The inclusion criteria were: type of publication (we included only original articles or reviews), language (English), period (1999 to 2010), population (athletes and non-athletes, young and adults), full-text, peer-reviewed, in indexed journals. After these criteria there remained 27 articles from SportDiscus, being 18 experimental and 9 reviews, and 18 article from Medline, being 14 experimental and 4 reviews.

2- PRE-EXERCISE STRETCHING AND RISK OF INJURY

Pre-exercise stretching has been a constant practice in physical education classes, both for health purposes and for the performance improvement. An obvious disconnection between recent evidence and actual practice exists. In the work by Shehab et al. (1) it was clear that the majority of professionals who were enrolled practiced stretching in their athletes, before both training and competitions, and this practice is almost universally seen. It is based on the premise that in a complacent system (elastic) the strengths will be absorbed by muscle-tendon junction, reducing, by this way, injury to the muscle fibers. However, where there is excessive rigidity, the injuries will be transferred to the contractile system, with little reduction in strength. This fact supported the existence of a mechanism to explain the association between reduced flexibility and injury occurrence, as demonstrated by Weldon and Hill (6), with individuals with passive rigidity, who has higher injury predisposition during exercise.

What the specialists did not expect was the higher occurrence of injuries in movements with not-exacerbated joint amplitudes (the lesions occurred during movements that were made within the normal amplitude in normal subjects), with the muscle active and eccentrically contracted (6). Herbert and Gabriel (22), after re-evaluating other studies, concluded that pre-exercise stretching is not confirmed as having efficacy in reducing the risk of injury during exercise. Shrier (3) suggests that stretching before exercise do not decrease the risk of injury. Janot et al. (7) confirms that pre-exercise stretching is popular belief, because there is no adequate level of evidence to support the fact that static stretching before exercise decreases injury.

Human experimental studies confirm these information. In the study by Amako et al. (5), with 901 young health military subjects, 518 in the group who have made pre-exercise stretching and 383 who have not made stretching before exercise, showed that there was no significant difference in the percentage of injuries between the two groups, although in absolute values the number of injuries were lower in the stretching group. After evaluating the injury types, the concluded that static stretching cannot prevent high energy injuries, such as fractures, joint displacement and laceration, however, the stretching can prevent low energy injuries, including muscle effort, mild pain after exercise and low degree tendinitis. An important fact that was not controlled in this study is that the subjects have made warm up before practicing the stretching exercises, a mechanism which could have prevented these types of injuries.

Pope et al. (4) showed, in a study with 1589 military recruits, divided in two groups (735 who stretched the gastrocnemius, soleus muscle, lower limbs tendon, quadriceps, hip adductor and flexors, during 20 seconds, statically, and 803 who did not practiced stretching), that a pre-exercise stretching protocol do not provide an injury risk reduction. It was noted a 5% decrease in the injury risk, if the results were expressed in absolute terms, making the effects of stretching very low. The recruits have made stretching during 40 sessions, so each subject has made in average 3100 sessions of stretching to prevent injury. As they took 5 minutes to complete each session, a mean of 260 hours would be necessary to prevent one lesion. It was clear in this study that the risk of injury is not related to practice or not stretching, but with age and physical condition.

Harting and Henderson (23), in a study with two military recruits companies during basic training with stretching four times a day, discovered that the group who has made stretching four times a day in addition to the conventional training had less injury than the control group. This results are not consistent with the other studies, and maybe there have been methodological problems, such as comparison between baseline characteristics, with the study group having more subjects with rigid tendons than in control group. Another aspect was the lack of controls with preexisting lesions, as well as the measures of good physical shape could have not been taken, suggesting that there were more subjects with low physical condition in control group.

3 -STRETCHING AND ATHLETIC PERFORMANCE

The stretching exercised has been considered as essential components of training programs for decades. Sectional transversal studies (24) demonstrated that the flexibility measures are related to performance in several sports, suggesting that stretching or flexing use to accentuate flexibility can improve performance. However, observations in athletes and trainers have put in doubt the prescription of stretching to improve sports performance, and this skepticism is sustained by a crescent number of empiric data. The effect of stretching in flexibility leading to a gain in movement proportion is clear (25-30), but what it is not known is if stimulating flexibility is good in some sports activities.

The efficacy of pre-exercise static stretching to accentuate athletic performance has been recently questioned (31). The majority of relevant researches have focused on short-term effects of static stretching or flexing, and not in long-term results, regarding the functional movement proportion (11). The study by Nelson et al. (32), conducted with college students to evaluate knee flexing muscle strength, evidenced that there was a reduction in muscle strength after an acute stretching training.

Other research by Nelson et al. (33), evaluating 11 men and 5 women who participated in a athletic championship, in jumping proofs, running and decathlon, in which all participants have done 4 protocols of passive stretching before performing 3 cycles of running for 20m, showed that the running time for 20m was significantly increased when the run was done after stretching. The pre-exercise stretching can compromise the performance in activities whose success depends of strength production rate and explosion. In the study by Ogura et al. (34), investigating 10 university soccer players, in different stretching protocols, concluded that the higher the stretching time the higher the strength loss. Little and Williams (35) showed, in a study with professional soccer players, that ballistic exercises or ballistic stretching provided higher times in speed physical tests comparing to static stretching, although they did not note strength loss or gain, but this was justified by a lower stretching time than other studies, a time not sufficient to cause autogenous inhibition.

Different from these results, and confirming this theory, the study by Zakas el al. (36) demonstrated that there was no knee flexing straight gain nor loss in soccer players, after a short-term static stretching program. The study by Papadopoulos et al. (37) also did not found benefit in the application of stretching in strength-time curve characteristics. Ribeiro et al. (38) showed, in a study with 11 healthy subjects, that passive stretching, as well as specific warm-up, did not influence the production of strength in the 10RM test.

4 -CONCLUSIONS

The aplication of stretching exercises to accentuate flexibility has been relatively immutable for many years. The focus on stretching and flexibility has been largely restricted to micro-structural changes in tissues, prevention of injury, and application of warm-up. The wrong conceptions are beginning to be described and the traditional beliefs are being challenged.

Stretching and flexing seem to be techniques which develops flexibility, and this later can be the proportion of movement in a given joint or set of joints, within morphological limits.

Regarding the way to develop flexibility, there are three types of methods, which are the dynamic (ballistic), static (isometric) and the PNF, with its different thecniques. This later seem not to decrease the risk of injury, as well as do not decrease the late pain in physical exercise.

In the search for maximal sport performance, the traditional paradigms of flexibility accentuation through simple stretching should be challenged. In general, it seems that endurance sports there is no need to practice high levels of stretching exercises to develop flexibility, which means that it can be done at the end of the training. In acyclic sports, in which there is need to have a high level of flexibility, the stretching can be done in the main part of the training or class, or at the end, because if it is done at the beginning it can decrease the potency strength to a specific sport ability.

REFERENCES

AMAKO, M.; ODA, T.; MASUOKA, K.; YOKOI, H.; CAMPISI, P. Effect of static stretching on prevention of injuries for military recruits. Military Med., v. 168, n. 6, p. 442-447, 2003.

ARMINGER, P. Prevention muscolotendinous injuries: a focus on flexibility. Atletic Therapy Today, v. 5, n. 4, p. 20-25, 2006.

BARRETT, C.; SMERDELY, P. A comparison of community-based resistance exercise and flexibility exercise for seniors. Australian J. Physiotherapy, v. 48, p.215-219, 2002.

BAZETT-JONES, D. M.; WINCHESTER, J. B.; McBRIDE, J. M. Effect of potentiation and stretching on maximal force, rate of force development, and rage of motion. J. Strength and Condit. Research, v. 19, n. 2, p. 421-426, 2005.

BEEDLE, B. B.; LYDIG, S. N.; CARNUCCI, S. M. No difference in pre- and post-exercise stretching on flexibility. J Strength Condit Research, v. 21, n. 3, p. 780-783, 2007.

BEEDLE, B. B.; MANN, C. L. A comparison of tho warm-ups on joint range of motion. J Strength Condit Research, v. 21, n. 3, p. 776-779, 2007.

CHAN, S. P.; HONG, Y.; ROBINSON, P. D. Flexibility and passive resistance of the hamstring of young adults using two different static stretching protocols. Scand. J. Med. Sci. Sports, v. 11, n. 2, p. 81-86, 2001.

CIPRIANI, D.; ABEL, B.; PIRRWITZ, D. A comparison of two protocols on hip range of motion: implications for total daily stretch duration. J. Strength and Condit. Research, v. 17, n. 2, p. 274-278, 2003.

CONE, J. R. Warming for intermittent endurance sports. Strengtth and Condit. J., v. 29, n. 6, p. 70-77, 2008.

DECOSTER, L. C.; SCANBON, R. L.; HORN, K. D.; CLELAND, J. J. Standing and supine hamstring stretching are equally effective. J. Athletic Training, v. 39, n. 4, p. 330-334, 2004.

FORD, G. S.; MAZZONE, M. A.; TAYLOR, K. The effect of 4 different durations of static hamstring stretching on passive knee-extension range of motion. J. Sport Rehabil., v. 14, n. 2, p. 95-107, 2005.

FORD, F.; McCHESNEY, J. Duration of maintained hamstring ROM following termination of three stretching protocols. J. Sport Rehabil., v. 16, p. 18-27, 2007.

FUNK, D. C.; SWANK, A. M.; MIKLA, B. M.; FAGAN, T. A.; FARR, B. K. Impact of prior exercise on hamstring flexibility: a comparison of proprioceptive neuromuscular facilitation and static stretching. J. Strength and Condit. Research, v. 17, n. 3, p. 489-492, 2003.

GRIBBLE, P. A.; GUSKIEWICZ, K. M.; PRENTICE, W. E.; SHIEDS, E. Effects of static and hold-relax stretching on hamstring range of motion using the flexibility LE1000. J. Sport Rehabil., v. 8, n. 3, p. 195-208, 1999.

HARTING, D. E.; HENDERSON, J. M. Increasing hamstring flexibility decreases lower extremity overuse injuries in military basic trainees. Am. J. Sports Med., v. 27, n. 2, p. 173-177, 1999.

HERBERT, R. D.; GABRIEL, M. Effects of stretching before and after exercising on muscle soreness and risk of injury: systematic review. BMJ, v. 325, n. 31. p. 468-473, 2002.

JANOT, J. M.; DALLECK, L. C.; REYMENE, C. Pré-exercise Stretching and performance. IDA Fitness J., v. 4, n. 2, p. 44-51, 2007.

KOLBER, M. J.; ZEPEDA, J. Addressing hamstring flexibility in athletes with lower back pain: a discussion of commonly prescribed stretching exercises. Strength and Condit. J., v. 26, n. 1, p. 18-23, 2004.

LAUR, D. J.; ANDERSON, T.; GEDDES, G.; CRANDALL, A.; PINCIVERO, D. M. The effects of acute stretching on hamstring muscle fatigue and perceived exertion. J. Sports Sciences, v. 21, p. 163-170, 2003.

LITTLE, T.; WILLIAMS, A. G. Effects of diferential stretching protocols during warm-ups on high-speed motor

capacities in professional soccer players. J. Strength and Condit. Research, v. 20, n. 1, p. 203-207, 2006.

MAGNUSSON, S. P.; HAGAARD, P.; MONSEN, E. B.; BOJSEN-MOLLER, E. Passive tensile stress and energy of the human hamstring muscles in vivo. Scand. J. Med. Sci. Sports, v. 10, n. 6, p. 351-359, 2000.

McNEAL, J.; SANDS, W. A. Stretching for performance enhancement. Current Sports Med., v. 5, n. 3, p. 141-146, 2006.

MITCHELL, U. H.; MYRER, J. W.; HOPKINS, J. T.; HUNTR, I.; FELAND, J. B.; HILTON, S. C. Acute stretch perception alteration contributes to the success of the PNF contract-relax stretch. J. Sport Rehabil., v. 16, n. 2, p. 85-92, 2007.

NELSON, A. G.; KOKKONEN, J.; ELDREDGE, C.; CORNWELL, A.; GLICKMAN-WEISS, E. Chronic stretching and running economy. Scan. J. Med. Sci. Sports, v. 11, n. 5, p. 260-265, 2001.

NELSON, R. T.; BANDY, W. Eccentric training and static stretching improve hamstring flexibility of high school males. Athletic Training, v. 39, n. 3, p. 254-258, 2004.

NELSONN, A. G.; KOKKONEN, J.; ARNALL, D. A. Acute muscle stretching inhibits muscle strength endurance performance. J. Strength and Condit.Research, v. 19, n. 2, p. 338-343, 2005a.

NELSON, A. G.; DRISCOLL, N. M.; LANDIN, D. K.; YOUNG, M. A.; SCHEXNAYDER, I. C. Acute effects of passive stretching on sprint performance. J. Sports Sciences, v. 23, n. 5, p. 449-454, 2005b.

OGURA, Y.; MIYAHARA, Y.; NAITO, H.; KATAMOTO, S.; AOKI, J. Duration of static stretching influences muscle force production in hamstring muscles. J. Strength Condit. Research, v. 21, n. 3, p. 788-792, 2007.

PAPADOPOULOS, C.; KALAPOTHARAKOS, V. I.; NOUSSIVOS, G.; MELIGGAS, K.; GANTIRAGA, E. Theo f static stretching on maximal voluntary contraction and force-time curve characteristics. J Sports Rehabil., v. 15, n. 3, p. 185-194, 2006.

POPE, R. P.; HERBERT, R. D.; KIRWAN, J. D.; GRAHAM, B. J. A randomized trial of preexercise stretching for prevention of lower-limb injury. Med. Sci. Sports Exerc., v. 32, n. 2, p. 271-277, 2000.

PROVANCE, S.; HEISERMAN, L.; BIRD, E.; MAYHEW, J. Effect of stretching duration on hamstring flexibility. Missouri AHPERD J., v. 16, p. 21-26, 2006.

REES, S. S.; MURPHY, A. J.; WATSFORD, M. L.; McLACHIAN, K. A.; COUTTS, A. J. Effects of proprioceptive neuromuscular facilitation stretching on stiffness and force-producing characteristics of the ankle in active women. J. Strength Condit. Research, v. 21, n. 2, p. 572-577, 2007.

RIBEIRO, F. M.; OLVEIRA, F.; JACINTO, L.; SANTORO, J.; LEMOS, A.; SIMÃO, R. Acute influence of passive stretching and specific warm up in the performance of the maximum load in the 10RM test. Fit. Perf. J., v. 6, n. 1, p. 5-9, 2007.

ROWLANDS, A. V.; MARGINSON, V. F.; LEE, J. Chronic flexibility gains: effect of isometric contraction duration during proprioceptive neuromuscular facilitation stretching techniques. Research Quarterly for Exercise and Sport, v. 74, n. 1, p. 47-51, 2003.

RUBIN, E. C.; COSTA, A. L. L.; GOMES, P. S. C. The effects of stretching on strength performance. Sports Med., v. 37, n. 3, p. 213-224, 2007.

THE EFFICACY OF STRETCHING IN PHYSICAL ACTIVITY: A SYSTEMATIC LITERATURE REVIEW

ABSTRACT

Coaches, teachers and specialists in physical activity recommend the practice of pre-exercise stretching to prevent injury. For the general population, this seems to be a good advice, because stretching seems to improve flexibility and the athletic performance. The aim of this study was to identify and justify the development of quality physical flexibility through stretching exercises and its use during physical education classes or training sessions. Methodologically, we accessed the Medline and SportDiscus databases searching for scientific reviews and experimental studies, all in English, published between 1999 and 2010. We conclude that pre-exercise stretching does not reduce injury risk and, in some sports practiced in the heating phase, does not improve the performance, on the contrary it could even hurt, but improves the rate of movement of specific articulation group or joint.

KEYWORDS: Exercise; Stretching; Flexibility; Injury; Performance.

L'EFFICACITÉ DE L'ETIREMENT DANS L'ACTIVITE PHYSIQUE: UNE REVUE SYSTEMATIQUE DE LA LITTERATURE

RÉSUMÉ

Les entraîneurs, enseignants et experts en activité physique recommandent la pratique de la pré-exercice d'étirement pour éviter les blessures. Pour la population générale, ce qui semble être un bon conseil, mais aussi d'étirement pour améliorer la flexibilité, par conséquent, accroître la performance athlétique. Mais les études interrogent la valeur de pré-exercice allongé et dans certaines situations, l'étirement pendant athlétique aperformance de développement. La pratique des professionnels dans le domaine de l'activité physique doit être fondée sur des preuves scientifiques. En tant que tel, on ne sait pas quand les effets positifs de la fusion des exercices de pré-étirage ainsi que l'amélioration des performances après vous étirer. Le but de cette étude était d'identifier et de justifier le développement de la flexibilité physique de qualité à travers des exercices d'étirement, et son utilisation à un moment donné de la classe ou de la session. Sur le plan méthodologique, ont été consultés la base de données Medline et SportDiscus, où il a rencontré articles de revue scientifique et expérimentale, dans des revues et, de 1999 à 2010, tout en anglais. Nous concluons que la pré-exercice d'étirement ne réduit pas le risque de blessure et, dans certains sports, pratiquée dans la phase de chauffage, ne jouit pas d'une augmentation des revenus, au contraire, pourrait nuire, bien qu'il ne améliorer la proportion de mouvements d'une articulation donnée conjoint ou d'un groupe.

MOTS-CLÉS: exercice. Stretching. Flexibilité. Blessure. Performance.

LA EFICACIA DE TRAMO EN ACTIVIDAD FÍSICA: UNA REVISIÓN SISTEMÁTICA DE LA LITERATURA

RESUMEN

Los entrenadores, maestros y expertos en actividad física recomiendan la práctica de pre-ejercicio de estiramiento para evitar lesiones. Para la población general, esto parece ser un buen consejo, pero también se extiende para mejorar la flexibilidad, como resultado, el rendimiento atlético mejorado. Pero los estudios interrogan el valor de alargado antes del ejercicio y en algunas situaciones el estiramiento durante aperformance desarrollo atlético. La práctica de los profesionales en el campo de la actividad física debe estar basada en la evidencia científica. Como tal, no está claro si los efectos positivos de la fusión de los ejercicios de pre-estiramiento, así como la mejora de los resultados después de estirar. El objetivo de este estudio fue identificar y justificar el desarrollo de la flexibilidad física de calidad a través de ejercicios de estiramiento, y su uso en un momento dado de la clase o sesión. Metodológicamente, se accede a la base de datos Medline y SportDiscus, donde conoció a los artículos de revisión científica y experimental, en revistas revisadas por pares y, de 1999 a 2010, todo en Inglés. Llegamos a

la conclusión de que antes del ejercicio de estiramiento no reduce el riesgo de lesiones y, en algunos deportes, practica en la fase de calentamiento, no goza de un incremento en el ingreso, por el contrario, podría perjudicar, aunque sí mejora la proporción de movimiento de una articulación dada articulación o grupo.

PALABRAS CLAVE: Ejercicio. El estiramiento. Flexibilidad. Lesión. Rendimiento.

A EFICÁCIA DO ALONGAMENTO NA ATIVIDADE FÍSICA: UMA REVISÃO SISTEMATICA DA LITERATURA

RESUMO

Treinadores, professores e especialistas em atividade física recomendam a prática do alongamento pré-exercício para prevenir lesão. Para a população em geral, isto parece ser um bom conselho, como também o alongamento para melhorar a flexibilidade, em conseqüência, a melhora do desempenho atlético. Mas, estudos interrogam o valor de alongar-se pré-exercício e em algumas situações o desenvolvimento o alongamento para aperformance atlética. A prática dos profissionais da área da atividade física deve ser pautada em evidências científicas. Como tal, não estão claro os efeitos positivos quando da incorporação de alongamentos pré-exercícios como também da melhora da performance após alongar-se. O objetivo deste estudo foi identificar e justificar o desenvolvimento da qualidade física flexibilidade por meio de exercícios de alongamentos e, sua utilização em determinado momento da aula ou sessão. Metodologicamente, foram acessados as Bases de Dados SportDiscus e Medline, onde encontrou-se artigos científicos de revisão e experimentais, em revistas indexadas e revisadas, no período de 1999 à 2010, todos em língua inglesa. Conclui-se que alongamento pré-exercício não diminui risco de lesão, bem como, em alguns esportes, praticado na fase de aquecimento, não beneficia um aumento no rendimento, ao contrario, poderia prejudicar, embora melhore a proporção de movimento de uma determinada articulação ou grupo articular.

PALAVRAS-CHAVE: Exercício. Alongamento. Flexibilidade. Lesão. Performance.