Artigo Original

Exercícios de alongamento na visão de treinadores e praticantes

Stretching exercises by the trainers' and exercisers' point of view

Villiney Santos Matos[1*], Sebastião Barbosa-Netto[1], Marcos Bezerra de Almeida[1]

1 Universidade Federal de Sergipe, São Cristóvão-SE, Brasil

* Correspondência: v.matos.tfp@gmail.com*

Resumo: *Objetivo*: identificar as características de avaliação, prescrição e prática dos exercícios de alongamento/flexibilidade na visão de treinadores e praticantes de exercício. *Métodos*: foram analisados dados de 424 praticantes e 106 treinadores que responderam a questionários específicos. *Resultados*: 64% dos praticantes alongam no início do treino, enquanto 54% no fim do treino, para prevenir lesões/dores musculares e relaxamento muscular. Apesar de 96% dos treinadores responderem que os exercícios de alongamento são essenciais, apenas 62% afirmaram prescrevê-los. Para 60% dos treinadores, a prescrição depende de cada sessão de treino, enquanto 40% utilizam dados da avaliação física. Os principais motivos para prescrever esses exercícios foram prevenir lesões (antes do treino) e relaxar a musculatura (depois do treino). Os exercícios são realizados preferencialmente em uma a duas séries com duração de 10 a 20 segundos de alongamento estático ativo. *Conclusão***:** praticantes e treinadores costumam alongar/prescrever alongamentos com objetivos distintos para início e final da sessão, com base nas características do treino e com séries de curta duração.

Palavras-chave: Exercícios de Alongamento Muscular. Treinamento Físico. Flexibilidade.

Abstract: *Objective*: to identify the characteristics of evaluation, prescription, and practice of stretching/flexibility exercises from the perspective of trainers and exercisers. *Methods*: data from 424 exercisers and 106 trainers who responded to specific questionnaires were analyzed. *Results*: 64% of exercisers stretch at the beginning of training, while 54% stretch at the end of training, to prevent muscle injuries/pain and muscle relaxation. Although 96% of trainers responded that stretching exercises are essential, only 62% said they prescribed them. For 60% of trainers, the prescription depends on each training session, while 40% use data from physical assessments. The main reasons for prescribing these exercises were to prevent injuries (before training) and relax muscles (after training). These exercises are preferably performed in one to two series lasting 10 to 20 seconds of active static stretching. *Conclusion***:** exercisers and trainers usually stretch/prescribe stretches with different objectives for the beginning and end of the session, based on the characteristics of the training and with a short duration series.

Keywords: Muscle Stretching Exercises. Exercise Training. Flexibility.

Citação: Matos, V. S.; Barbosa-Netto, S.; Almeida, M. B. Exercícios de alongamento na visão de treinadores e praticantes. *Arq Cien do Esp*.

Recebido: 11/2023
Aceito: 02/2024

Nota do Editor: A revista *"Arquivos de Ciências do Esporte"* permanece neutra em relação às reivindicações jurisdicionais em mapas publicados e afiliações institucionais

1. Introduction

A few years back, Nuzzo[1] suggested that flexibility should be down-weighted as a major physical fitness component, at least when compared to body composition, muscle strength/power, and cardiorespiratory fitness. More recently, Alizadeh et al.[2] concluded that resistance exercises are sufficient to maintain or improve flexibility levels as long as they are practiced in a full range of motion. However, it should be noted that stretching exercises have been used for various purposes, such as warming up[3], increasing the range of motion[4,5], preventing injury[6,7] and delayed-onset muscle soreness incidence[8,9], managing pain[10,11], and improving several kinds of performance[12,13]. It is also worth mentioning that the purpose of stretching is directly related to the objective of the main activity/sport to be practiced.

In this sense, a constant concern has been observed regarding the possible effects of stretching on the subsequent performance of muscle strength. Nevertheless, systematic reviews conducted over the last decade suggest that static stretching performed for a short duration (<60 s) is unlikely to impair strength performance[14,15]. In addition, Opplert & Babault[16] concluded that the effect of dynamic stretching on strength is not consensual.

On the other hand, the interpretation of these findings needs to take into account how these exercises occur in daily practice since the conditions seen in the laboratory research environment do not always reproduce those in which the phenomenon occurs (ecological validity). Consequently, this creates a gap between the investigation process and the natural training environment. Thus, for a more ecological approach, it is necessary to identify how stretching is truly prescribed by exercise trainers and exercised by practitioners.

Therefore, the present study aimed to identify the characteristics of evaluation, prescription, and practice of stretching exercises regarding the type, duration, series, training moment, and objectives in the view of exercise trainers and exercisers.

2. Methods

Sample

The sample size was calculated considering a 95% confidence level, an acceptable error of 5%, an estimated population proportion of 80%, and a possible 20% element loss (http://estatistica.bauru.usp.br/calculoamostral/ta_ic_proporcao.php) as n = 308. Trainers at gym clubs or fitness training centers, as well as exercisers currently with a minimum of three months of practice, all aged ≥18 years and regardless of gender, were considered eligible to take part in the study. A group of 530 subjects (106 exercise training professionals and 424 exercisers) took part in the study. All participants gave their voluntary consent for inclusion in the study, which was previously approved by the Institutional Research Ethics Committee under protocol nº 904.223.

Study Design

Researchers met trainers and exercisers directly at their respective gyms/fitness training centers, which were all located in the same city (Aracaju, Sergipe, Brazil) and duly

registered with the Regional Council of Physical Education. First, the researchers gave a brief explanation of the purposes of the study and asked the participants to answer a specific questionnaire (for trainers or exercisers) created for the study. A pilot study was conducted to analyze if there could be any misunderstanding about the questions. The questions that presented doubts were reformulated until we reached the final version of each questionnaire. After this, both instruments were validated by three independent sports science researchers.

The Questionnaires

The questionnaires were specific for each target group of the sample (trainers and exercisers). Both were based on scientific literature and were validated by two experienced researchers. The questions were related to the methodological aspects of stretching (type, duration, series, training moment, and objectives) and the exercisers' stretching habits.

Data Analysis

Objective data (closed questions) were analyzed descriptively, considering relative and absolute frequency measures. The answers to the open questions were analyzed using the content analysis method proposed by Bardin[17], based on the categorization of the terms observed according to their similarity.

3. Results

Exercisers

Most of the exercisers reported getting through a pre-workout evaluation (n = 305; 72,3%), with 218 (51,7%) having the flexibility measured. Stretching was highly frequent among exercisers, with only 30 (7,1%) subjects reporting not stretching at any moment of the training session. Amid the exercisers that do stretch, 157 (37,2%) stretch only before resistance training, 116 (27,5%) only after, and 112 (26,5%) stretch before and after, which makes stretching before weightlifting a common habit for almost two out of three subjects (64%), and a little over half always finishing the session with a stretching (54%). Other seven (1,7%) reported stretching during the resistance training session. Injury prevention was the main reason for stretching. Stretching as a warm-up strategy was only mentioned in the closed question (Figure 1).

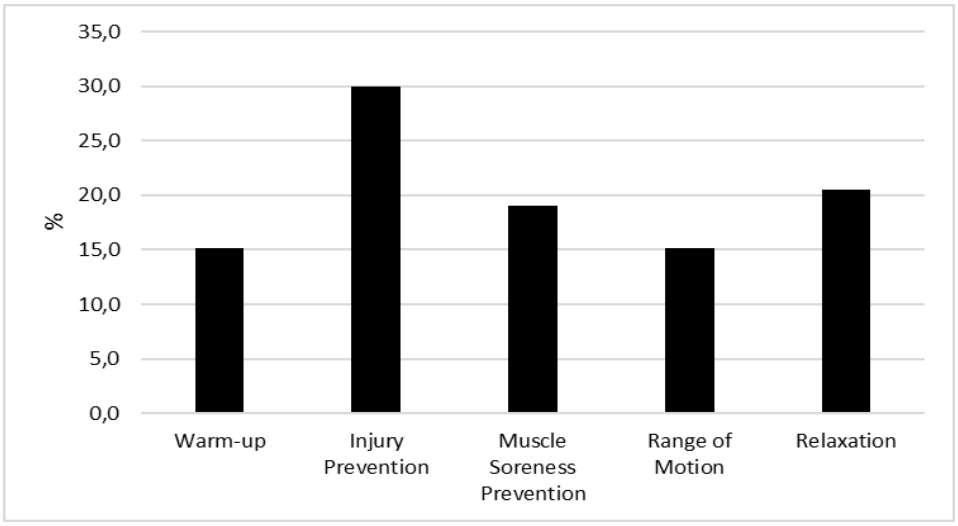

Figure 1. Exercisers' answers about goals for performing stretching exercises.

When asked about "how" they perform the stretching, 361 (85.1%) participants reported stretching on their own, as opposed to those who stretch with some help or who do not usually stretch. For most of the group, the inclusion of these exercises in the training program was considered very important. However, only about half of the subjects claimed to have the habit of "always stretching" (Table 1).

Table 1. Exercisers' stretching habits (n = 424).

What is the degree of importance of stretching in the training program?			
Very Important	Little Important	Indifferent	No Answer
375 (88.4%)	25 (5.8%)	23 (5.4%)	1 (0.2%)
Do you have a habit of stretching?			
Always	Occasionally	Seldon	Never
219 (49.8%)	129 (30.4%)	52 (12.3%)	24 (5.7%)

Trainers

Of the 106 trainers, 66 (62.3%) stated that they prescribe stretching exercises, 38 (35.8%) do not prescribe and 2 (1.9) did not respond. However, almost the entire sample (n = 102; 96.2%) considered this training modality very important and that it should be

included in a training program. Only 50 trainers presented the bases for prescribing stretching exercises, with 60% of them reporting being based on the methodological aspects of each training session, and 40% on information from the previous physical assessment.

When trainers were asked to indicate when stretching exercises should be performed, 9 (8.6%) indicated "only at the beginning of the training session", while 54 (51.4%) indicated "only at the end of the training session", and 42 (40.0%) indicated "both at the beginning and the end of the training session". The main objectives mentioned by the trainers for stretching before the training session were to prevent injuries, increase the range of motion, and warm up. On the other hand, at the end of the training session, the most cited objective was to relax the musculature, with more than twice as many mentions of preventing delayed-onset muscle soreness (Figure 2).

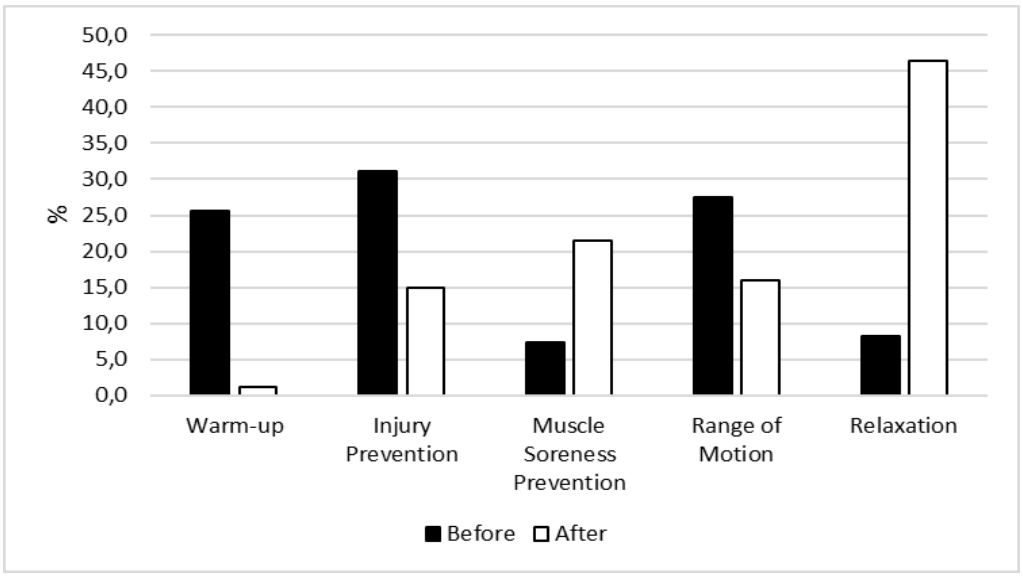

Figure 2. Trainers' opinions on the goals for stretching exercises prescription before and after the training session.

Regarding the protocol training aspects of stretching exercises, there was no clear position on the number of bouts, with more than 95% of responses suggesting performing no more than three sets for each exercise. Also, according to 83.3% of trainers, stretching should last between 10 and 20 s, with the most prevalent response being 15 s. Interestingly, only two trainers suggested stretching durations longer than 30 seconds. The most typical stretching method is static stretching, regardless of whether it is active or passive (Table 2).

Table 2. Trainers' responses on protocol training aspects of stretching exercises.

Number of sets most recommended by trainers: (n = 103)			
One Bout	Two Bouts	Three Bouts	>Three Bouts

40 (38.5%)	34 (32.7%)	24 (23.1%)	5 (4.6%)	

Stretching time most recommended by trainers: (n = 102)

10 seconds	15 seconds	20 seconds	30 seconds	>30 seconds
23 (22.5%)	37 (36.3%)	25 (24.5%)	15 (14.7%)	2 (2.0%)

*Stretching method most recommended by trainers: (n = 102)**

Active Static	Passive Static	Dynamic	Proprioceptive Neuromuscular Facilitation	Ballistic
71 (69.6%)	54 (52.9%)	33 (32.4%)	20 (19.6%)	4 (3.9%)

*More than one alternative allowed.

4. Discussion

The goals of the present study were to identify the characteristics of evaluation, prescription, and practice of stretching exercises regarding the moment of training, exercisers' objectives, type, duration, and sets, from the perspective of trainers and exercisers. The main findings indicated that just over half of the exercisers had their flexibility assessed and that the results of this assessment are usually considered by less than half of the trainers as a parameter for prescription. For the rest of the trainers, the prescription of stretching exercises will depend on the strength and endurance exercises of each workout. Practically two out of three trainers prescribed stretching to their students and three out of four exercisers reported that these exercises were part of their training routine. Notably, it is more common for exercisers to stretch than not to stretch, both before and after the main training, and in both situations, the main purposes for practicing these exercises would be to prevent injuries, relax, and avoid muscle pain. Regarding trainers, almost half revealed that they prescribe stretching at the beginning of training, mainly aiming to prevent injuries and increase the range of movement, in addition to warming up the muscles. On the other hand, nine out of ten stated that they prescribe it at the end of training especially to promote muscle relaxation. Finally, the most common training prescription composition is no more than three sets lasting no more than 20 seconds of static exercises, both active and passive.

It is noteworthy that only 40% of trainers used physical assessment as a reference for developing a flexibility training program, which has proven to be a questionable trend[18]. But after all, the prescription of these exercises is based on what? This question is pertinent since the majority of the sample indicated that stretching exercises are included in their training programs, but the prescription for 60% of trainers seems to depend on the muscle groups predominantly requested in each training session and not on previous information obtained in the pre-training assessment.

Physical assessment must be carried out aiming at extracting as much information as possible about the exerciser/athlete to create a training program that meets their needs.

Hence, subsequent evaluation and reevaluations can help to identify possible reasons for the low adherence and relevance attributed to stretching exercises[1,2]. This lack of interest may also be based on the undervaluation given to knowledge about the health and physical fitness benefits of this type of exercise[19-21], since flexibility is an important component of physical fitness[22], and therefore should be equally valued. Furthermore, it seems logical that gains in muscle mass and reduction in body fat have an observable aesthetic effect, whereas changes in flexibility do not.

Most coaches considered that stretching exercises should be performed after the main activity, contradicting the habits demonstrated by exercisers who mostly responded that they usually stretch before the main training.

Although there are no specific recommendations, the American College of Sports Medicine suggests that stretching be performed after strength or aerobic exercises[22], however, they do not present the arguments that support this suggestion. Part of the scientific literature understands that the prior use of stretching exercises can have a temporarily limiting effect on strength production[14,16,23]. Perhaps because of this information, most trainers are prioritizing prescribing these exercises at the end of the training session. However, Kay and Blazevich[15] observed that stretches up to 45 seconds do not cause more than a 2% reduction in the immediate capacity to produce force, which in practice does not represent a real significant loss. Therefore, this should not be a justification for stretching not to be performed before the main task.

A very contradictory point between the responses of trainers and exercisers, and the literature occurred when they were asked "Why stretch?". For a large part of the sample, stretching exercises may prevent injuries and muscle pain. Herbert et al.[9] carried out a systematic review on this topic and were categorical in stating that stretching exercises do not prevent delayed onset muscle pain. In addition, the authors state that their results were so consistent that new studies on the effects of stretching on delayed onset muscle soreness would not be necessary. Still, more recently Afonso et al.[8] expanded the review to include meta-analysis and recommended that this strategy be avoided, as no scientific evidence was found robust enough to support the argument for preventing delayed onset muscle soreness.

Zech and Wellmann[24] showed that more than 90% of football players empirically justify the use of stretching as a preventive factor for injuries. However, studies published over the last three decades have been consistent in indicating that stretching exercises do not prevent injuries[8,25-27]. Afonso et al.[8] add that there is no clear association between stretching and injury risk, as most injuries are multifactorial. Furthermore, Lewis[6] highlights that the studies that presented data favorable to injury prevention were composed of warm-up exercises associated with stretching exercises[28-30], not being able to measure the isolated contribution of each variable to injury prevention.

On the other hand, it is important to highlight trainers also indicated warming up as one of the objectives for stretching at the beginning of the session. Physiological responses resulting from increased body temperature tend to improve performance in exercise and sports[31,32]. However, it is worth noting that static stretching is not capable of

causing significant increases in body temperature and, consequently, a benefit to athletic performance would not be expected[16,33,34]. Still, dynamic stretching exercises seem to contribute more significantly to the warm-up than static stretching exercises[32].

One of the most frequent reasons for stretching at the end of the training session was increasing the range of motion[35]. However, we can assume that maximizing gains in flexibility would require more than the 10-minute period that trainers have informed to assign for these exercises, which denotes a potential devaluation of this component in training[1].

Muscle relaxation was the most cited reason to stretch at the end of training by the trainers, and the use of static stretching exercises seems to be coherent. For this purpose. Besides, the intensity, duration, and frequency most reported are in accordance with the ACSM[22] recommendations for static stretching exercises.

Lastly, it is worth highlighting that although flexibility is an important component of physical fitness, its use must be based on scientific evidence so that there is an alignment between objectives and expected results. Based on the data presented in the present study, it seems clear that these exercises are often used for the wrong reasons or purposes. Therefore, considering that the majority of interviewees stated that they found it very important to include these exercises in training routines, trainers must give this modality a more critical view.

It is also essential to highlight that this study was not intended to present itself as a guideline or normative for the prescription of stretching, but rather as an unprecedented guiding instrument for the development of future studies that consider this type of exercise, as a dependent or independent variable, serving as a basis for respecting ecological validity.

5. Conclusion

In summary, even when physical assessment protocols include flexibility, this information is not used to prescribe stretching exercises. Both exercisers and trainers mostly claim to have the habit of stretching or prescribing stretches. In general, stretching is used before training to warm up and prevent pain and injuries, and at the end of training to relax muscles and increase range of movement. The exercises are preferably performed in one to two sets lasting 10 to 20 seconds of active static stretching.

Authors´ contributions: VSM: análise dos dados; redação do manuscrito; SBN: concepção original do estudo; coleta e análise dos dados, redação do manuscrito; MBA: concepção original do estudo; análise dos dados, redação do manuscrito

Finacial support: Não aplicável.

Ethics: Comitê de Ética em Pesquisa da Universidade Federal de Sergipe, protocolo de Aprovação nº 904.223

Conflict of interest: The authors declare no conflict of interest.

References

1. Nuzzo JL. The case for retiring flexibility as a major component of physical fitness. *Sports Med.* 2020;50(5):853-870. doi: 10.1007/s40279-019-01248-w.
2. Alizadeh S, Daneshjoo A, Zahiri A, et al. Resistance training induces improvements in range of motion: a systematic review and meta-analysis. *Sports Med.* 2023;53(3):707-722. doi:10.1007/s40279-022-01804-x.
3. Ullman ZJ, Fernandez MB, Klein M. Effects of isometric exercises versus static stretching in warm-up regimens for running sport athletes: a systematic review. *Int J Exerc Sci.* 2021;14(6):1204-1218.
4. Afonso J, Clemente FM, Nakamura FY, et al. The effectiveness of post-exercise stretching in short-term and delayed recovery of strength, range of motion and delayed onset muscle soreness: a systematic review and meta-analysis of randomized controlled trials. *Front Physiol.* 2021;12:677581. doi: 10.3389/fphys.2021.677581.
5. Behm DG, Alizadeh S, Anvar SH, Drury B, Granacher U, Moran J. Non-local acute passive stretching effects on range of motion in healthy adults: a systematic review with meta-analysis. *Sports Med.* 2021;51(5):945-959. doi: 10.1007/s40279-020-01422-5.
6. Lewis J. A systematic literature review of the relationship between stretching and athletic injury prevention. *Orthop Nurs.* 2014;33(6):312-320; quiz 321-312. doi: 10.1097/nor.0000000000000097.
7. Rosado-Portillo A, Chamorro-Moriana G, Gonzalez-Medina G, Perez-Cabezas V. Acute hamstring injury prevention programs in eleven-a-side football players based on physical exercises: systematic review. *J Clin Med.* 2021;10(9):2029. doi: 10.3390/jcm10092029.
8. Afonso J, Claudino JG, Fonseca H, et al. Stretching for recovery from groin pain or injury in athletes: a critical and systematic review. *J Funct Morphol Kinesiol.* 2021;6(3). doi: 10.3390/jfmk6030073.
9. Herbert RD, de Noronha M, Kamper SJ. Stretching to prevent or reduce muscle soreness after exercise. *Cochrane Database Syst Rev.* 2011(7):Cd004577. doi: 10.1002/14651858.CD004577.pub3.
10. Luan L, El-Ansary D, Adams R, Wu S, Han J. Knee osteoarthritis pain and stretching exercises: a systematic review and meta-analysis. *Physiotherapy.* 2022;114:16-29. doi: 10.1016/j.physio.2021.10.001.
11. Siriphorn A, Eksakulkla S. Calf stretching and plantar fascia-specific stretching for plantar fasciitis: A systematic review and meta-analysis. *J Bodyw Mov Ther.* 2020;24(4):222-232. doi: 10.1016/j.jbmt.2020.06.013.
12. Konrad A, Nakamura M, Bernsteiner D, Tilp M. The accumulated effects of foam rolling combined with stretching on range of motion and physical performance: a systematic review and meta-analysis. *J Sports Sci Med.* 2021;20(3):535-545. doi: 10.52082/jssm.2021.535.
13. Thomas E, Ficarra S, Nunes JP, et al. Does stretching training influence muscular strength? A systematic review with meta-analysis and meta-regression. *J Strength Cond Res.* 2023;37(5):1145-1156. doi: 10.1519/jsc.0000000000004400.
14. Chaabene H, Behm DG, Negra Y, Granacher U. Acute effects of static stretching on muscle strength and power: an attempt to clarify previous caveats. *Front Physiol.* 2019;10:1468. doi: 10.3389/fphys.2019.01468.
15. Kay AD, Blazevich AJ. Effect of acute static stretch on maximal muscle performance: a systematic review. *Med Sci Sports Exerc.* 2012;44(1):154-164. doi: 10.1249/MSS.0b013e318225cb27.
16. Opplert J, Babault N. Acute effects of dynamic stretching on muscle flexibility and performance: an analysis of the current literature. *Sports Med.* 2018;48(2):299-325. doi: 10.1007/s40279-017-0797-9.
17. Bardin L. *Análise de conteúdo.* São Paulo, Brasil: Edições 70; 2011.
18. Araújo CG. Flexibility exercises are often recommended but flexibility is rarely evaluated: a misconnection. *J Sports Med Phys Fitness.* 2023;63(11):1135-1137. doi: 10.23736/s0022-4707.23.15237-6.

19. Halabchi F, Alizadeh Z, Sahraian MA, Abolhasani M. Exercise prescription for patients with multiple sclerosis; potential benefits and practical recommendations. *BMC Neurol.* 2017;17(1):185. doi: 10.1186/s12883-017-0960-9.
20. Mansoori SS, Moustafa IM, Ahbouch A, Harrison DE. Optimal duration of stretching exercise in patients with chronic myofascial pain syndrome: A randomized controlled trial. *J Rehabil Med.* 2021;53(1):jrm00142. doi: 10.2340/16501977-2781.
21. Wakimoto K, Dakeshita T, Wakimoto J, et al. Effects of triple-treatment trunk stretching on physical fitness and curvature of the spine. *Heliyon.* 2018;4(12):e00985. doi: 10.1016/j.heliyon.2018.e00985.
22. Garber CE, Blissmer B, Deschenes MR, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc.* 2011;43(7):1334-1359. doi: 10.1249/MSS.0b013e318213fefb.
23. Mascarin NC, Vancini RL, Lira CA, Andrade MS. Stretch-induced reductions in throwing performance are attenuated by warm-up before exercise. *J Strength Cond Res.* 2015;29(5):1393-1398. doi: 10.1519/jsc.0000000000000752.
24. Zech A, Wellmann K. Perceptions of football players regarding injury risk factors and prevention strategies. *PloS One.* 2017;12(5):e0176829. doi: 10.1371/journal.pone.0176829.
25. Charlton PC, Drew MK, Mentiplay BF, Grimaldi A, Clark RA. Exercise interventions for the prevention and treatment of groin pain and injury in athletes: a critical and systematic review. *Sports Med.* 2017;47(10):2011-2026. doi: 10.1007/s40279-017-0742-y.
26. McHugh MP, Cosgrave CH. To stretch or not to stretch: the role of stretching in injury prevention and performance. *Scand J Med Sci Sports.* 2010;20(2):169-181. doi: 10.1111/j.1600-0838.2009.01058.x.
27. Pope RP, Herbert RD, Kirwan JD, Graham BJ. A randomized trial of preexercise stretching for prevention of lower-limb injury. *Med Sci Sports Exerc.* 2000;32(2):271-277. doi: 10.1097/00005768-200002000-00004.
28. Behm DG, Blazevich AJ, Kay AD, McHugh M. Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: a systematic review. *Appl Physiol Nutr Metabol.* 2016;41(1):1-11. doi: 10.1139/apnm-2015-0235.
29. Soligard T, Myklebust G, Steffen K, et al. Comprehensive warm-up programme to prevent injuries in young female footballers: cluster randomised controlled trial. *BMJ.* 2008;337:a2469. doi: 10.1136/bmj.a2469.
30. Woods K, Bishop P, Jones E. Warm-up and stretching in the prevention of muscular injury. *Sports Med.* 2007;37(12):1089-1099. doi: 10.2165/00007256-200737120-00006.
31. Kapnia A, Dallas CN, Gerodimos V, Flouris AD. Impact of warm-up on muscle temperature and athletic performance. *Res Q Exerc Sport.* 2023;94(2):460-465. doi: 10.1080/02701367.2021.2007212.
32. Li FY, Guo CG, Li HS, Xu HR, Sun P. A systematic review and net meta-analysis of the effects of different warm-up methods on the acute effects of lower limb explosive strength. *BMC Sports Sci Med Rehabil.* 2023;15(1):106. doi: 10.1186/s13102-023-00703-6.
33. Hernandez-Martinez J, Ramirez-Campillo R, Vera-Assaoka T, et al. Warm-up stretching exercises and physical performance of youth soccer players. *Front Physiol.* 2023;14:1127669. doi: 10.3389/fphys.2023.1127669.
34. Vieira DCL, Opplert J, Babault N. Acute effects of dynamic stretching on neuromechanical properties: an interaction between stretching, contraction, and movement. *Eur J Appl Physiol.* 2021;121(3):957-967. doi: 10.1007/s00421-020-04583-3.
35. Nakamura M, Ikezu H, Sato S, et al. Effects of adding inter-set static stretching to flywheel resistance training on flexibility, muscular strength, and regional hypertrophy in young men. *Int J Environ Res Public Health.* 2021;18(7). doi: 10.3390/ijerph18073770.