

**PROTOCOL FOR THE ASSESSMENT OF INDIVIDUAL TACTICAL BEHAVIOR (PADTI) – VALIDATION AND REPRODUCIBILITY: PRELIMINARY EVIDENCE****PROTOCOLO DE AVALIAÇÃO DO DESEMPENHO TÁTICO INDIVIDUAL (PADTI) – VALIDAÇÃO E REPRODUTIBILIDADE: EVIDÊNCIAS PRELIMINARES**Ricardo Silva Denis<sup>1</sup>, Diogo Bertella Foschiera<sup>2</sup>, Rosimeide Francisco Santos Legnani<sup>3</sup> e Elto Legnani<sup>1</sup><sup>1</sup>Federal Technological University of Paraná, Curitiba-PR, Brazil.<sup>2</sup>Federal Institute of Paraná, Palma-PR, Brazil.<sup>3</sup>Ponta Grossa State University. Ponta-Grossa-PR, Brazil.**ABSTRACT**

In order to carry out the process of validation and reproducibility of the Protocol for the Assessment of Individual Tactical Behavior of Soccer athletes (PADTI), a study was carried out divided into three stages: I) preparation of the PADTI; II) logical, content and construct validation and; III) reproducibility. The PADTI was developed based on the 8 fundamental tactical principles of soccer, which were inserted in a Microsoft Excel® spreadsheet, used to collect, store and process the tactical actions of soccer players during the game. The PADTI validity process was performed by 8 professionals, using a spreadsheet to account for items using a Likert scale (5 points). Reproducibility was carried out in two moments with an interval of 15 days, using as a sample the tactical behaviors of the athletes of the Brazilian team, during a soccer match of the 2018 world cup. validity (IV) of 90%. There were no significant differences between the responses of the evaluators ( $\chi^2 = 12.199$ ;  $p = 0.094$ ). The intraclass correlation (ICC) values were greater than 0.814 (CI: 95%: 0.251 - 0.954;  $p < 0.001$ ) and Cronbach's Alpha values were greater than  $\alpha = 0.814$ . The results indicated that the PADTI is a valid and useful methodology for assessing the tactical performance of soccer players in a game situation.

**Keywords:** Tactical behavior in soccer, Tactical principles in soccer; Evaluation of tactical principles in soccer.

**RESUMO**

Com o objetivo de realizar o processo de validação e reprodutibilidade do Protocolo de Avaliação do Comportamento Tático Individual de atletas de Futebol (PADTI), foi realizado um estudo dividido em três etapas: I) elaboração do PADTI; II) validação lógica, de conteúdo e constructo e; III) reprodutibilidade. O PADTI foi elaborado com base nos 8 princípios táticos fundamentais do futebol, os quais foram inseridos em uma planilha do programa Microsoft Excel®, utilizada para coletar, armazenar e processar as ações táticas dos atletas de futebol durante o jogo. O processo de validade do PADTI, foi realizado por 8 profissionais, por meio de uma planilha para contabilizar os itens utilizando-se de uma escala *likert* (5 pontos). A reprodutibilidade foi realizada em dois momentos com intervalo de 15 dias, utilizando como amostra os comportamentos táticos dos atletas da seleção brasileira, durante uma partida de futebol da copa do mundo de 2018. O PADTI foi aprovado pela maioria dos avaliadores especialistas, com índice de validade (IV) de 90%. Não foram observadas diferenças significantes entre as repostas dos avaliadores ( $\chi^2=12,199$ ;  $p = 0,094$ ). Os valores de correlação intraclasse (ICC) foram superiores a 0,814 (IC: 95%: 0,251 - 0,954;  $p < 0,001$ ) e os valores de *Alpha de Cronbach* foram superiores a  $\alpha=0,814$ . Os resultados indicaram que o PADTI é uma metodologia válida e útil para avaliação do desempenho tático de atletas de futebol em situação de jogo.

**Palavras-chave:** Comportamento tático no futebol, Princípios táticos no futebol; Avaliação de princípios táticos no futebol.

**Introduction**

The evolution and organization process of soccer has influenced decisively its practice around the world. This way, as a result of this evolution process, game analysis provides important data on collective and individual actions of athletes on the field<sup>1,2</sup>, contributing to identification of success factors for teams and athletes<sup>1-7</sup>.

Initially, researches on athletes' performance during matches aimed at their individual technical and tactical actions, but as of the 80s, research shifted focus to collective tactical behaviors<sup>8</sup>. In this sense, over the last few years, there was a significant increase in the volume of studies on the tactical behaviors of soccer players<sup>9,10</sup>, evidencing the interest of

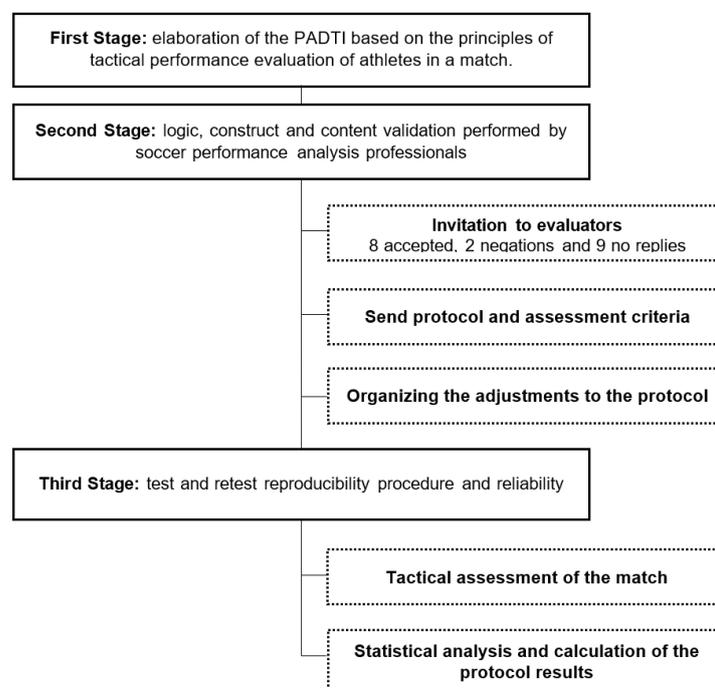
researchers and coaches in better understanding the moves and movements that occur with and without the ball during a soccer game<sup>4,11</sup>.

Thus, as a natural evolution arising from the curiosity of coaches and researchers on this topic, several strategies and instruments were developed to assess the individual and collective tactical behavior of soccer players, such as protocols in closed environment or laboratories<sup>12</sup>, reduced width and length games<sup>13,14,15</sup> and even game situation analysis<sup>8,16</sup>. An example of these protocols is the FUT-SAT<sup>14</sup>, an instrument that assesses the tactical behavior of indoor soccer and soccer athletes, under the perspective of fundamental tactical principles, specifically during training, through small-sized games dispute<sup>9</sup>.

Notwithstanding the great usefulness of these instruments, as well as their contribution to understanding the game and the athletes' tactical behavior<sup>2,9,10,11</sup>, there is a gap in the scientific literature on the assessment of individual tactical behavior in a real game situation (without changing the structure of soccer games), specially using the fundamental tactical principles. In this sense, the objective of this study is to describe the preliminary procedures for the elaboration, validation and reproducibility of the Individual Tactical Behavior Assessment Protocol (PADTI) of soccer players in a game situation.

## Methods

This work is as a descriptive and correlational study, with the purpose of carrying out the validation and reproducibility procedures of PADTI Protocol. The study has three stages: I) PADTI preparation; II) logic, content and construct validation, and; III) Test and Retest Reproducibility procedures, as shown in Figure 01.



**Figure 01** – Procedure flowchart

Source: authors

This work was prepared from concepts established in the scientific literature about the fundamental tactical principles of soccer<sup>17,18,19</sup>. Specialized literature on the topic was the basis for content validation, as well as the construct validation tried to identify how PADTI

measures the hypothetical construct named individual tactical performance<sup>20</sup>. At this stage, an initial version of PADTI went under evaluation by an expert committee. For the validation procedures, the concepts of logic, content, and construct validity, and test and retest reproducibility assessed the intra-evaluator error.

### Preparation of the Individual Tactical Behavior Assessment Protocol

PADTI was prepared with the central objective of analyzing the tactical performance of athletes throughout and through all actions in the match, to track and evaluate offensive and defensive actions during the entire time the ball is in play. The PADTI is based on fundamental tactical principles relating to collective sports games<sup>21</sup> using 8 principles for tactical performance assessment of athletes in game situation, of which four are offensive (penetration, offensive coverage, depth mobility and width and length) and four defensive (delay, defensive coverage, balance and concentration). These principles were selected because they represent the internal logic of the soccer game, being fundamental to understand the dynamics and interactions composing the organization of a soccer game<sup>17,18,19</sup>.

The game structure (field measures and goals, number of athletes in the field and game time) used for performance analysis, in this assessment, is the same one used on FIFA and associated federations regulated games and championships. This way, the analysis of the athletes' performance is the closest to the one found in the most important sports moment, i.e. competition, enabling the investigation of the athletes' actions with and without the ball, as they occur in this context.

PADTI was prepared with the Microsoft Excel<sup>®</sup> program, Figure 02 show the examples of initial screens of the instrument in that program. The instrument is composed of three spreadsheets that collect, store and process information related to the frequency of tactical actions performed by each player over a soccer game. In this spreadsheet, it is also possible to compute the time of actual participation of each athlete in the game, allowing the calculation of individual indexes. The tool is available for download at the following link: [https://docs.google.com/spreadsheets/d/1Tt\\_OTIXAmH\\_o\\_GGgBZDI6m-ihCgtMa4X/edit?usp=sharing&oid=109131047682870646375&rtpof=true&sd=true](https://docs.google.com/spreadsheets/d/1Tt_OTIXAmH_o_GGgBZDI6m-ihCgtMa4X/edit?usp=sharing&oid=109131047682870646375&rtpof=true&sd=true). (PADTI formulas do not work in the online version of Microsoft Excel software, it is necessary to download the file for the tool to work properly).

Fundamental Offensive Tactical Principles (PTFO)						
Players	Action Taken					Unfulfilled Actions
	Penetration	Offensive Coverage	Mobility	Space	Total	
Player 1	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 2	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 3	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	1	+1 Unfulfilled Actions
Player 4	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 5	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 6	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 7	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 8	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 9	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions
Player 10	+1 Penetration	+1 Offensive Coverage	+1 Mobility	+1 Space	0	+1 Unfulfilled Actions

**Figure 02** – Organization of the Individual Tactical Behavior Assessment Protocol of Soccer athletes in the Microsoft Excel<sup>®</sup> program

Source: authors

The first spreadsheet contains data related to tactical actions based on Fundamental Offensive Tactical Principles (PTFO): Penetration, Offensive coverage, Depth mobility and Width and length. The second spreadsheet computes data related to tactical actions of the Fundamental Defensive Tactical Principles (PTFD): Delay, Defensive coverage, Balance and Concentration. Both spreadsheets have tags for easy viewing and data insertion at the time of analysis. Moreover, the spreadsheets have separate columns for actions performed and not performed assessed from the comparison of the actions of each player with a PADTI conceptualization sheet.

The third spreadsheet computes the time (minutes) of each player in the game, being divided in time where the team possesses the ball (considered as an offensive phase) and the time where the opposing team possesses the ball (defensive phase). In addition to those spreadsheets, PADTI has a conceptualization sheet and a list of formulas. The conceptualization sheet characterizes the tactical actions, and their relation with specific tactical principles, it is composed of eight specific tactical principles of soccer used in the assessment protocol. The purpose of this sheet is to frame each tactical action of the player evaluated and classify these actions into “Performed” and “Not Performed”, following the theoretical concepts related to each principle. The conceptualization sheet describes all characteristics that the actions must have, in order to have the best characterization as possible.

Complementarily, PADTI has a list of formulas necessary for the calculations of indexes generated by the protocol. The computing of the frequencies of each player's tactical actions and game time generates the Tactical Performance Index (IT), Offensive Performance Index (IO), Defensive Performance Index (ID), Total Tactical Actions per Minute (ATM), Offensive Tactical Actions per Minute (AOM), Defensive Tactical Actions per Minute (ADM) and Tactical Actions Not Performed per Minute (ANRM).

Offensive Performance Index: $I_O = \frac{\Sigma_{RO}}{\Sigma_{RO} + \Sigma_{NRO}}$	Defensive Performance Index: $I_D = \frac{\Sigma_{RD}}{\Sigma_{RD} + \Sigma_{NRD}}$
Tactical Performance Index: $I_T = \frac{I_O + I_D}{2}$	Total Tactical Actions per Minute: $A_{TM} = \frac{\Sigma_{RO} + \Sigma_{RD}}{T}$
Defensive Tactical Actions per Minute: $A_{DM} = \frac{\Sigma_{RD}}{T_D}$	Offensive Tactical Actions per Minute: $A_{OM} = \frac{\Sigma_{RO}}{T_O}$
Tactical Actions Not Performed per Minute: $A_{NRM} = \frac{\Sigma_{NR}}{T}$	

**CHART 1** – PADTI Index Calculation Formulas.

**Note:** Legend: Tactical Performance Index (IT); Offensive Performance Index (IO); Offensive Actions Performed (RO); Offensive Actions Not Performed (NRO); Defensive Performance Index (ID); Defensive Actions Performed (RD); Defensive Actions Not Performed (NRD); Total Tactical Actions per Minute (ATM); Total Game Time (T); Offensive Tactical Actions per Minute (AOM); Offensive Time (TO); Defensive Tactical Actions per Minute (ADM); Defensive time (TD); Tactical Actions Not Performed per Minute (ANRM).

**Source:** authors

Tactical performance indices are calculated using a simple mathematical formula based on the arithmetic mean of tactical actions performed and not performed in relation to the total of defensive and offensive actions separately, considering the time that each athlete remained in the game, considering the different types of tactical actions performed (defensive and offensive) correctly and incorrectly.

#### *PADTI Validation Procedures: logic, construct and content*

The 17 soccer professionals with different academic titles (specialization, master's and doctor's degree) were invited for the PADTI validation procedure. From the professionals invited, 2 refused the invitation, and 7 failed to reply to the e-mail, and did not participate in the research. The PADTI's content was assessed by a panel of Eight professionals, 4 of which were soccer professionals (with employment relation with teams of the Brazilian A Series Soccer Championship), 3 with master's degree and 1 with doctor's degree (with employment relation with Federal/State Universities). The evaluators declared to have between 5 and 20 years of experience with performance analysis in team sports. In addition, the group was divided into 2, since half of the evaluators showed greater proximity to theoretical concepts (masters and doctors who teach classes at universities) and the other half showed greater proximity to knowledge related to daily practice (working in clubs). Thus, the protocol evaluation was performed based on practical and theoretical knowledge, not prioritizing just one type.

The sample selection criteria and PADTI content evaluation procedures were similar to those applied in studies of the same nature<sup>22,23</sup>. All invitees signed the Free and Informed Term of Consent. The Ethics Committee of Universidade Tecnológica Federal do Paraná approved the project through opinion n. 2.063.607.

#### *Logic, Construct and Content Validation*

For the logic, construct and content validation procedures, the 8 soccer professionals previously selected, evaluated the PADTI. They received the material to proceed with the

evaluations, which consisted of sheets and spreadsheets to compute the items assessed. In the evaluation process, the experts assessed 12 items using a 5-point Likert scale: 1 - Totally Inappropriate; 2 - Inappropriate; 3 - Partially Appropriate; 4 - Appropriate; and, 5 – Totally Appropriate. In addition to the scale score, the evaluators could make suggestions, comments and justifications related to the items evaluated, as a way to assist or improve each item assessed (the answers had no suggestions to change the protocol).

The items assessed were: Importance of tactical principles presented to tactical assessment in soccer; Importance of tactical principles presented in the training of soccer athletes; Definition and concepts of tactical principles; Application of concepts of each tactical principle; Conceptualization (performed and not performed) of tactical actions according to each principle; Number of athletes, field size and game time estimated for the assessment; Positioning of cameras in relation to the game field, and; Evaluation sheet.

Each item created relates to the contents of the analysis and conceptualization sheets, as well as the methodology used during the application of the protocol. Throughout this process, each evaluator received a document explaining the entire protocol utilization process, and, in case they had any doubts, they should be cured before the protocol evaluation.

After the evaluators' analysis, we computed the Validity Index (IV) of each item in order to know whether it should suffer any alteration. For the item to be considered valid, it should obtain a minimum consensus of 75% of the total points each item could obtain, that is, it should score, at least, 30 points, in the sum of all grades from the evaluators. If an index fails to reach a minimum consensus, said index should be changed or reviewed, going through the validation process again until it reaches minimum consensus. The IV was calculated by the sum of the value of each concept given by the evaluators, (5 being "totally appropriate", 4 "appropriate", 3 "partially appropriate", 2 "inappropriate" and 1 "totally inappropriate").

#### *Test and Retest Reproducibility Procedure and Reliability*

For the instrument reliability evaluation, in relation to reproducibility and reliability, we intentionally selected 1 (one) 2018 World Cup game. The duration of the game was 97 minutes, divided into 6 parts, where T3: 17 minutes; T6: 20 minutes and the others 15 minutes each). In the first evaluation (test), we analyzed the entire game, and we observed 9377 (100%) tactical actions. The same evaluators carried out the second evaluation (retest), 15 days after the first evaluation. In this case, T1 was randomly selected, through a draw from the six parts previously divided of the game. After analysis, we computed 1662 tactical actions, representing 17% of the entire game. The same evaluator, who was already familiar with the analysis protocol, carried out all evaluations.

We analyzed all effective actions pursuant to concepts of fundamental tactical principles collected from the observation of recorded images of games broadcasted on open TV (public domain). The game was stored in a notebook (brand Acer Aspire E15) for later analysis. We projected the game recording in a monitor (brand AOC *Sniper* G60VQ6). The analysis referring to the test (observation of the entire game) had a duration of 9 hours. We performed the reproducibility analysis only in segment T1, which had a duration of approximately 1 hour and 30 minutes. The same observer analyzed the game in two different moments.

We transferred the PADTI spreadsheet data to the statistical software SPSS® version 25.0, and analyzed it according to descriptive statistics, considering the occurrence of offensive and defensive tactical principles, as well as individual tactical indexes. For the calculation of the intra-evaluator error and reliability indexes, we used the Intraclass

Correlation Coefficient (ICC) and *Cronbach's alpha*, respectively. We considered a statistical significance of  $p < 0.05$ .

## **Results**

### *Logic and content validation*

After data tabulation, with analysis criteria previously defined, we carried out the analysis of the evaluations and suggestions recommended by the experts committee, the results were analyzed individually. Considering the total number of evaluators, we observed 61 evaluations classified as “Totally Appropriate”; 23 “Appropriate”; 11 “Partially Appropriate”; 1 “Inappropriate” and no evaluation classified as “Totally Inappropriate”.

**Table 1** – Validity indexes obtained by PADTI, pursuant to expert evaluation.

	Specialists		Masters and Doctors		Total	
	Validity Index (IV)	%	Validity Index (IV)	%	Validity Index (IV)	%
Criteria 1	20	100%	19	95%	39	97.5%
Criteria 2	20	100%	19	95%	39	97.5%
Criteria 3	20	100%	19	95%	39	97.5%
Criteria 4	19	95%	18	90%	37	92.5%
Criteria 5	16	80%	18	90%	34	85%
Criteria 6	18	90%	18	90%	36	90%
Criteria 7	19	95%	18	90%	37	92.5%
Criteria 8	19	95%	17	85%	36	90%
Criteria 9	19	95%	14	70%	33	82.5%
Criteria 10	19	95%	16	80%	35	87.5%
Criteria 11	16	80%	17	85%	33	82.5%
Criteria 12	16	80%	18	90%	34	85%
<b>Total</b>	<b>221</b>	<b>92,1%</b>	<b>211</b>	<b>87,9%</b>	<b>432</b>	<b>90%</b>

**Note:** Total Validity Index: minimum consensus > 75% of the total score that each item could obtain (minimum of 30 points in the sum of all evaluators grades)

**Source:** research data

With a total 96 grades and the score of each concept, the protocol received 432 points from a total of 480, reaching a validity index (IV) of 90%. In relation to the concepts for each evaluated criteria, all concepts obtained indexes superior to 75% of approval from the evaluators, considered satisfactory. In addition, we used the Friedman test to verify the existence of significant differences between the responses of the evaluators in each concept; the test indicated that there was no statistically significant difference between the responses.

#### Intra-evaluator Reproducibility

The results found in the intra-evaluator reproducibility are in Table 2, showing that all indexes and principles have high intraclass correlation values (ICC), superior to 0.814 (IC: 95%: 0.251 - 0.954;  $p < 0.001$ ) and inferior to 0.992 (IC 95%: 0.966 – 0.998;  $p < 0.001$ ).

**Table 2** – Reproducibility indicators of tactical principles, total numbers and tactical performance assessment indexes (n=1662 tactical actions)

	<i>Cronbach's alpha</i>	ICC	IC (95%)		p
Penetration	0.973	0.944	0.414	0.989	< 0.01
Offensive coverage	0.984	0.984	0.939	0.996	< 0.01
Depth mobility	0.814	0.814	0.251	0.954	0.01
Width and length	0.878	0.875	0.531	0.968	< 0.01
Delay	0.981	0.976	0.888	0.994	< 0.01
Defensive coverage	0.952	0.948	0.801	0.987	< 0.01
Balance	0.817	0.828	0.302	0.957	< 0.01
Concentration	0.991	0.992	0.966	0.998	< 0.01
Total Offensive Actions Performed	0.982	0.975	0.861	0.994	< 0.01
Total Defensive Actions Performed	0.985	0.987	0.947	0.997	< 0.01
Total Offensive Actions not Performed	0.982	0.981	0.929	0.995	< 0.01
Total Defensive Actions not Performed	0.984	0.963	0.464	0.993	< 0.01
Tactical Performance Index	0.990	0.983	0.867	0.996	< 0.01
Offensive Tactical Performance Index	0.982	0.977	0.888	0.994	< 0.01
Defensive Tactical Performance Index	0.988	0.975	0.693	0.995	< 0.01
Actions Performed per Minute	0.990	0.988	0.947	0.997	< 0.01
Offensive Actions Performed per Minute	0.982	0.975	0.861	0.994	< 0.01
Defensive Actions Performed per Minute	0.985	0.987	0.947	0.997	< 0.01
Actions not Performed per Minute	0.990	0.975	0.488	0.995	< 0.01

Source: authors

## Discussion

The purpose of this study is to describe the preparation, validation and reproducibility preliminary procedures of the Individual Tactical Behavior Assessment Protocol (PADTI) for soccer athletes in game situation. The purpose of the PADTI is to analyze the defensive and offensive tactical principles of athletes as a method of assistance and control of individual and collective tactical performance in games and championships.

In the PADTI preparation and validation process, we adopted the main procedures recommended by the scientific literature in the area: logic, construct and content validation, as well as the reproducibility procedures and reliability<sup>24</sup>. In the validation process, from the 12 criteria evaluated, 11 showed an index equal or superior to 50% of the evaluations in the category “Very Appropriate”, showing that the protocol could be a useful tool in the evaluation of the tactical performance of players during soccer games. In addition, considering the evaluation in its entirety, the majority of the expert evaluators approved the PADTI (IV= 90%).

Other athletes tactical behavior evaluation protocols went through the same validation process during their preparation, such as the FUTSAT<sup>14</sup>, the Decision Making Assessment Instrument for soccer athletes<sup>25</sup>, the tactical skills development profile for indoor soccer athletes<sup>26</sup>, and the Technical-Tactical Performance Assessment Instrument (IAD-VB) for volleyball athletes<sup>27</sup>. Although the validation procedures of these instruments are diverse, due to different characteristics of the tools and specifics of each sport, the authors adopted an IV index of 80% for the criteria to be considered valid and approved.

In this sense, the consulted experts granted the PADTI a general IV of 90%, much higher than other previously validated instruments. For comparison effects, IAD-VB adopted an index of 85% to consider satisfactory the expert evaluation, and reached 92.9% of general index for content validation, values close to those found in this study<sup>27</sup>. When comparing the evaluators' grades, there were no statistically significant differences between the evaluators' responses ( $\chi^2=12.199$ ;  $p = 0.094$ ).

In the validation process of technical and tactical evaluation instruments in sports, it is common to test the reproducibility of instruments. Collet *et al.*<sup>27</sup> and Costa *et al.*<sup>14</sup> found high reliability values inter and intra-evaluators in their relevant instruments. In relation to intra-evaluator reproducibility, PADTI evidenced intra-class correlation indicators (ICC), superior to 0.814 (IC: 95%: 0.251 – 0.954;  $p < 0.001$ ) for all variables analyzed, as well as, good internal consistency, presenting a *Cronbach's alpha* superior to 0.814, reflecting high rates of reproducibility and reliability.

There are several instruments for evaluating the tactical behavior of soccer athletes<sup>28</sup>, however, for an adequate and effective tactical assessment, quality measurement instruments are needed. In this sense, for a tactical behavior assessment tool to be considered valid and consistent, it must present in its elaboration a detailed and well-described methodological process, paying attention to the processes of face validity, content validity, construct validity, as well as such as inter and intra-evaluator reliability procedures, as well as, it must be easy to apply and consider the real context of the game<sup>24</sup>. In this context, PADTI complied with the main requirements in its elaboration and validation process.

Unlike the various protocols available in the literature, which assess the tactical performance of soccer players in different contexts (small games), modifying rules, number of players, time and field dimensions, or making a tactical assessment through technical indicators<sup>13,14,15</sup>. PADTI provides an analysis in real game context using the tactical actions of athletes as a parameter. This characteristic gives greater external validity to the PADTI, as it is capable of evaluating the tactical performance of the soccer athlete in the real context of the game, making the PADTI closer to the reality of soccer athletes and the expectation of the coaching staff.

Likewise, and as an original proposal, PADTI can provide a series of indicators of tactical performance of each athlete (individually) and the team evaluated (collectively). This was observed during the reproducibility procedures, where the frequencies of each player's tactical actions and each athlete's game time generated the following indicators: Tactical Performance Index (IT), Offensive Performance Index (IO), Defensive Performance Index (ID), Total Tactical Actions per Minute (ATM), Offensive Tactical Actions per Minute (AOM), Defensive Tactical Actions per Minute (ADM), and Tactical Actions Not Performed per Minute (ANRM).

During the reproducibility procedures, we computed 1662 (17%) actions from the part of the game previously selected (T1), categorized into offensive and defensive actions. From these indicators it was possible to compare the athletes' tactical performance and classify them as the best and worst tactical performance. Taking the IT as a parameter, we realized that over the assessed period, defense athletes (full-backs, defense and defensive midfielder) obtained a better tactical performance than attack players (midfield and forward).

Lower reproducibility indices were found in relation to the variables mobility (depth mobility), space (width and length) and balance. It is important to highlight that, during a real soccer game, these variables occur less frequently, when compared to the others, as they vary a lot according to the positioning and function performed by the athletes on the field. In this sense, because they have a lower frequency, they are more likely to change between one assessment and another of reproducibility. However, even with this variation, the results indicate satisfactory indices of reproducibility for these variables.

PADTI in its essence has an innovative and original purpose regarding the evaluation of tactical behavior of soccer players in game situation. As it enables a tactical performance analysis with images from a real soccer game, time where the athlete, theoretically, should present his best physical, emotional, technical and tactical performance. As emotions resulting from soccer game situations and other factors involved in the field (adversary, supporters, game time, weather, championship situation, game place, and others) can modify the player's performance throughout the game, which is reduced in a training environment<sup>1,2,3,4,6,29</sup>.

Another point to be emphasized in the PADTI methodology is its low utilization cost. This tool only needs a game that can be recorded by a camera, or from television broadcasts, a computer with *Microsoft Excel*<sup>®</sup> to carry out the analysis, and previous knowledge on the tactical principles used. PADTI is a viable alternative to clubs and technical committees that intend to use performance analysis based on specific tactical principles of soccer to contribute with the improvement of tactical performance of athletes and teams.

On the other hand, as its main limitations PADTI does not have the capacity to evaluate the tactical performance of the athletes in dead-ball situations (fouls and corners). Likewise, when using television images, they can omit specific positions of some athletes, which suggests that the indicators presented should be analyzed with caution. Although previous studies of protocol validation for team sports<sup>22</sup> have used a smaller sample than the one used in the present study, a greater number of team sports specialists can be used in the subsequent phases of validation of the PADTI. Ultimately, as a suggestion for future studies, this study recommends that the objectivity of the protocol be investigated, i.e., the inter-evaluators error, specially, with the use of images obtained directly at games site, using an open angle camera in order to analyze all actions and participations of athletes in a more comprehensive manner.

## Conclusion

In the PADTI preparation process, we observed rigorous methodological processes, obeying criteria established by the specialized scientific literature. In the validity stage, the experts committee issued expressive logical, construct and content validity indexes, making possible the PADTI validation.

During the reproducibility and reliability processes, PADTI showed high statistical indicators related to the *Intraclass Correlation Coefficient*, which can be interpret as low intra-evaluator error and high reliability indexes.

We conclude that the indexes were high for all variables analyzed, such as: Tactical Performance Index (IT), Offensive Performance Index (IO), Defensive Performance Index (ID), Total Tactical Actions per Minute (ATM), Offensive Tactical Actions per Minute (AOM), Defensive Tactical Performance per Minute (ADM) and Tactical Actions Not Performed per Minute (ANRM). Therefore, we consider PADTI a valid and useful methodology to evaluate the tactical performance of soccer athletes in game situation.

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**ORCID** number:

Ricardo Silva Denis: <https://orcid.org/0000-0003-1613-7928>

Diogo Bertella Foschiera: <https://orcid.org/0000-0001-5305-1432>

Rosimeide Francisco Santos Legnani: <https://orcid.org/0000-0001-7604-3056>

Elto Legnani: <https://orcid.org/0000-0002-8251-8000>

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**Correspondence address:** Diogo Bertella Foschiera, Rua José Joaquim Bahls, 1916 – Alto da Glória – 85555-000 – Palmas – PR – Brasil, foschieradiogo@gmail.com