Test and retest reproducibility of protocol to assess tactical behavior and offensive situations in Soccer

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Abstract

The purpose of this study is to analyze the reproducibility of offensive actions that result in goals in the Brazilian A Series Soccer Championship (2017). The sample was intentionally selected and comprised 10% (58) of effective offensive actions that resulted in a goal (n = 582) of the two best ranked teams. The selected offensive actions were obtained through images broadcasted on TV, and recorded and edited using the software Sportscode Version 11.0. The selection took place at two different moments, within an interval of 15 days, using the Assessment Protocol of Individual Tactical Performance, and we observed the following types of attacks and fundamental offensive tactical principles: offensive cover, mobility, space and penetration. The analysis was performed using descriptive statistics, weighted Kappa test and correlation coefficient (CCC), considering statistical significance of $p < 0.05$. The tactical principles of Penetration, Offensive Cover, and Variability showed higher CCC values (0.98 to 1.00). In all tactical principles analyzed, the accuracy values were high (0.99 to 1.00). A 100% concordance was observed regarding the test and retest reproducibility of the attack methods ($x2 = 116.0$; $p \leq 0.001$). The reproducibility indicators of the assessment protocol of offensive actions were satisfactory, indicating their utilization in larger scale studies.

Keywords: Performance analysis; Tactical analysis; Offensive tactical principles; Individual tactical behavior.

Introduction

The interest in instruments for tactical performance assessment has risen the interest of professionals in various sports[1-4]. In soccer, some instruments have contributed to the development and growth of the sport[5-10]. In general, these instruments collect information that is analyzed and passed on to technical commissions and athletes, contributing to the improvement of the tactical performance of athletes and soccer teams throughout a sports season[5].

In this sense, game analysis can provide indicators on the individual and collective tactical behaviors of athletes and soccer teams, allowing the identification of the main actions performed by the athletes, as well as the decision making process during the matches[6,11]. The interaction between defensive and offensive tactical behaviors are determining factors in the achievement of goals and, consequently, in matches results[12-14].

In soccer there are many instruments to analyze the soccer players' tactical performance[1,5,6,8,9,15]. Therefore, these instruments can be classified as laboratory and field tests, and, in general, they

collect information related to the individual tactical performance of soccer players during matches with reduced space[5,6,11].

In view of these assumptions, this study is justified by the fact that none of the instruments mentioned above are to assess the tactical behavior of the athletes when considering the effectiveness of the types of soccer attacks, such as: positional attack, quick attack, and counter-attack[12–14,16]. Therefore, this investigation aims at to carry out the test and retest reproducibility of an assessment protocol of offensive actions resulting in goals in matches of the Brazilian A Series Soccer Championship in the year of 2017.

Method

Sample

The target population considered for this study comprised 582 effective offensive actions that resulted in a goal in matches of the2017 Brazilian Soccer Championship. From these data, 10% (n = 52) of the effective offensive actions that resulted in a goal were intentionally selected, from the two best ranked teams in the competition of that year. In order to make the observations, we considered the offensive actions that happened during a match. We excluded effective offensive actions (goals), resulting from dead ball situation, such as penalties, fouls, corners and touchlines. The data was extracted from the database of the project named "Associação Entre os Princípios Táticos Fundamentais Ofensivos e a Eficácia das Ações de Ataque em Equipes de Futebol Profissional" approved by the Ethics and Research Committee of the Universidade Tecnológica Federal do Paraná in July 2018 (opinion number 2.700,073).

Procedures

All effective actions were analyzed according to the concepts of fundamental tactical principles and attack methods[17], which were collected by observing images recorded from matches broadcasted by SPORTV and PREMIERE channels. We used a Sony DVD recorder to make the recordings and the selected images (offensive actions) were stored on a Macbook Pro Apple 11 notebook and edited in a video editing software: Sportscode Version 11.0.

As a way of verifying the test and retest reproducibility of the assessment protocol of offensive actions resulting in goals on the matches of the A Series Brazilian Men's Soccer Championship in 2017, the data was collected at two different moments through an intra-observer analysis[18]. Thus, the same observer analyzed the game in two different moments, within an interval of 15 days.

In the observational analysis of the game, three types of attacks present in offensive situations were taken into account: positional attacking, quick attacking and counterattacking[12–14,16], as well as the fundamental offensive principles: offensive cover, mobility, space and penetration[6] occurred in each of them. We collected the data using the PADTI protocol[15], having as a criteria the number of occurrences (total sum of each principle observed), as well as the variability in the occurrence of the principles during effective attack actions.

Instrument

The PADTI protocol is composed of three Microsoft Excel® spreadsheets composed of lines describing each player in the field. For each one of these lines, there are tags in the columns corresponding to each offensive tactical principle analyzed. In addition, three fields count the types of attacks present in offensive actions. When observing the game situation, by clicking on the principle corresponding to an action performed, it quantifies the action in real time. Therefore, for each game move, the instrument shows the total of each principle performed per player, as well as the total sum of the principles performed by the player, which will result in the total sum of the team's principles. Therefore, the data for each athlete was automatically counted in the PADTI spreadsheet, as well as the attack methods present in each offensive situation.

Statistical analysis

The data was transferred from the PADTI spreadsheet to the statistical software SPSS® 20.0 version. The data was analyzed using descriptive statistics

regarding the occurrence of types of attack and offensive tactical principles. The weighted Kappa test was performed to assess the reproducibility of repeated measures (occurrences of attack types) and, for offensive tactical principles occurrences, the correlation coefficient (CCC) proposed by Lin[19] was used. In all analysis, significance values of $p < 0.05$ were considered.

Results

The descriptive analysis was intended to present the results of the concordance between the two observations resulting from the offensive actions (n = 58) resulting in goals in the matches of the Brazilian A Series Soccer Championship in 2017. In TABLE 1, for each offensive action (attack) observed, we computed an average of 19.31 actions, or tactical principles, within a range of 28 actions.

In relation to the tactical principles, the offensive principle "Space" obtained the lowest frequency (n = 6) in one single attack move, while the principle of "Offensive Cover" had a higher frequency (n = 14) of actions taken, respectively. In all offensive moves, there was variability in the offensive tactical principles (4).

TABELA 1 - Descriptive values of the offensive tactical principles between two teams participating in the 2017 "A" Series Brazilian soccer championship (n = 58).

Tactical principles	Minimum	Maximum	Average	Standard deviation
Penetration	2	11	5,31	2,542
Offensive cover	2	14	6,64	3,577
Mobility	2	7	4,12	1,415
Space	1	6	3,24	1,031
Total	7	35	19,31	6,852
Variability	4	4	4,00	0,000

As for the prevalence between attack methods, in TABLE 2, we observed that there was a higher occurrence in the positional attack method (39.7%), followed by quick attack (36.2%). Regarding reproducibility between the attack methods, there was a 100% reproducibility, that is, both in the test and retest, the entire sample was classified under the same attack method, with no changes in the two moments where the analysis was made.

TABELA 2 - Reproducibility evidence (test and retest) between types of attacks and their prevalence in the 2017 Brazilian championship (n = 58).

	Quick attack	Counter-attack	Positional attack	x^2	p
	% (n)	% (n)	% (n)		
Quick attack	100 (21)	0.0 (0)	0.0 (0)		
Counter-attack	0.0 (0)	100 (14)	0.0 (0)		
Positional attack	0.0 (0)	0.0 (0)	100 (23)	116.0	0.001
Total	36.2 (21)	24.1 (14)	39.7 (23)		

TABLE 3 presents the tactical principles of Penetration, Offensive Cover and Variability, which obtained the highest CCC values (0.98 to 1.00). The lowest Pearson correlation coefficient was observed for the offensive tactical principles of Space (Pearson = 0.94) and Mobility (Pearson = 0.94), respectively. As for accuracy, in all tactical principles analyzed, the accuracy values were high (0.99 to 1.00).

TABELA 3 - Lin's concordance correlation coefficients (1989) between offensive tactical principles (n = 58).

Tactical principles	CCC	IC-95%		Pearson (precision)	Accuracy
Space	0.95	0.91	- 0.97	0.94	0.99
Mobility	0.94	0.91	- 0.96	0.94	0.99
Penetration	1.00	1.00	- 1.00	1.00	1.00
Offensive Cover	0.98	0.98	- 0.99	0.99	0.99
Variability	0.99	0.98	- 0.99	0.99	0.99

Variability = number of times that the four principles occurred in the same offensive action; CCC.= Concordance Correlation Coefficients.

Discussion

This study verified the concordance and reproducibility of a protocol to assess effective offensive actions that resulted in goals during the matches of the Brazilian A Series Soccer Championship of 2017. Offensive Cover is the offering of the pass line to the ball carrier[17], this option can be a possibility of basic action to disrupt marking and unbalance the attack by applying another concept in the sequence. In this sense, the tactical principle that occurred most frequently was the Offensive Cover.

On this regard, these results differ from those found by others authors[20–23], who have pointed to a higher occurrence of the offensive tactical principle Space. The divergence between the results found can be explained by the fact that the aforementioned studies were carried out with athletes from basic

categories, in mini-matches situations, where the reduction in the number of athletes and the size of the field can influence the athletes' performance. On the other hand, the lower incidence of actions related to the Space tactical principle observed in this study can demonstrate a tactical evolution developed by professional athletes. It should be noted that the analysis were performed in a real game situation, where the organizations of the attacks occurred on an official field, which, in this case, is larger than the field where the studies were performed.

Another variable analyzed in this study was the variability of the occurrences of tactical principles simultaneously in offensive actions, that is, the appearance of four offensive principles (Penetration, Offensive Cover, Space and Mobility). We observed that in all offensive plays there was variability in the offensive tactical principles, regardless of the attack method analyzed. The results are similar to those observed by others authors[22,24,25]. However, it should be noted that, in the studies in question, because of the FUT-SAT system[6], which is aimed at analyzing space situations and reduced number of players, the tendency for all principles to occur could be even higher.

Thus, it can be suggested that, regardless of the activity analyzed (game in reduced space or real game) and the attack method used, the higher the occurrence and variability of the offensive tactical principles, the higher the probability of scoring goals, and, consequently, of winning the matches. Regarding the attack methods, we observed that the positional attack had a higher prevalence. This type of offensive action is characterized as more paced, it prioritizes the creation of plays, emphasizes longer ball possession, and, consequently, requires a game based on the tactical principle of offensive cover[12].

As for the reproducibility between the attack methods analyzed, we observed a high reproducibility, that is, the retest results were identical to those of the test. The entire sample was classified in the same way, with no changes in the two moments of the analysis. These results differ from those found by others studies[26,27], in which the counter-attack was mostly used by under-20 European teams and teams that competed in the 2006 world soccer championship, respectively.

Although not a usual practice in sport, the construction and validation of the analysis instruments requires that they be tested and analyzed for their validity, reproducibility and objectivity. These indicators may suffer some variations, depending on the sport analyzed. In this sense, Elferink-Gemser, Visscer, Richart and Lemnink[1] found intra-class correlation values that varied from 0.53 to 0.89 to the different variables related to technical skills in sports. However, Lemmink, Elferink-Gemser and Visscher[4] found higher intra-class correlation values, ranging from 0.79 to 0.91 in the neuromotor tests analyzed in Hockey athletes. Faber, Nijhuis-Van Der Sanden, Elferink-Gemser and Oosterveld[2] found intra-class correlation values higher than 0.70 in all motor skills assessed in tennis players.

Consequently, we can observe similar results when we analyze the reproducibility indicators of instruments aimed at soccer. According to Costa, Garganta, Greco, Mesquita and Maia[6], the Kappa reproducibility values ranged from 0.79 to 0.99 for the FUTSAT test. Thus, Quina, Camões and Graça[10] reported similar values for the instrument designed from the GPAI[9] and FUT-SAT[6]. Under this perspective, the results of this research seem to be in line with what is found in literature, because, when considering the variables in isolation, the tactical principles of Penetration, Offensive Cover and Variability were the items that obtained the highest CCC values (0,98 to 1.00). The lowest Pearson correlation coefficient was observed for the offensive tactical principles of Space (Pearson = 0.94) and Mobility (Pearson = 0.94), respectively. As for accuracy, in all tactical principles analyzed, the values were high (0.99 to 1.00).

When considering the limitations of the study, it is necessary to report that the images extracted from the matches broadcasted by the Television had closed angle images, which may have hindered a more detailed analysis of the entire context of the plays, making it difficult to observe the players' actions. As a relevant aspect, the possibility of identifying and evaluating the occurrence of attack principles and methods in a real game situation stands out, which enabled the extraction of information directly from the real context of the soccer game. In addition, using a complete national championship as a reference for this research provided a deepened understanding of the goal profile that characterizes the effective attack actions in the Brazilian soccer, specifically the A Series professional league.

Conclusion

In conclusion, the test and retest reproducibility procedures of the assessment protocol of offensive actions resulting in goals in matches of the Brazilian A Series Soccer Championship of 2017 are satisfactory indicators of reproducibility. In relation to the evaluation of the attack methods, the Kappa values indicated high concordances. From the five items related to the tactical principles analyzed, three of them had almost the perfect correlation coefficients, indicating that the analyzed protocol can be used in larger studies.

Resumo

Reprodutibilidade teste e reteste de um protocolo para avaliar comportamento tático e situações ofensivas no futebol.

O objetivo do estudo foi analisar a reprodutibilidade do protocolo de avaliação de ações ofensivas resultantes em gols, no Campeonato Brasileiro de Futebol da Série A (2017). A amostra foi selecionada intencionalmente e compreendendo 10% (58) das ações ofensivas eficazes das duas equipes primeiras colocadas que resultaram em gol (n=582). As ações ofensivas selecionadas foram obtidas por meio de imagens veiculadas na TV, gravadas e editadas no software Sportscode versão 11.0. A coleta ocorreu em dois momentos, com intervalo de 15 dias, utilizando-se do Protocolo de Avaliação do Desempenho Tático Individual. Foram observados os tipos de ataques e princípios táticos fundamentais ofensivos: cobertura ofensiva, mobilidade, espaço e penetração. A análise foi realizada por meio da estatística descritiva, teste de Kappa ponderado e coeficiente de correlação (CCC), considerando significância estatística de $p < 0,05$. Os princípios táticos Penetração, Cobertura Ofensiva e Variabilidade apresentaram maiores valores de CCC (0,98 a 1,00). Em todos os princípios táticos analisados os valores de acurácia foram elevados (0,99 a 1,00). Observou-se 100% de concordância em relação a reprodutibilidade teste e reteste dos métodos de ataque ($x2=116,0$; $p \leq 0,001$). Os indicadores de reprodutibilidade do protocolo de avaliação de ações ofensivas foram satisfatórios, indicando a sua utilização em estudos de maior escala.

Palavras-chave: Análise de desempenho; Análise tática; Princípios táticos ofensivos; Comportamento tático individual.

References

1. Elferink-Gemser MT, Visscher C, Richart H, Lemmink KAPM. Development of the tactical skills inventory for Sports. Percept Mot Skills. 2004;99(7):883-95. Available from: https://www.researchgate.net/publication/8083862_Development_of_the_Tactical_Skills_Inventory_for_Sports.

2. Faber IR, Nijhuis-Van Der Sanden MWG, Elferink-Gemser MT, Oosterveld FGJ. The Dutch motor skills assessment as tool for talent development in table tennis: a reproducibility and validity study. J Sports Sci. 2014;33(11):1-10.

3. Kannekens R, Elferink-Gemser MT, Post WJ, Visscher C. Self-assessed tactical skills in elite youth soccer players: A longitudinal study. Percept Motor Skills. 2009;109(2):459-72.

4. Lemmink KAPM, Elferink-Gemser MT, Visscher C. Evaluation of the reliability of two field hockey specific sprint and dribble tests in young field hockey players. Br J Sports Med. 2004;38(2):138-42. Available from: https://www.researchgate.net/publication/8661995_Evaluation_of_the_reliability_of_two_field_hockey_specific_sprint_and_dribble_tests_in_young_field_hockey_players.

5. Costa IT, Garganta J, Greco PJ, Mesquita I. Análise e avaliação do comportamento tático no futebol. Rev Educ

Física UEM. 2010;21(3):443-55.
6. Costa IT, Garganta J, Greco PJ, Mesquita I, Maia J. Sistema de avaliação táctica no Futebol (FUT-SAT): desenvolvimento e validação preliminar. Motricidade. 2011;7(1):69-84.
7. González-Víllora S, Costa IT. ¿Cómo evaluar la táctica en Fútbol? Sistema de evaluación de la táctica en Fútbol (Fut-Sat). Educ Física Deport. 2015;34(2):467-505.
8. Grehaigne J-F, Godbout P, Bouthier D. Performance assessment in team sports. J Teach Phys Educ. 1997;16:500-16.
9. Oslin JL, Mitchell SA, Griffin LL. The Game Performance Assessment Instrument (GPAI): development and preliminary validation. J Teach Phys Educ. 1998;17(2):231-43.
10. Quina JN, Camões M, Graça A. Desenvolvimento e validação de um instrumento de avaliação da competência táctica em futebol. Rev Port Ciências Desporto. 2011;11(4):77-77.
11. Teoldo I, Guilherme J, Garganta J. Para um futebol jogado com ideias. Curitiba: Appris. 2016.
12. Castelo J. Futebol: modelo técnico-táctico. Lisboa: Faculdade de Motricidade Humana. 1994.
13. Garganta J. Modelação táctica do jogo de futebol: estudo da organização da fase ofensiva em equipas de alto rendimento [thesis]. Porto (PT): Universidade do Porto; 1997.
14. Sarmento H. Análise do jogo de futebol: padrões de jogo ofensivo em equipas de alto rendimento: uma abordagem qualitative [thesis]. Vila Real (PT): Universidade de Trás-os-Montes e Alto Douro; 2012.
15. Denis RS. Protocolo de avaliação do desempenho tático individual de atletas de Futebol em situação de jogo [undergraduate thesis]. Curitiba (PR): Universidade Tecnológica Federal do Paraná; 2017.
16. Castelo J. Conceptualização de um modelo técnico/táctico do jogo de futebol. Identificação e caraterização das grandes tendências evolutivas do jogo das equipas de rendimento superior [thesis]. Lisboa (PT): Universidade Técnica de Lisboa; 1992.
17. Costa IT, Silva JMG, Greco PJ, Mesquita I. Princípios táticos do jogo de Futebol: conceitos e aplicação - os princípios táticos. Motriz. 2009;15(3):657-68.
18. Thomas JR, Nelson JK, Silverman SJ. Métodos de pesquisa em atividade física. 6a ed. Porto Alegre: Artmed; 2012. 478 p.
19. Lin LI-K. A Concordance correlation coefficient to evaluate reproducibility. Biometrics. 1989;45(4):255-68.
20. Costa IT, Garganta J, Greco PJ, Mesquita I, Afonso J. Assessment of tactical principles in youth soccer players of different age groups. Rev Port Ciências Desporto. 2010;10(1):147–57.
21. Sousa RB, Soares VOV, Praça GM, Matias CJAS, Costa IT, Greco PJ. Avaliação do comportamento tático no Futebol: princípios táticos fundamentais nas categorias Sub-14 e Sub-15. Rev Bras Ciência Mov. 2015;23(2):59-65.
22. Américo HB, Machado GF, Teoldo I. Comparação do comportamento tático de jogadores de futebol entre categorias sub-11 e sub-17. Rev Min Educ Física. 2013;9:715-21.
23. Silva RNB, Costa IT, Garganta JM, Muller ES, Castelão DP, Santos JW. Desempenho tático de jovens jogadores de Futebol: comparação entre equipes vencedoras e perdedoras em jogo reduzido. Rev Bras Ciência Mov. 2013;21(1):75-89.
24. Silva RNB da, Thiengo CR, Talamoni GA, Lima MR, da Costa IT. Desempenho tático de jogadores sub-15 do São Paulo futebol clube a partir do teste fut-sat. Educ Física Deport. 2015;34(1):181-99.
25. Rechenchosky L, Borges PH, Menegassi VM, Jaime MDO, Guilherme J, Teoldo I, et al. Comparison of tactical principles efficiency among soccer players from different game positions. Hum Mov. 2017;18(5):31-8.
26. Barreira D. Transição defesa ataque em futebol. Análise sequencial de padrões de jogo relativos ao campeonato português 2004/2005 [undergraduate thesis]. Porto (PT):Universidade do Porto; 2006.
27. Castelão DP, Garganta J, Afonso J, Costa IT. Análise sequencial de comportamentos ofensivos desempenhados por seleções nacionais de futebol de alto rendimento. Rev Bras Ciencias Esporte. 2015;37(3):230-6. Available from: http://dx.doi.org/10.1016/j.rbce.2015.05.001.

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