Effects of a training program using the Pilates method in flexibility of sub-20 indoor soccer athletes

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ABSTRACT

The flexibility consists in the motor capacity related with the amplitude of movement reached by each joint. The flexibility suffers decrease with the age, being that during the adolescence, in result of the fast pubertal growth, considerable loss of this characteristic occurs. It is known, also, that athletes of soccer and futsal, as result of the programs of force aiming the gesture of the kick, tend to have considerable shortening of posterior thigh muscles, that promotes a loss of income and it premakes the athletes to the muscular injuries. Thus, the objective of the present study was to verify the effect in the flexibility by a program of *Pilates*® in a sub-20 futsal team, that is considerate a highly inclined population to limitations of this capacity, and that can afford a lot of benefits with the increment of it. For such, it was divided the athletes group in Pilates group (GP, n = 6) and control group (GC, n = 5). It was opted to evaluate the flexibility of athletes with two methods (fleximeter and Wells's bench). Evaluations were realized in three distinct moments: pre (24 hours before the start of the program), post-immediate (24 hours after the end of the program) and post-delayed (15 days after the end of the program). The program was realized three times per week with approximately 25 minutes, during four weeks. The results of the present study prove that the training protocol with the *Pilates*® method used by the researchers did increase the flexibility of sub-20 futsal athletes. This program presented acute effects, represented by the statistically significant increase to the flexibility in post-immediate ($p < 0.05$ in Wells's bench and $p < 0.01$ in Fleximeter), and chronics, observed on the small decline (no statistically significant, $p > 0.05$) in post-delayed period to the both methods. It is suggested that more studies should be to realize with the *Pilates*® method aiming to elucidate all possibilities of application of this therapeutic modality.

Keywords: Sport. Adolescents. Prevention. Muscle shortening.

INTRODUCTION

The word flexibility derives form the Latin *flectere* or *flexibilis*, 'to bend over'. Perhaps one of the simplest definitions is the movement breadth available in an articulation or group of articulations[1], being limited by bones, muscles, tendons, ligaments and articulation capsules[2].

Contrary to what happens to muscles, the stretching capacity of tendons, ligaments and capsules is very limited, due to their function of articular stabilization[3]. Weineck[4] has described the influence of different types of tissues which contribute to flexibility for articular resistance: capsule and articulation 47%; muscles 41%; tendons 10% and skin 2%.

Flexibility is an individual capacity, once it depends on factors such as: genetic history, gender, age, muscular and adipose volume, besides external factors such as training and room temperature, among others[5].

Such capacity weakens with age, especially during adolescence, more remarkably in male gender[6]. It is believed that up to 17 years of age flexibility may be recovered and incremented by suitable training programs, indeed. After this age, this capacity tends to progressively reduce both in men and women[5-6].

As muscular flexibility increases, the exercises may be performed with greater movement breadth, greater strength more rapidly, greater fluency as well as more efficiently[5,7]. Thus, lack of flexibility is a limiting factor to sportive performance, being a facilitator for muscular injuries[5,8-10].

Futsal is becoming a worldwide popular sport which attracts an increasing number of participants. Due to the easiness to find spaces for its practice, it is one of the mostly spread sports in Brazil, being played for over 12 million of Brazilians, according to data from the Brazilian Confederation of Futsal – CBFs[11].

Grau[10], affirms that when adolescents join centers for soccer preparation, intense training, body building, and maybe badly-elaborated flexibility programs, build athletes with little flexibility. Consequently, the sportive gesture (the kick, in this case) behaves less precise and powerful, exactly for the deficiency in flexibility, especially in the posterior muscles of the thigh (hamstrings).

This muscular group, together with the posterior group of the leg (gastrocnemius), is the most prone to muscular strains (injury generated by the over-stretching of the fibers or sudden muscular contractions). These muscles are characterized for a biarticular nature and an eccentric demand in a large part of the time (for instance, the hamstrings in the disacceleration phase of the kicking and the gastrocnemius in the landing)[12].

The main techniques for development of flexibility are: ballistic, stretching, statics and PMF (proprioceptive neuromuscular facilitation)[5]. However, techniques such as Pilates® have been appearing as new options to be studied, tested and confirmed.

This technique's name makes reference to its creator, Joseph Pilates (1880-1967). Its first practitioners were almost exclusively dancers and athletes. Nevertheless, in the last years, the Pilates® method has become a popular method in rehabilitation as well as fitness. In the USA, there are over 5 million practitioners and in a simple search in the Internet there are over 200 videos available on the topic[13].

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The Pilates® training intends to improve the general flexibility and aims at health through the 'strength center' of posture and breathing coordination with the performed movements. The method is based on six principles with the purpose to consciously move with no fatigue or pain. These principles are: breathing, control, concentration, articular organization, movement flow and accuracy[14]. It is a method which works with muscular exercises of low contraction impact, intensely strengthening the abdominal muscles[15]. However, even with its benefits, little is published on this therapeutic modality, especially in athletes.

Thus, the aim of the present study was to verify the effect over flexibility provided by a Pilates® program in a population highly prone to limitations of this nature, and which can strongly profit from its improvement.

METHODOLOGY

The study consisted of a randomized, double-blind clinic essay. The sample used was the sub-20 futsal team from the Caxias do Sul University (UCS), composed of 11 athletes between 17 and 20 years of age (mean 18.1 years ± 0.83), mean height of 175.82 cm (± 6.60) and mean weight of 70.18 kg (± 6.24).

Prior to the beginning of the study, the athletes were randomly divided in two groups. Later on, it was observed that there was not statistically significant difference concerning age, height and weight means between groups ($p > 0.05$), so as to avoid that these variables could interfere in the final result of this research. Exclusion criteria were: muscle injury history in the previous period of 6 weeks; not presence at the evaluations and/or interventions; or lack of full participation in the team's training activities.

Control Group (CG) was composed by five athletes, mean age of 17.8 years (± 0.84), mean height of 176.20 cm (± 5.22), and mean weight of 68.20 kg (± 1.92).

The Pilates Group (PG) consisted of six athletes with mean age of 18.3 years (± 0.82), mean height of 75.50 (± 8.07) and mean weight of 71.83 kg (± 8.23).

The CG participated only in the evaluations and did not receive any kind of different training from the sports club routine.

The PG, besides the evaluations performance, participated in a training routine with the Pilates® method during four weeks, three times a week and duration of approximately 25 minutes per session, which was applied by an instructor with Pilates® method background.

The evaluations were performed 24 hours prior to the beginning of the intervention with the Pilates® method (named here **Pre**), 24 hours after the last intervention (named **Post-Immediate**) and 15 days after the last intervention (named **Post-Delayed**). All interventions were performed at the same time (17:30 h) and always prior to the trainings.

The first evaluation procedure consisted of the flexibility test on the Wells Bench, Cardiomed, also known as sitting-reaching test. In this test, the individual was placed in sedestation, on a mat, feet with total contact with anterior face of the bench and lower limbs with knee extension as well as fleeted hips. After proper positioning, the individuals were told to move the scalimeter of the bench to their maximum, performing a chest flexion. The obtained value for each try was expressed in centimeters (cm) and was immediately taken by the evaluator.

The second method of evaluation consisted in chest anterior flexion with the individual in orthostatic position, with lower limbs in extension and use of the Fleximeter, produced by the Code Research Institute and Com. LTDA) attached to the subject's chest. During this chest flexion, the instrument would show the obtained value in degrees (°) by the individual in each try, which was immediately registered by the evaluator.

In order to avoid compensations during the performance of both tests, the individuals had their knees always stabilized by the evaluator, who would invalidate the try in case some irregularity was committed (such as knee flexion).

Figure 1 *– Flexibility evaluation with the Wells Bench*

Figure 2 *Flexibility evaluation by the Fleximeter*

All the procedures described above were always executed in the same manner as well as order. Moreover, for each one of the measurements (Wells Bench and Fleximeter) the volunteers performed three tries, and only the one with the highest value was considered in the data analysis.

The evaluations were always performed by the same evaluator, who did not have previous information on the ranking of the volunteers either in the CG or PG. Besides that, the results of the evaluations had not been revealed to the executors of the interventions until the end of the study.

The training program with the Pilates® method was divided in two parts: in the 6 first interventions (2 weeks), an exercise protocol (Protocol 1) which had as aim to familiarize the athletes with the Pilates® method was used; from the 7th to the 12th intervention (3rd and 4th weeks), the athletes were submitted to a more advanced exercise protocol (Protocol 2).

Protocol 1 consisted of the following exercises: Leg Circles (20 repetitions each leg); Up and Down (10 repetitions); Scissors (10 repetitions each leg); Side Kick (30 repetitions each leg); The Saw (10 repetitions); Spine Stretch (10 repetitions); and ending with the Rest Position.

Protocol 2 consisted of the following exercises: Scissors (20 repetitions); Shoulder Bridge, with hip sustained (10 repetitions each leg); Neck Pull (10 repetitions); The Saw (20 repetitions); Spine Stretch (10 repetitions); Push Up (10 repetitions); and finally the Rest Position.

All individuals received and signed a free and clarified consent form, agreeing on participating in the study, knowing that this does not imply in financial help, does not offer health risks, and that the personal profile data would remain anonymous.

The study was submitted and approved by the Ethics Committee in Research (ECR) of the Caxias do Sul University – UCS, according to what is determined in the resolution 196/96 fo the National Health Board (HNB).

The paired t-student test for the intra group analyses and the non-paired t-student test for inter group analyses were used for statistical analysis. For both analyses the significance level established was of $p < 0.05$.

RESULTS

Figures 3 and 4 demonstrate the the behavior of the Control Group (CG) as well as the Pilates Group (PG) in the three steps of the program in the evaluation with the Fleximeter: Pre, Post-Immediate and Post-Delayed.

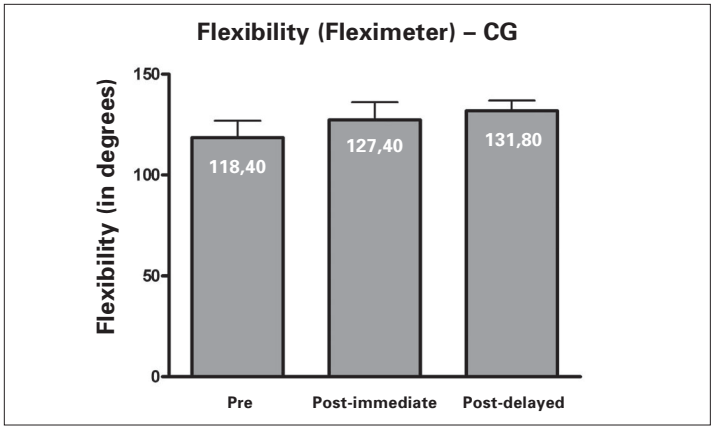

Figure 3 *– GC evaluations with Fleximeter*

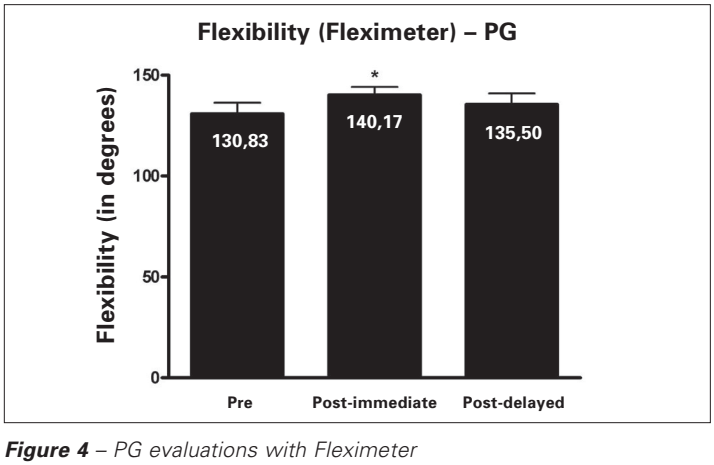

Figure 4 *– PG evaluations with Fleximeter*

In the Fleximeter, the CG obtained as means, concerning the Pre, Post-Immediate and Post-Delayed moments, respectively: 118.40º (± 18.78), 127.40º (± 19.32) and 131.80º (± 11.54). No statistically significant difference was found between values ($p > 0.05$).

The CG presented in the three moments the following results: 130.83º (± 13.63), 140.17º (± 9.99) and 135.50º (± 13.55). The CG also presented extremely significant difference ($p < 0.01$) between the Pre and Post-Immediate steps, in the evaluation with the Fleximeter.

Figures 5 and 6 show the behavior of the CG and PG in the three steps of the program in the evaluation with the Wells Bench.

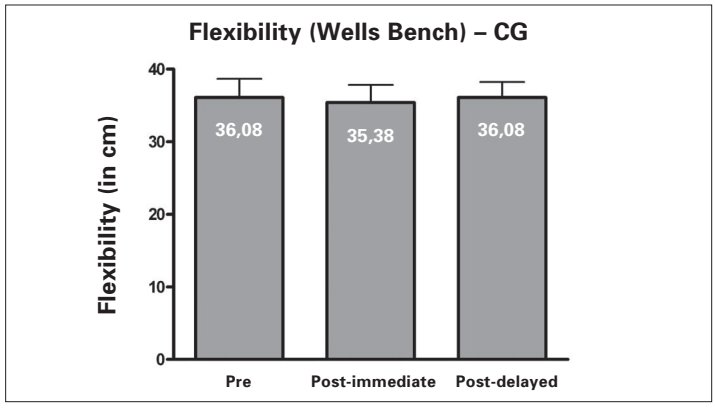

Figure 5 *– CG evaluations with Wells Bench*

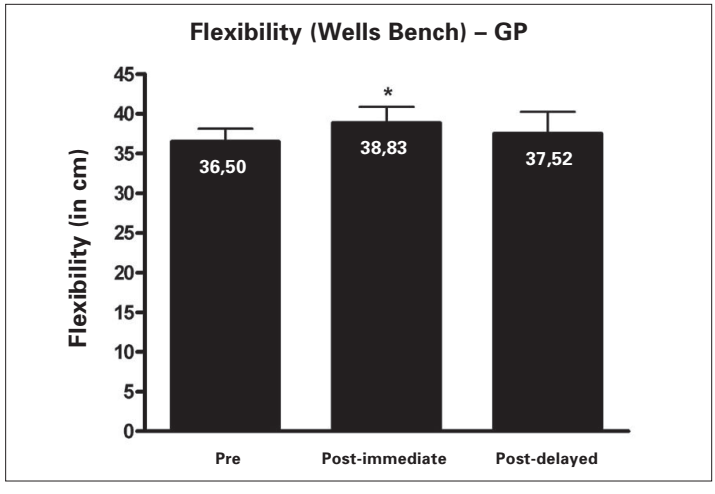

Figure 6 *– GP evaluations with the Wells Bench*

In the Wells Bench, the CG obtained as means 36.08 cm (± 5.81), 35.38 cm (± 5.46) and 36.08 cm (± 4.81), concerning the Pre, Post-Immediate and Post-Delayed moments, respectively, with no statistically significant difference between values ($p > 0.05$).

The PG, in this evaluation method, presented the following values: 36.50 cm (± 3.96), 38.83 cm (± 5.04) and 37.52 cm (± 6.68). Between the Pre and Post-Immediate moments, the values presented statistically significant difference ($p < 0.05$).

Figures 7 and 8 show the comparison between the two groups concerning steps 1 and 2 of the program (Pre and Post-Immediate).

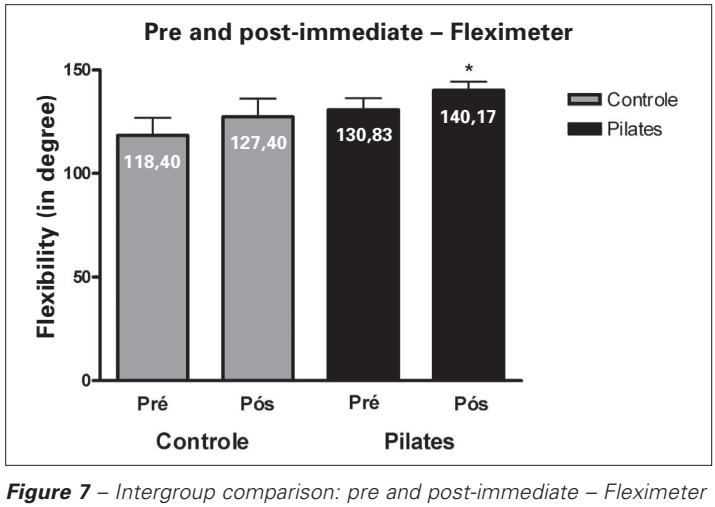

Figure 7 *– Intergroup comparison: pre and post-immediate – Fleximeter*

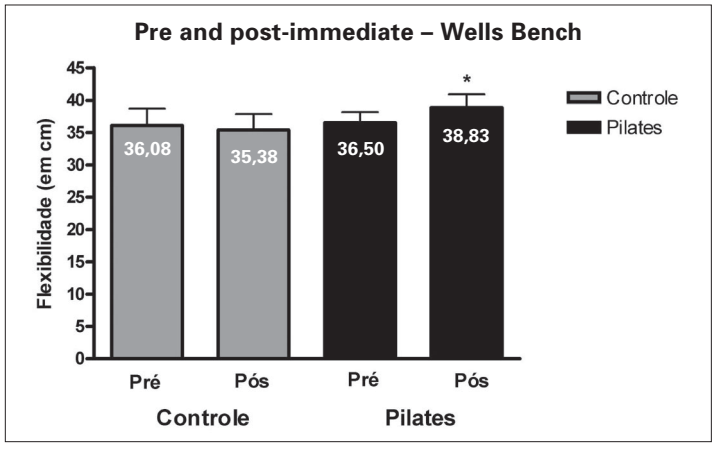

Figure 8 *– Intergroup comparison: pre and post-immediate – Wells Bench*

DISCUSSION

Whenever a test which can fundamentally demand the participation of flexibility of the individuals is used, some factors which might affect their results should be considered[16]. Life habits, kind of training, besides factors such as room temperature and previous warm-up of muscles, affect the flexibility measurements[5,16].

In order to standardize to the most the physical fitness of the athletes for the evaluation moments, this procedure was always performed at times prior to the training. The athletes were not allowed to perform stretching or warm-up activities before the procedure.

There is not a universally accepted definition concerning dynamic flexibility, which makes the performance evaluation terms more directed to the static measurement. The flexibility measurement procedures may be classified in direct (such as the Fleximeter) and indirect methods (as the Wells Bench)[16].

Data concerning flexibility measurements through the use of the fleximeter in any age group, of athletes or non-athletes were not found in the literature. Thus, our data may serve as foundation for future studies.

Concerning the Wells Bench evaluation, Gallahue and Ozmun[6], present data obtained by Ross in 1985, where the male population of 18 years presented 38.1 cm of flexibility of posterior chain, data slightly higher than in our findings (36.29 cm, joining data from the two groups in the Pre phase). After the program performance, the athletes of the PG obtained a mean value of 38.83 cm, which is similar to what has been described in the literature as normal for this age group; however, the athletes of the CG remained with values below the ones established for this age.

The outcomes obtained by the use of both evaluation modalities suggest that the Pilates® training program was successful in its objective to promote the increment of flexibility of the athletes. The statistically significant difference ($p < 0.05$) found between the Pre and Post-Immediate periods in the evaluation with the Wells Bench, as well as the extremely significant difference ($p < 0.01$) observed in the same period in the evaluation with the Fleximeter, confirm the effectiveness of the used protocol.

The Post-Delayed evaluation was planned to observe the behavior of the athletes after an interruption period of the training program. The CG data remained on the same range, not being observed any significant difference concerning the Pre and Post-Immediate evaluations. The PG, which had obtained significant increase of flexibility with the Pilates® training program, suffered a slight decrease (with no statistically significant relevance), both in the evaluation by the Fleximeter and the Wells Bench. These data suggest that the protocol used presented chronic effects over the flexibility of the athletes, which even after 15 days away from the sessions, kept this capacity higher than the potential presented in the Pre period.

The use of the two evaluation modalities by the present study also served to determine the similarity of the data obtained in each phase by each evaluation means, increasing the trustworthiness of the results.

Segal *et al.*[17], as well as our study, have observed the increase of flexibility with the use of the Pilates® method, measuring the behavior of this capacity by the test known as 'fingertip-to-floor test'[18]. In a total of six months of program, this distance decreased 4.3 cm, being this decrease of 3.4 cm in only 2 months, what demonstrated an extremely significant statistical difference ($p < 0.01$) in the increase of flexibility with the use of the Pilates® method in non-athletes.

Donzelli *et al.*[19], observed that a protocol based on the Pilates CovaTech method, during a period of six months, considerably reduced the algic picture of the patients with back pain, where great part of this analgesia was obtained with only one month of program. The authors also mention Geweniger studies (2002) and Anderson and Spector (2000), who demonstrate the effectiveness of the method.

A lot has already been reported concerning the benefits the increase in flexibility may bring. Cyrino *et al.*[20], highlight that suitable levels of muscular strength and flexibility are crucial for good musculo-skeletal performance, contributing for the preservation of healthy muscles and articulations during life, and that the decline of the flexibility levels gradually makes the performance of different daily tasks difficult, leading many times to early loss of autonomy.

Guiselini[21], highlights that about 70% of the accidents with older individuals are consequence of decreased capacity to walk, run and jump, associated with coordination decrease and emphasizing hence the importance of a flexibility training also in this age group.

In the sports environment, flexibility is concerned with both muscular injuries and sportive performance[5,8-10].

According to Grau[10], when a players wants to improve his kicking power, he first thinks of 'strength', especially of quadriceps, searching this strengthening in body building activities or in the sports gesture itself. In other words, it works with contractions in a concentric manner anyway. This kind of exercise makes the muscle lose elesticity little by little; therefore, a little of its reaction strength. Since the effect is also extended to the antagonists, the hamstrings will present certain stiffness, which will limit the breadth of movement.

As a result, we may expect: higher energy expenditure for the performance of movements; lower precision of movements; and higher risk of muscular strains, especially in eccentric contractions, such as the kick disacceleration.

Inklaar *et al.*[22], presented a significative correlation between muscular shortening and muscular tendinites/ruptures. Dvorak and Junge[23], highlight that muscular injuries usually present a difficult diagnosis and a slow and complex treatment, with the need of a reserved prognostic, what makes the definition of the time out from the sport difficult[12].

In soccer, a sport with sportive gestures very similar to futsal, it is the most frequent muscular injuries (39.2%), being the thigh the most injured anatomic region (34.5%), in a study by Cohen *et al.*[24], with eight Brazilian professional teams during a period of two years.

A study with futsal athletes in the XV Brazilian Championship of Sub-20 Teams, Ribeiro and Costa[11], found the thigh as the most injured body part (28.12%), being the muscular strain an injury type of considerable occurrence (9.37%).

Thus, with knowledge on the benefits flexibility may provide, especially to athletes, it is worth mentioning the importance of programs directed to the improvement of this capacity. Adolescent athletes are especially targeted since this age period is when remarkable decline of flexibility is observed[6], a process which can be reversed, though[5].

CONCLUSION

It is concluded with the present study that the training protocol in the Pilates® method applied by the researchers was able to improve flexibility of sub-20 futsal athletes. Such program presented acute effects, represented by the statistically significant increase of flexibility in the Post-Immediate, and chronic effects, observed in the slight decrease (with no statistically significant difference) in the Post-Delayed (15 days after the end of the sessions).

Therefore, the Pilates® method behaved as a useful therapeutic tool in the increase of flexibility of athletes highly prone to decrease of this condition, both due to the sports modality they practice and by the vital cycle in which they are. It is hence an important alternative in the prevention as well as recovery of injuries triggered by the decrease of the muscular length.

Further studies should be conducted with the Pilates® method in order to elucidate all the possibilities of application of this therapeutic modality.

All the authors declared there is not any potential conflict of interests regarding this article.

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