pensamento complexo que deve atuar em escala e em função de um dado nível de integração. Todo o investigador está acompanhado pela maldição de Goethe que nos alerta que quanto mais cavarmos na vertical à procura de uma dada realidade tanto mais nos afastamos da possibilidade de a integrar na horizontalidade dos saberes. Um especialista em desporto estará menos desperto ou possibilitado para realizar as sínteses integrativas.

Por isso, pensar hoje o desporto, obriga à seletividade heurística. Múltiplas heurísticas permitem criar diversos mosaicos das realidades específicas do desporto. Urge, posteriormente o esforço hermenêutico de penetrar na realidade aparente e escondida desses mosaicos e realizar a aventura da grande síntese integradora. Essa síntese é possível? Não, pensamos que não é, mas funcionará como utopia, como ideal, como pulsão reguladora que controlará, sempre que possível, a força mutilante dos dados e teorias soltos e os tentará integrar num grande desenho sintetizador que será tanto maior quanto a capacidade integradora do hermeneuta.

Todo o cientista de desporto probo deve evitar compulsar as ideias alheias de forma a estas se adaptarem às suas conceções, mas considerá-las como contraponto, positivo ou negativo, das teorias que vai construindo. Um erro fatal deve evitar quem cientifica o desporto – tentar adaptar a realidade às suas teorias. Se a realidade não se adapta à teoria não é a realidade que está errada, mas sim a teoria.

O instrumento mais importante que deve apetrechar o cientista em desporto, quer na recolha dos dados quer na construção das teorias é a síntese de duas qualidades humanas que raramente estão bem distribuídas na comunidade científica – humildade e bom senso.

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Effects of a self-training program on shooting performance in young basketball players.

KEYWORDS:

Technical skills. Self-directed practice. Youth athletes. Basketball.

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ABSTRACT

The purpose of the present study was to investigate the effects of a self-training program on shooting performance of young basketball players. Fourteen male basketball players aged 16.64 ± 0.50 years, divided in control group (n = 7) and experimental group (n = 7), were assessed on free-throw, 2-point and 3-point shooting performance, before and after a 5-week training program. During the five-week period, the experimental group accomplished a shooting training program that included 600 shots per week. Both groups maintained their regular basketball practice. The results show that the experimental group significantly increased their shooting performance on 3-point (p <.01) and on free-throw (p <.05). In conclusion, these results show that self-shooting basketball practice, in addition to formal practice, significantly improves shooting performance of young basketball players.

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Efeito de um programa de treino na eficácia do lançamento em jovens basquetebolistas.

RESUMO

O objetivo do presente estudo foi investigar o efeito da aplicação de um programa de treino autónomo na eficácia do lançamento em jovens basquetebolistas. Catorze basquetebolistas do sexo masculino com 16.64 ± 0.50 anos de idade, divididos aleatoriamente em grupo de controlo (n = 7) e grupo experimental (n = 7), foram avaliados na eficácia do lance-livre, do lançamento de 2 pontos e do lançamento de 3 pontos, antes e após um programa de treino de cinco semanas. Durante o período das cinco semanas, o grupo experimental realizou de forma autónoma um programa suplementar de treino de lançamento. Ambos os grupos mantiveram a prática regular de basquetebol no clube. Os resultados obtidos mostram que o grupo experimental melhorou significativamente os níveis de eficácia no lançamento de 3 pontos (p < .01) e no lance-livre (p < .05). Estes resultados permitem afirmar que praticar o lançamento de forma autónoma, como complemento ao treino formal, melhora de forma evidente os níveis de eficácia desta habilidade em jovens basquetebolistas.

PALAVRAS-CHAVE:
Habilidades técnicas. Prática autónoma.
Jovens atletas. Basquetebol.

INTRODUCTION

Basketball is now a media phenomenon that brings together millions of players worldwide. In Portugal, the game has grown in popularity and is currently one of the most practiced indoor sports (Instituto Português do Desporto e Juventude, 2015). However, Portuguese national basketball teams' coaches often report countless difficulties during international competitions, highlighting the imbalance of physical characteristics and technical skills between Portuguese players and their opponents not only at senior but also at the youth level. In fact, some authors emphasize the importance of physical and physiological characteristics to achieve success (Hoare, 2000; Torres-Unda et al., 2013), while others recommend that coaches responsible for youth basketball teams should focus their attention on developing players' technical skills since these seem to be less influenced by the biological maturity status (Wierike, Elferink-Gemser, Tromp, Vaeyens, & Visscher, 2015).

Among all basketball technical skills, shooting presents itself as one of the most important (Dobovicnik, Jakovljevic, Zovko, & Erculj, 2015; Gaetano, Gaetano, Domenico, & Mario, 2016; Knudson, 1993; Satern, 1993) and also as one of the game-related statistics that best discriminate winning and losing teams (Čaušević, 2015; García, Ibáñez, Santos, Leite, & Sampaio, 2013; Ibáñez, García, Feu, Lorenzo, & Sampaio, 2009; Ibáñez, Sampaio, Sáenz-López, Giménez, & Janeira, 2003; Lorenzo, Gómez, Ortega, Ibáñez, & Sampaio, 2010). Therefore, it is possible that a reinforcement of basketball shooting practice, aiming the improvement of Portuguese players' shooting performance, may contribute to better competitive results and higher international performances.

According to the theory of deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993), a high-level performance is the result of the accumulation of countless hours of selected and intentional practice. Therefore, training activities should allow a great number of opportunities for repetition and performance improvement (Ericsson, Charness, Feltovich, & Hoffman, 2006). Likewise, it is possible that to maximize the performance in a technical skill such as basketball shooting, coaches should create opportunities for athletes to perform a higher volume of that specific skill during practice. However, due to external factors such as school calendars and schedules, it is extremely difficult to extend the hours of formal basketball practice in Portugal. In this context, it seems to be necessary that coaches find other strategies to increase the time dedicated to shooting training.

Faced with the aforementioned constraints, the athletes by themselves can also play an important and active role in their individual development as basketball players. Since it is not possible to increase their contact time with coaches, encouraging athletes to train outside of formal basketball practice is perhaps a sustainable strategy to promote the increase of shooting practice volume. Indeed, this type of individual practice is a common strategy used by many basketballers during their careers. Yet, literature

is surprisingly scarce in studies concerning this supplementary workload, regardless of the sport or training type.

Hence, the aim of the present study was to investigate the effects of a self-training program, additional to the formal practice, on shooting performance of young male basketball players. Given that accumulated practice time and volume seem to be key factors to developing motor skill performance (Ericsson, 2008; Ericsson et al., 1993, 2006; Mally, 2009), we hypothesized that the increase of the number of shots performed by the introduction of a self-training routine, without any intervention from coaches, may be sufficient to promote significant gains in basketballers' shooting performance.

METHOD

EXPERIMENTAL APPROACH TO THE PROBLEM

The present study was designed to investigate the effects of a 5-week basketball shooting training program on shooting performance of young basketball players. Two groups (experimental group [EG] and control group [CG]) were selected for this purpose. Both groups maintained their regular basketball practice, with the EG performing an additional 5-week self-shooting training program. All participants were assessed on free-throw (FT), 2-point (2P) and 3-point (3P) shooting performance, before (T0) and after (T1) the training program. All players were assessed by the same team of evaluators between December 2016 and February 2017.

PARTICIPANTS

Fourteen young male basketball players from a team member of the Braga Basketball Association participated in this study. All players competed in the 2016/2017 under-18 XXI Portuguese National Championship and practiced 7-9 hours/week. During the season, eight players regularly played in outside positions (i.e., guard and small forward) and six players regularly played in inside positions (i.e., power forward and center). For the study propose, players were randomly assigned into two groups (EG, n = 7 and CG, n = 7). Further sample characteristics are presented in table 1; no significant ($p > .05$) mean differences were found between groups. The club approved this study, and a written informed consent was obtained from parents or legal guardians of each player, and their individual assent was also obtained. This study was approved by the local Institutional Research Ethics Committee.

TABLE 1. Descriptive statistics (M ± sd) for age, training experience,height and weight of young basketball players.

VARIABLE	EXPERIMENTAL GROUP (n = 7)	CONTROL GROUP (n = 7)	p VALUE	COHEN'S d
	$M \pm SD$ (95% CI)	$M \pm SD$ (95% CI)		
AGE (years)	16.71 ± 0.49 (15.75, 17.67)	16.57 ± 0.54 (15.51, 17.63)	.611	.27 (small)
TRAINING EXPERIENCE (years)	7.71 ± 3.86 (0.14, 15.28)	5.57 ± 2.82 (0.04, 11.10)	.259	.63 (moderate)
HEIGHT (cm)	186.77 ± 4.99 (176.99, 196.55)	188.93 ± 5.31 (178.52, 199.34)	.448	.42 (small)
WEIGHT (kg)	79.93 ± 6.89 (66.43, 93.43)	77.70 ± 8.54 (60.96, 94.44)	.601	.29 (small)

CI = confidence interval

PROCEDURES

Anthropometry

Height (cm) was measured without shoes and with the head positioned to the Frankfurt plane, using a stadiometer (Holtain Ltd., UK) with a precision of 0.01 cm. Weight (kg) was measured with a digital scale (Tanita® HD-384, Tanita Corp., Japan) with a precision of 0.01 kg. All measurements were taken by experienced anthropometrists according to the International Working Group on Kinanthropometry protocols (Ross & Marfell-Jones, 1995).

Shooting performance

Basketball shooting performance was assessed with a test battery developed by Pojskic, Šeparovic, and Užicanin (2011). The tests were performed at the team' training center, where the basketball court measurements, the backboard and the hoop are in accordance with the International Basketball Federation official rules (International Basketball Federation, 2014). The balls used in the tests were those adopted by the Portuguese Basketball Federation for men's under-18 2016/2017 season. All tests were performed in a single session with a 5 min recovery period between them. Prior to shooting testing protocol, the athletes accomplished 15 min of general warm-up and specific basketball shooting drills. Shooting performance was assessed as follows:

1. Free-throw shooting accuracy test: each player performed three series of ten FT, with a 3 min recovery period between series. Shooting position was marked on the floor at a distance of 4.05 m from the vertical projection of the hoop's center on the floor. Two other players, positioned below the hoop, caught the rebound and passed the ball back for a new shot. There was no time limit for performing the test;

2. Two-point shooting accuracy test: each player performed three series of ten 2P shots from five different positions, i.e. two jump shots from each position (FIGURE 1[A]). There was a 3min recovery period between each shooting series. Shooting positions were marked on the floor at a distance of 5m from the vertical projection of the hoop's center on the floor. Two other players, positioned below the hoop, caught the rebound and passed the ball back for a new shot. There was no time limit for performing the test;

3. Three-point shooting accuracy test: each player performed three series of ten 3P shots from five different positions (i.e., two jump shots from each position) (FIGURE 1[B]). There was a 3min recovery period between each shooting series. Shooting positions were marked on the floor at a distance of 6.75m (adjusted from the original 6.25m) from the vertical projection of the hoop's center on the floor. Two other players, positioned below the hoop, caught the rebound and passed the ball back for a new shot. There was no time limit for performing the test.

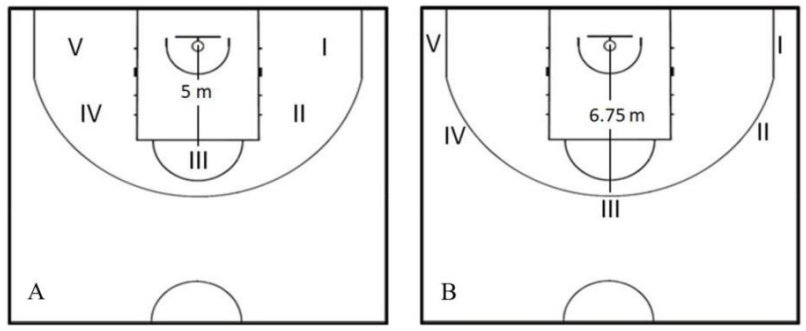

FIGURE 1. Two-point (A) and three-point (B) shooting accuracy tests.

Shooting training program

The shooting training program consisted of a workload corresponding to 600 shots per week distributed as follows: 200 FT, 200 2P shots and 200 3P shots. This program lasted 5 weeks (3000 total shots) and it was performed as self-directed practice, i.e. outside of formal basketball practice and without any intervention or feedback from the coaches.

To accomplish the training program the following indications were given: (a) to shoot 200 FT, 200 2P shots and 200 3P shots per week, during five consecutive weeks, (b) to shoot the 2P shots from outside the restrictive area, (c) to vary the positions in the court for the 2P and 3P shots (i.e., vary the angles in relation to the basket), and (d) to perform all shots at a competitive pace. In addition to the aforementioned indications, no restrictions were imposed regarding the actions prior to shots execution (e.g., dribble, auto-pass, colleague's pass, FT shooting routine), neither regarding the distribution of the 600 shots throughout the week. It was only suggested that players should distribute the shots in a balanced way throughout each week, avoiding performing the total volume of shots in a single day.

DATA QUALITY CONTROL

To ensure data quality control, reliability estimates were computed. The technical error of measurement (TEM) was 0.1cm for height and 0.1kg for weight. ANOVA-based intraclass correlations (R) values for shooting performance tests were 0.65 (2P), 0.57 (3P), and 0.55 (FT).

DATA ANALYSIS

Results are presented through mean and standard deviation ($M \pm sd$). Normality and homogeneity of variances were checked and no significant violations were noticed. An independent-measures *t*-test was used to determine differences between groups on age, training experience, height, weight, and pre-test. A repeated-measures *t*-test was used to determine the presence or absence of gains in each group. Cohen's *d* (Hopkins, Marshall, Batterham, & Hanin, 2009) were calculated and interpreted as follows: < 0.20 (trivial), 0.20 to 0.59 (small), 0.60 to 1.19 (moderate), 1.20 to 1.99 (large), 2.00 to 3.99 (very large), and > 4.00 (extremely large). Then, an analysis of covariance (ANCOVA) for each basketball shooting test - with the pre-tests as covariates - was used to determine differences between groups on post-test; partial eta squared ($p\eta^2$) was used as a measure of explained variance. All data analysis was done using IMB SPSS 24.0 (IMB Corp., Armonk, NY) and the significance level was set at 5%.

RESULTS

Results between the pre- and post-training for shooting performance (FT, 2P and 3P) in both groups (EG and CG) are presented in table 2. The EG significantly increased shooting performance in both FT ($p < .05$; $d = 1.30$) and 3P ($p < .01$; $d = 2.23$). Furthermore, no significant ($p > .05$) mean differences were found between groups on pre-training in any of the shooting performance tests. When controlling for the pre-tests, it was found that significant differences between the two groups on post-training occurred only in 3P shooting performance ($p < .01$; $p\eta^2 = .50$). Figure 2 graphically illustrates individual variation in shooting performances from pre- to post-training.

QUADRO 2. Results between pre- and post-training and between the two groups in T0 and T1 (with pre-tests as covaiates) for shooting performance.

TEST	GROUPS	T0	T1	GAINS		VALUE					
		M ± *SD* (95% CI)	*M* ± *SD* (95% CI)	ABSOLUTE	%	*p**	COHEN'S *d*	*p*†	COHEN'S *d*	*p*‡	$p\eta^2$
FT (%)	EG	69.54±14.60 (40.92, 98.16)	79.53 ± 10.45 (59.05, 100.01)	9.99	14.37	.014	1.30 (large)	.554	0.33 (small)	.469	0.05
	CG	65.70 ± 8.11 (49.80, 81.60	73.33 ± 12.62 (48.59, 98.07)	7.63	11.61	.176	0.58 (small)				
2P (%)	EG	52.86 ± 8.29 (36.61, 69.11)	60.47 ± 9.70 (41.46, 79.48)	7.61	14.40	.222	0.52 (small)	.616	0.28 (small)	.332	0.09
	CG	50.49 ± 8.92 (33.02, 67.97)	55.24 ± 11.55 (32.60, 76.88)	4.76	9.41	.452	0.30 (small)				
3P (%)	EG	31.43 ± 9.60 (12.61, 50.25)	54.29 ± 8.10 (38.41, 70.17)	22.86	72.73	.001	2.23 (very large)	.343	0.53 (small)	.007	0.50
	CG	37.63 ± 13.57 (11.03, 64.23	39.04 ± 8.76 (21.87, 56.21)	1.41	3.75	.817	0.09 (trivial)				

FT = free-throw; 2P = 2-point shot; 3P = 3-point shot; EG = experimental group;CG = control group; T0 = pre-training ; T1 = post-training; CI = confidence interval; $p\eta^2$ = partial eta squared. *Significant difference from T0 to T1 (p < .05). †Significant difference between groups, in T0 (p < .05). ‡Significant difference between groups, in T1 (p < .05)

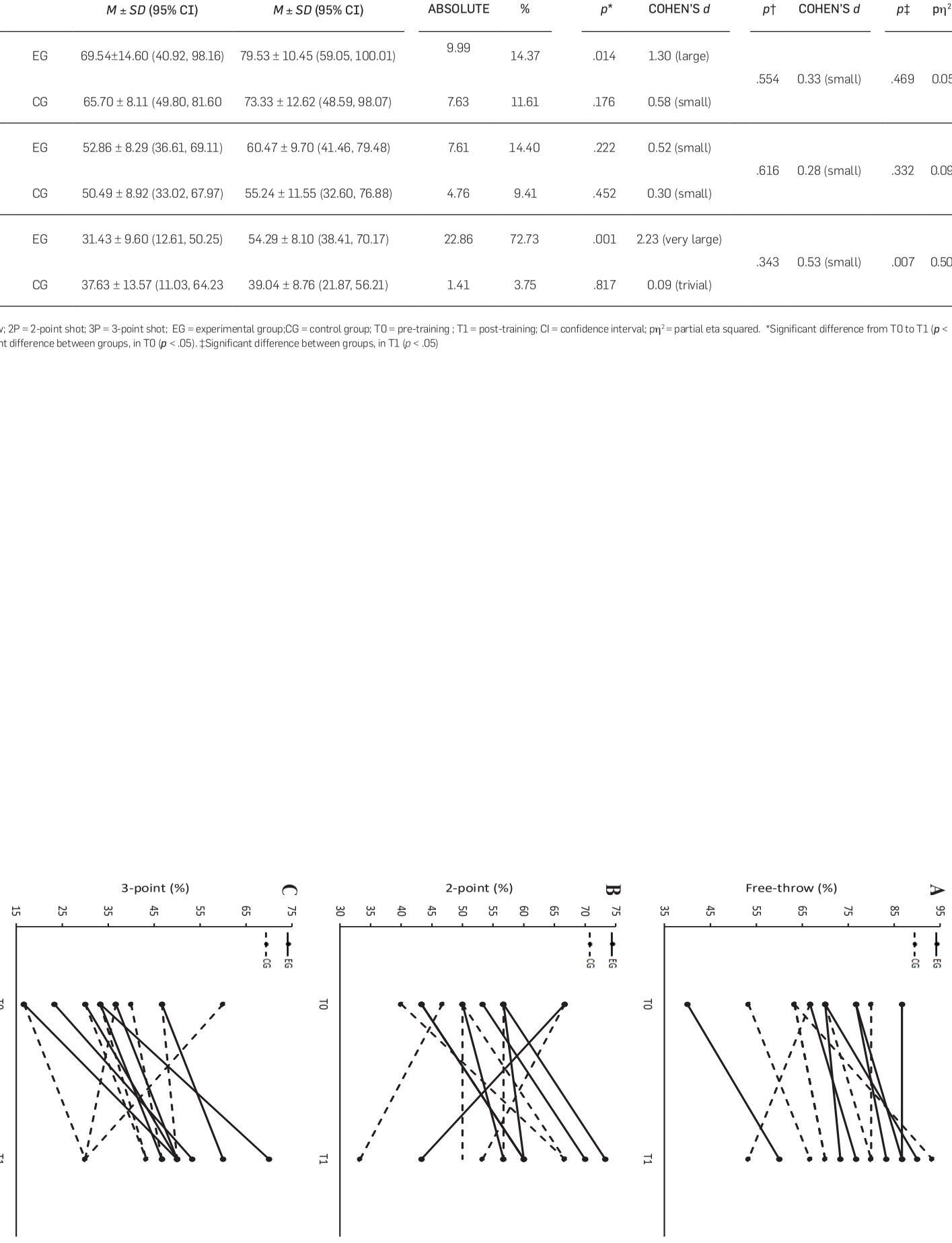

FIGURE 2. Individual variation in free-throw (A), 2-point (B) and 3-point (C) shooting performance from pre- (T0) to post-training (T1).

DISCUSSION

Literature is unanimous when considering the accumulated effect of practice as one of the most important factors in developing sports performance (Baker & Horton, 2004; Durand-Bush & Salmela, 2002; Ericsson & Lehmann, 1996; Helsen, Starkes, & Hodges, 1998; Issurin, 2010; Smith, 2003). In fact, high competition sport is currently characterized by a strong correlation between training volume and athletes' performance (Bompa & Haff, 2009). In this regard, some authors refer that coaches should focus their attention on optimize and increase practice time in order to maximize players' opportunities to improve their performance (Ericsson et al., 2006; Ericsson & Lehmann, 1996; Smith, 2003). Given the notorious difficulty to extend the time of formal practice, the self-directed practice may be a sustainable strategy to considerably increase training volume. Therefore, the aim of the present study was to investigate the effects of a self-training program, additional to the formal practice, on shooting performance of young male basketball players.

The results between groups in pre-training (T0) showed no significant differences in any of the assessed variables (i.e., age, training experience, height, weight, FT, 2P, and 3P), which confirms that, on average, young basketball players from both EG and CG were in equal condition before the training program implementation.

Additionally, our findings validate the hypothesis that the 5-week self-directed training, in addition to basketball practice but without any intervention from coaches, was powerful enough to significantly enhance basketball players' shooting efficiency. Although gain trajectories varied across players (FIGURE 2), our findings show that, on average, this training methodology contributed to a significant improvement of FT (gains of 14.37%) and 3P (gains of 72.73%) shooting performance in EG. The greater progression margin in 3P shooting performance seems to justify the higher magnitude of the gains recorded in this specific long shot (from T0 = 31.43% to T1 = 54.29%). Furthermore, despite the absence of statistically significant changes, the EG also obtained relevant gains (14.40%) in the 2P shooting performance. On the other hand, no significant gains from T0 to T1 were noticed in CG players. Yet, they slightly improved in FT (gains of 11.61%), 2P (gains of 9.41%) and 3P (gains of 3.75%). Since these players maintained regular basketball practice within the club, these changes may reflect the impact of formal team practice and competition on players' shooting performance.

Overall, these results clearly reveal the effectiveness and usefulness of this self-directed approach since the improvements achieved by EG represent the cumulative effect of training loads and substantial increase of the total number of shots performed. Even though when controlling for the pre-tests, significant differences between the two groups on post-training (T1) favoring players from EG were found in 3P shooting performance. This perhaps suggests that, at this age, formal basketball practices by itself are not sufficient to improve young players' shooting performance, namely in shots performed at long distances.

Unfortunately, the available literature lacks in studies using self-training programs aiming to improve basketball shooting performance. However, our findings seem to confirm the importance of cumulative practice time and repetitions volume to motor skill acquisition and performance (Ericsson, 2008; Ericsson et al., 1993, 2006; Mally, 2009). Although not investigated in the present study, it is also possible that intrinsic muscular and neuromuscular adaptations, as well as motor coordination are in part responsible for the enhanced shooting performance in basketballers submitted to the self-training (Bompa & Haff, 2009). Therefore, we suggest that using a self-directed practice, supplementary to formal basketball practice, is a powerful strategy to increase the volume of shooting practice and, above all, the shooting performance of young basketball players.

As a result, coaches should strongly encourage players to develop self-workout habits, while stimulating the responsibility for their own training and evolution process (Larson, 2000; Ommundsen & Lemyre, 2007; Zimmerman, 2006). Besides promoting self-reflection, this type of practice requires a high level of discipline and commitment of the athletes towards their coaches and teammates (Toering, Elferink-Gemser, Jordet, & Visscher, 2009). Therefore, clubs and coaches should, whenever possible, create the necessary conditions (e.g., by providing material and spaces) for players to have the possibility of practicing their shot outside the context of formal basketball practice, developing thus self-directed workout routines.

In contrast, since coaches' intervention also seems to play an important role in the development of successful basketball shooters (Satern, 1988), it is considered that a self-directed practice should not replace the shooting practice in formal practice space, but should be a complement of the work developed in the presence of the coaches. Since it is necessary to ensure quality in each skill repetition and not only to repeat it countless times (Ashy, Lee, & Landi, 1988), players should seek, while helped by coaches during formal practice, to refine their performance and to create progression strategies to achieve new skill levels (Ericsson, 2008).

In summary, the results of the present study show that self-shooting basketball practice, in addition to formal practice, significantly improves shooting performance levels of young basketball players. These encouraging results not only confirm our hypothesis, but also show that self-directed practices are apparently enough to promote great changes in such short-term. Moreover, it can be a useful complement to the workout developed in the formal practice context when prescribed and adjusted by the coaches themselves according to the needs and competitive level of their players. Given the higher importance of shooting in the game of basketball (Dobovičnik et al., 2015; Gaetano et al., 2016; Knudson, 1993; Satern, 1993), it is expected that continuous investment in improving the performance of this technical skill will allow, in part, to respond to the difficulties experienced by the Portuguese national basketball teams' coaches during international competitions. Therefore, it is recommended that coaches strongly encourage their players to practice basketball shots outside the formal practice environment, in order to develop better basketball shooters in Portugal.

The present study is not without limitations. First, we acknowledge that our sample is not widely representative. Although it is expected that young basketballers from the city of Braga are relatively similar to those from other Portuguese regions, the generalization of the results should be done with caution. Second, the sample size could limit the power of the statistical tests. However, previous studies using shooting training programs also reported similar sample sizes. For example, Khlifa et al. (2013) only sampled 18 basketball players. The third limitation is linked to the method used to control that players from experimental group performed the 3000 shots during a 5-week period and that players from control group did not performed any extra shots. Since a self-directed practice implies no supervision, the players' commitment and dedication were crucial. Finally, it is suggested that future studies investigate the effects of self-directed practice, complementary to the formal practice, on basketball shooting performance in female players, different competitive levels, and/or during competition.

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Adaptação transcultural do Inventário de Competências Táticas nos jogos desportivos coletivos.

PALAVRAS-CHAVE:
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RESUMO

Este estudo teve como objetivo adaptar e validar para praticantes de jogos desportivos coletivos portugueses o conteúdo de um questionário de autoavaliação de competências táticas -T*actical Skills Inventory for Sports* - desenvolvido por Elferink-Gemser, Visscher, Richart e Lemmink (2004). Os procedimentos metodológicos envolveram a tradução de Inglês para Português por um especialista em língua inglesa e três especialistas em ciências do desporto e a retroversão de Português para Inglês, a fim de corroborar e ajustar a redação da versão traduzida. A validade do conteúdo (relevância, representatividade, especificidade e clareza de cada questão) foi avaliada por seis peritos de metodologia dos jogos desportivos. De seguida, 40 estudantes de metodologia dos desportos coletivos responderam ao questionário e avaliaram a clareza e a dificuldade de resposta de cada item. Finalmente, a versão revista do questionário foi aplicada a 14 atletas de basquetebol do escalão de sub14 feminino, de uma equipa pertencente à Associação de Basquetebol do Porto, com a finalidade de testar a clareza de interpretação e o tempo de preenchimento. Concluiu-se que o questionário reúne as condições requeridas para ser aplicado a grandes amostras, mas será interessante analisar em que medida as respostas podem ser afetadas pelo efeito de desejabilidade social.

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