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Is technical performance related to the distance covered during U-19 futsal matches?

A performance técnica está relacionada com a distância percorrida em jogos de futsal da categoria sub-19?

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Abstract – The aim of the present study was to quantify the physical demand in terms of distance covered and to verify the relation with technical performance during simulated futsal matches of U-19 category. Sixteen players participated in the study. Two simulated matches were performed, and the physical demand was quantified by the total distance covered, distance covered per minute and distance at different intensities. In addition, technical performance variables were analyzed during matches. The total distance covered was, on average, 3259.97 ± 180.27 m, with 113.26 ± 6.11 m / min. Approximately 26% of the total distance was covered at high intensity (i.e.,> 15 km.h^{-1}), with significant decrease of these actions in the second half of matches ($p < 0.05$). There were no significant correlations between physical and technical performance variables. However, there were positive correlations classified as "strong" of technical variable "unsuccessful kicks" with the total distance covered during match. This study demonstrated that simulated futsal matches of the U-19 category present high physical demand, with values of distance covered per minute at different intensities similar to those found in professional Brazilian players during official matches. There were no significant correlations between physical and technical performance during matches; however, correlations classified as "strong" between unsuccessful kicks were obtained with total distance covered (r=0.51; p=0.06), distance covered at high intensity (r=0.51; p=0.09) and with distance covered in sprints (r=0.56; p=0.06), suggesting that the efficacy of kicks is influenced by the match intensity.

Key words: Athletic performance; Physical training; Team sports; Technical training.

Resumo – *O objetivo do presente estudo foi quantificar a demanda física, em termos de distância percorrida, e verificar a relação com o desempenho técnico durante partidas simuladas de futsal em atletas da categoria sub-19. Participaram do estudo 16 jogadores de nível estadual. Foram realizadas duas partidas simuladas, sendo a demanda física quantificada pela distância total percorrida, distância percorrida por minuto e distância em diferentes intensidades. Ainda, analisou-se variáveis de desempenho técnico durante as partidas. A distância total percorrida foi, em média, de 3259,97 ± 180,27 m, com média 113,26 ± 6,11 m/min. Aproximadamente 26% da distância total foi percorrida em ações de alta intensidade (i.e., >15 km/h), com decréscimo significativo destas ações no segundo tempo dos jogos (p<0,05). Não foram observadas correlações significativas entre as variáveis de demanda física e as variáveis de desempenho técnico. Contudo, verificou-se correlações positivas classificadas como "fortes" da variável técnica finalização errada por atleta no jogo com a distância total percorrida no jogo (r=0,54; p=0,06), distância percorrida em alta intensidade (r=0,51; p=0,09) e com a distância percorrida em sprints (r=0,56; p=0,06). Este estudo demonstrou que partidas simuladas de futsal, realizadas com atletas da categoria sub-19, apresentam uma elevada demanda física, com valores de distância percorrida por minuto e percorrida em diferentes faixas de intensidade semelhantes aos encontrados em atletas brasileiros profissionais durante jogos oficiais. Não se observou correlações significativas entre o desempenho físico e o desempenho técnico durante as partidas; contudo, foram obtidas correlações classificadas como "fortes" da variável finalização errada com a distância total e com a distância percorrida em alta intensidade, sugerindo que a eficácia das finalizações é influenciada pela intensidade do jogo.*

Palavras-chave: *Desempenho atlético; Esportes coletivos; Treinamento físico; Treinamento técnico.*

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INTRODUCTION

Performance in team sports usually has a multifactorial character (i.e., technical-tactical, physical, psychological aspects, etc.). In this sense, the structuring of training programs in these sports is a complex task, making it necessary to identify the sport characteristics and the main factors associated with performance[1].

In futsal, physical demand is an aspect that draws attention to training. A match is played by two teams of five players on a 40 x 20 meter court where substitutions are unlimited; consequently, the physical demands are of high intensity[2,3]. The total distance covered in a match, or the distance covered per minute, obtained through time-motion analysis has been used as important indicators of the match physical demand[4-7]. The distance covered in matches can be analyzed under different intensity ranges, thus allowing verifying that athletes cover over 20% of the total distance at high intensities[2,4,8]. Moreover, it has been found that decisive moments of the matches are usually preceded by sprints with average distances between 10 and 30 meters[2].

In addition to physical performance, technical skills have been referred to in literature as essential in the context of sports performance, as it is through them that intelligence and tactical intentionality will be externalized and materialized[9]. Innumerous technical variables have been selected to try to discriminate the outcome of a futsal match. Miloski et al.[10], for example, found that disarming actions performed and suffered were important factors for victory[10].

The physical demand of futsal in terms of distance covered seems to be directly related to the tactical pattern performed during matches and players' technical skills[11-13]. According to the authors, competitive level is a variable capable of altering the tactical pattern of matches and directly influencing the intensity required in futsal matches. Knowledge of physical and technical demands at different competitive levels can help coaches and other professionals in the area to develop specific training programs. In soccer, for example, it was found that the decline in physical performance during the match is not accompanied by reduction in technical actions and involvement with the ball[14]. In this sense, studies that aim to characterize the match demands and understand their interrelationships are necessary in the context of futsal[13].

It is important to highlight that few studies have investigated the physical demand of futsal matches of Brazilian athletes, and available investigations have analyzed professional level athletes[4,7,13]. In addition, it is noteworthy that match demand analyses involve some computational processing complexity or have high cost. This reinforces the importance of conducting this type of study in order to provide futsal professionals with information not easy to be collected in the daily training routines of teams.

Thus, the aims of the present study were to quantify the physical demand in terms of distance covered and the technical performance of

U-19 players during simulated futsal matches and to verify the correlation between the distance covered and the technical performance of athletes.

METHOD

Participants

Sixteen male U-19 futsal athletes (age: 18.0 ± 1.0 years; body mass: 67.4 ± 9.7 kg; height: 176.0 ± 5.4 cm; % Fat: 10.1 ± 1.26), members of a Santa Catarina club that disputes state competitions participated in the study. Subjects were intentionally non-probabilistically selected by accessibility. As inclusion criteria, athletes should be in the specific preparatory period and have participated in the entire preseason in the club.

Data Collection Procedures

This study was approved by the Human Ethics Research Committee of the local University. All athletes were informed about the objectives and methodology of this research and signed the free and informed consent form. In addition, all were instructed to be properly fed and hydrated at the time of matches and to avoid the consumption of caffeine and other stimulant substances.

Two simulated futsal matches were performed in two days (96 h interval between matches), which were filmed for further analysis of physical performance. For these matches, athletes were divided into four quartets (Q1, Q2, Q3 and Q4) and were numbered from 1 to 16. Matches lasted 40min (timed), composed of two halves of 20min each, with 10min interval between them. These periods were divided into 4 blocks of 10min, alternating the two quartets in court at the end of each block in order to reproduce the scenario found in futsal matches, where players take turns or substitution approximately every 10 minutes. To define quartets, a draw was held, and the same quartets could not play against each other in the two matches. The distribution of quartets in simulated match 01 was: Q1 x Q2 (0 - 10 min), Q3 x Q4 (10 - 20 min), and the same quartet formation was repeated in the 2nd half. In simulated match 02, Q1 x Q3 (0 - 10 min) and Q2 x Q4 (10 - 20 min) played against each other, repeating such formations in the 2nd half. Official game rules were adopted, with the presence of a referee, and a court-side coach for technical / tactical guidance during matches in order to recreate conditions similar to those found in official matches.

Matches were filmed by two digital cameras (SONY®) operating at the acquisition frequency of 30 Hz, adjusted with manual focus, which were positioned in high places and in opposite areas of the court, each covering approximately 75% of the court with an overlapping area between them in order to capture all displacements performed by athletes.

Kinematic analysis of matches

The analysis of the athletes' displacements during matches was performed with the DVideo automatic video tracking software[15], based on obtaining

two-dimensional coordinates of each player generated during the game. The calibration of the match space was performed based on specific point measurements obtained on the court. To track players, it was necessary to perform the process called segmentation, which is the procedure used to detect and separate objects of interest in the image, which in this case are athletes, from other objects that may interfere in the analyses. Tracking was performed for each athlete separately, and the player's two-dimensional coordinates were obtained throughout the match.

The coordinates obtained were smoothed by a 3rd order Butterworth low-pass digital filter with cutoff frequency of 0.4 Hz[4]. Then, information regarding the distance covered by athletes during matches was calculated as a derivative, with error rate of 0.8%. The variables used in the present study were total distance covered, distance covered per minute and partial distance according to speed ranges predetermined by Barbero-Álvarez et al.[2]:

1) Walking (0 - 1 $m.s^{-1}$);
2) Jogging (1.1 - 3 $m.s^{-1}$);
3) Medium-intensity running (3.1 - 5 $m.s^{-1}$);
4) High-intensity running (5.1 - 7 $m.s^{-1}$); and
5) sprint (> 7.1 m.s-1).

From filming obtained, the technical performance of athletes in matches was also analyzed, based on variables proposed by Dogramaci et al.[6]:

- Right Pass: Every pass that has reached the intended target.
- Wrong Pass: Any pass that did not reach the intended target.
- Percentage of right passes: fraction / rate of right passes in relation to total passes made.
- Right Finalization: Any finalization that reached the target (goalkeeper), regardless of whether the ball was defended by the goalkeeper or not.
- Wrong Finalization: Any finalization that did not reach the target.
- Disarming with ball possession: All action of taking the ball from an opposing athlete in which the team of this athlete has taken ball possession.
- Disarming without ball possession: All action of taking the ball from an opposing athlete, who had it under control, but the opposing team followed with ball possession.
- Interception with ball possession: any blocking action, whether passing or finalizing, with subsequent ball possession maintenance.
- Interception without ball possession: any blocking action, whether passing or finalizing, in which the opposing team has the ball possession.
- Goals: any finalization that has reached the opposing goal.
- Involvement with the ball: Total number of times the athlete has actively participated in the play.

An experienced and trained researcher performed all analyses to minimize any measurement variations [6].

Statistical analysis

Data were presented as means and standard deviations after descriptive statistics. Data normality was tested by the Shapiro-Wilk test. The reproducibility of variables related to the distance covered in both simulated games was analyzed using the coefficient of variation (CV). CV values were between 2.73 and 9.15% for all variables. Thus, the average of variables between matches was considered for analysis. The total distance covered and the distance covered at different intensities (walking, jogging, medium and high intensity running and sprints) as well as technical performance variables were compared between the 1st and 2nd halves of matches using the "t" student test. Pearson's correlation (r) was used to analyze correlations between distance covered and athletes' technical performance. The magnitude of correlation was classified according to Hopkins[16]: trivial (0 - 0.1), small (0.1 - 0.3), moderate (0.3 - 0.5), strong (0.5 - 0.7), very strong (0.7 - 0.9) and almost perfect (0.9 - 1.0). The 5% significance level was adopted. For the analysis of the study, the SPSS 18.0 software was used.

RESULTS

The total distance covered by athletes, considering the average of both matches, was 3259.0 ± 238.6 m, and 113.3 ± 6.4 m / min. Figure 1 shows the absolute and relative distance covered at different intensities. Athletes covered, on average, 9.0 ± 0.7% (291.8 ± 16.2m) of the total distance walking, 33.8 ± 1.4% (1100.7 ± 44.3m) jogging; 29.9 ± 0.6% (976.0 ± 66.1m) at medium intensity; 17.6 ± 0.8% (575.2 ± 53.6m) at high intensity and 9.7 ± 0.8% (316.3 ± 39.4m) in sprints.

Figure 2 shows the distance covered at different intensities in the first and second halves of matches. In the second half of matches, there was a significant increase in the total distance (TD) and the percentage of distance covered (DPP) walking (1st half: TD = 137.7 ± 10.2 m and DPP = 8.5 ± 0.7 %; 2nd half: TD = 154.2 ± 16.6 m and DPP = 9.44 ± 0.9%; $p < 0.01$) and jogging (1st half: TD = 533.7 ± 60.8 m and DPP = 32.9 ± 2.7%, 2nd half: TD = 566.9 ± 68.9 m and DPP = 34.7 ± 3.2%; $p < 0.01$). At medium intensity, a decrease in the percentage of distance covered was found (1st half = 30.3 ± 1.0%; 2nd half = 29.5 ± 1.0%; $p < 0.01$), with no difference being recorded in the total distance covered (1st half = 492.3 ± 44.9 m; 2nd half = 483.6 ± 45.2 m; $p = 0.1$). In addition, there was a significant decrease in the total distance covered and the percentage of the distance traveled at high intensities (1st half: TD = 295.9 ± 37.3 m and DPP = 18.2 ± 1.5%; 2nd half: TD = 279.3 ± 33.3 m and DPP = 17.1 ± 1.6%; $p < 0.01$) and sprint (1st half: TD = 164.7 ± 37.9 m and DPP = 10.1 ± 2.1%; 2nd half: TD = 154.6 ± 29.9 m and DPP = 9.3 ± 1.9%; $p < 0.01$).

Table 1 presents technical performance variables during simulated matches, considering the total playing time and for the 1st and 2nd half. Maintenance of the technical performance was observed throughout the match, without significant differences between halves.

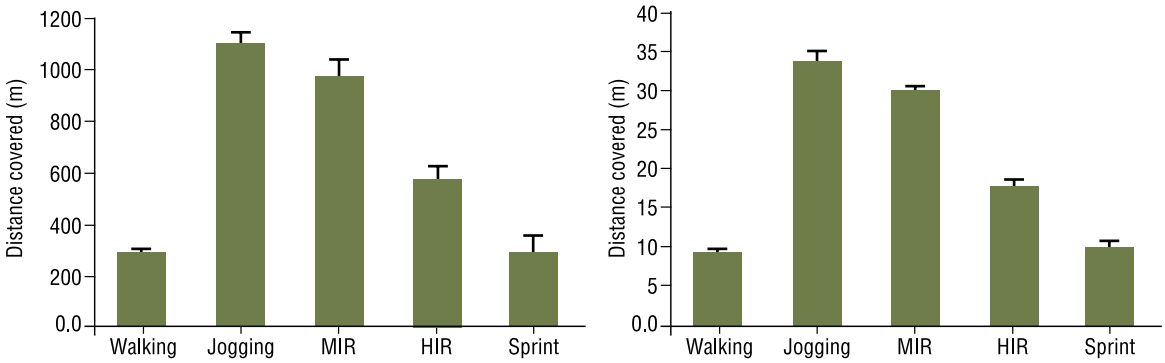

Figure 1. Distance covered (absolute and relative) at different intensities during simulated futsal matches.
Note. MIR = medium-intensity running; HIR = high-intensity running.

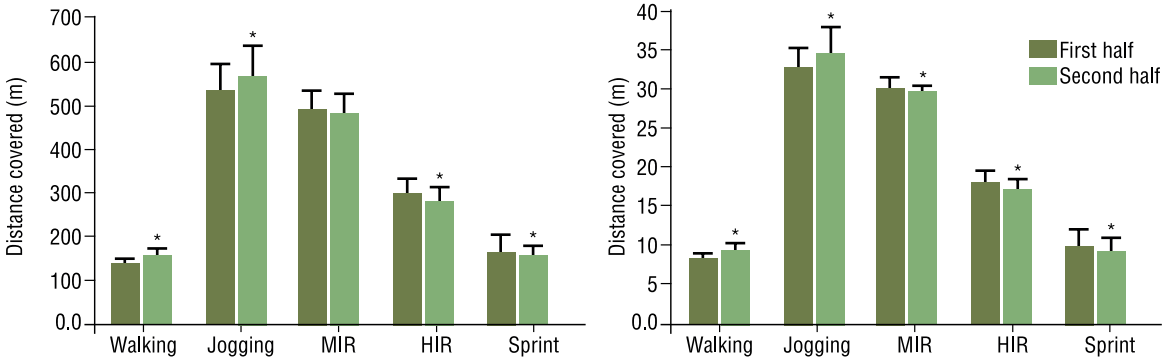

Figure 2. Comparison of the distance covered (absolute and relative) at different intensities between the first and second half of matches.
Note. MIR = medium-intensity running; HIR = high-intensity running. * = Different from the distance covered in the first half of the game ($p < 0.05$).

Table 1. Descriptive analysis of technical performance during simulated matches

	Total match	Total 1st half	Total 2nd half	Average per athlete - Total match	Average per athlete – 1st half	Average per athlete – 2nd half
Right pass (n)	417 ± 18.4	217.5 ± 6.4	199.5 ± 0.2	32 ± 13.8	16.7 ± 8.1	15.3 ± 6.1
Wrong pass (n)	69 ± 12.7	38 ± 2.8	31 ± 9.9	5.2 ± 3.2	2.9 ± 2.1	2.4 ± 1.7
Right pass (%)	85 ± 2.1	84.4 ± 3.1	85.6 ± 1.2	84.9 ± 11.2	84.4 ± 12.1	85.4 ± 10.4
Finalization in the target (n)	39.5 ± 1.4	15.5 ± 4.9	24 ± 3.5	3.2 ± 2.3	1.2 ± 1.2	1.8 ± 1.4
Wrong finalization (n)	17 ± 5.7	10.5 ± 6.4	6.5 ± 0.7	1.3 ± 1.3	0.8 ± 1.1	0.5 ± 0.6
Disarming with ball possession (n)	47 ± 2.8	23 ± 1.4	24 ± 4.2	3.7 ± 2	1.8 ± 1.1	1.8 ± 1.7
Disarming without ball possession (n)	21 ± 9.2	11 ± 4.2	10 ± 4.9	1.6 ± 1.6	0.8 ± 1.2	0.8 ± 1
Interception with ball possession (n)	42 ± 2.8	18.5 ± 2.1	23.5 ± 0.7	3.3 ± 1.5	1.4 ± 1.2	1.8 ± 1
Interception without ball possession (n)	28.5 ± 9.2	14.5 ± 2.1	14 ± 7.7	2.1 ± 1.2	1.1 ± 1	1.1 ± 1
Involvement in plays (n)	730 ± 62.2	367 ± 18.4	363 ± 43.8	55.5 ± 13.4	28.2 ± 8	27.7 ± 6.9
Goals (n)	15 ± 1.41	6 ± 2.8	9 ± 1.4	1.2 ± 1.3	0.5 ± 0.7	0.7 ± 0.8

As shown in Table 2, no significant correlations were observed between the distance covered and technical performance during simulated matches. Correlations classified as "strong" of technical variable wrong finalization by athlete in the match with the total distance covered in the match ($r = 0.54$; $p = 0.06$), distance covered at high intensity ($r = 0, 51$; $p = 0.09$) and with distance covered in sprints ($r = 0.56$; $p = 0.06$).

Table 2. Correlations between distance covered and technical performance variables during simulated futsal matches.

	Total distance	Distance/ min	Distance AI	Distance *sprints*
Right pass	-0.36	-0.23	-0.17	-0.15
Wrong pass	0.31	0.27	0.16	0.07
Right finalization	-0.26	-0.20	0.08	0.06
Wrong finalization	0.54*	0.25	0.51*	0.56*
Disarming with ball possession	0.17	0.32	0.24	0.05
Disarming without ball possession	0.30	0.06	0.12	-0.15
Interception with ball possession	-0.34	-0.29	-0.04	-0.17
Interception without ball possession	-0.17	-0.24	-0.11	-0.16
Involvement in plays	-0.29	-0.16	0.18	0.02

Note. AI: high intensity. * indicates correlations of strong magnitude.

DISCUSSION

The aim of the present study was to analyze the physical demand and verify the relationship with technical performance during simulated futsal matches in U-19 athletes. Physical demand was quantified by the total distance covered, distance covered per minute and covered at specific intensities. According to Bueno et al.[4] and Dogramaci et al.[6], these variables are able to identify the level of physical performance during a futsal match. Our main results show that simulated matches have similar characteristics to official matches and that U-19 players cover shorter distances during matches compared to professional athletes. In addition, although not significant, "strong" correlations were identified between technical performance variable "right finalization" and physical demand variables.

The distance covered by athletes during matches was, on average, 3259.97 ± 180.27m. This value is similar to those found by Bueno et al.[4], who reported an average distance of 313.2 ± 2248.5 m when analyzing five official matches of the national professional futsal league. These findings allow supposing that the matches performed in our study, despite being simulated, occurred at intensities close to those of official national level games. It is important to highlight that in collective modalities with unlimited number of substitutions and timed, such as futsal, the total distance covered may not be the main indicator of physical performance, as athletes usually stay for different periods of time on court[2].

Thus, the distance covered per minute is presented as a variable capable of better representing the general intensity of modalities with such characteristics, providing more accurate information about the physical demand of matches. In our study, athletes covered, on average, 113.26 ± 6.11 meters per minute, which is close to 114.8 ± 46.2m / min reported by Dogramaci et al.[6] for professional athletes, participants of the second division of the Spanish Futsal League. Comparing with studies performed with Brazilian athletes, the values obtained here are higher than those found by Bueno et al.[4] and Milioni et al.[7], which found that professional athletes walked 97.9 ± 16.2 and 103.2 ± 4.4m / min, respectively, during official matches.

According to Bueno et al.[4], such differences may be explained by the fact that different leagues have specific physical requirements. In addition, the tactical pattern adopted by teams is capable of directly influencing the physical demand of matches, and the adoption of offensive proposals, with pressure marking, tends to increase the intensity of actions, reflecting in longer distance covered per minute during the match[2].

Although distance covered per minute provides valuable information about the physical demands of futsal matches, it is very important to know the intensity of displacements performed. In the present study, athletes covered approximately 74% of the total distance in actions considered of low intensity, a value similar to that found in previous studies that used the same classification to determine intensity ranges[2-3]. Moreover, our results show that athletes covered 17.63 ± 0.84% (575 ± 53.61m) of the total distance of matches in actions considered of high intensity (≥ 18 km / h) and 9.7% (316.33 ± 39.36m) performing sprints (≥ 25.6 km / h). Regarding actions performed at high intensity, the results of the present study appear to be below those recorded for professional athletes of the Australian team[1,3], but are higher than those found for Spanish[2] and Thai[11] athletes. When analyzing the percentage of distance covered in sprints, our results are slightly higher than those reported in literature. According to Krustrup et al.[17], athletes with higher aerobic capacity cover longer distances at high intensities because they can recover better between efforts.

When the distance covered was compared between the first and second half of matches, there was a significant increase in the distance covered at low intensity (walking and jogging) and a decrease in the distance covered at high intensity and sprint in the second half of matches. These results are similar to those found by Barbero-Álvarez et al.[2] in professional Spanish athletes during official matches. According to the authors, this reduction in performance between halves may be due to reduced glycogen stores, heat stress and dehydration. In addition, this decrease in intensity throughout matches can be directly influenced by the tactical scheme adopted[11]. Tactical schemes considered offensive such as man-marking or pressure-marking induce higher physical demand and, consequently, make it difficult to maintain high intensity actions during the match.

In addition to physical performance, this study also analyzed the technical performance of athletes during simulated matches. As highlighted by Costa et al.[9], technical skills are essential in the context of performance of team sports, as it is through them that tactical intentionality materializes. Considering the above, it was sought to verify the relationship between technical and physical performance during matches. No significant correlation was found between these variables; however, from the perspective of Hopkins classification[16], positive correlations obtained from technical variable unsuccessful kicks with physical variables total distance covered, distance covered at high intensity and distance covered in sprints are considered as "strong". These relationships suggest that athletes who have the highest incidence of errors in goal finalizations are those who cover the

longest distance or at high intensity during the match.

Futsal has intermittent characteristics and unlimited substitutions, thus the match intensity maintained by the athlete remains high during almost every period of the match[1,2,5]. According to these characteristics, it has been shown that futsal match ends up by inducing high fatigue level[5,18], which may have consequences for performance, whether in physical or motor parameters[19]. Possibly, athletes who cover the greatest total distance during matches and, especially, the greatest distance at high intensity, end up by presenting higher fatigue levels. Thus, in the present study, this may suggest that it has negatively influenced efficiency in goal finalizations. As pointed out by Bangsbo et al.[20], in team sports, the effects of fatigue on performance are noticeable mainly in the second half, reflected by a drop in the work rate, which may adversely affect many match actions[20].

These findings suggest that resisting fatigue during a match is an important aspect of performance, both for maintaining physical performance and for maintaining technical efficiency. Thus, coaches and physical trainers should design their training programs in a way that meets the real needs of athletes. Furthermore, the use of more constant substitutions may assist in maintaining technical efficiency.

Finally, we highlight the possible study limitations. The main one is the fact that simulated futsal matches have been analyzed, in which, even trying to recreate the conditions of an official match (e.g. official rules with the presence of the referee, court-side coach to provide technical / tactical guidance during matches), motivational factors can influence performance. Additionally, only one team was analyzed in a total of two matches performed, which may limit inferences. Thus, further studies should be carried out to analyze a larger number of matches, with teams of different competitive levels.

CONCLUSION

Simulated futsal matches performed with U-19 athletes presented high physical demand, with values of distance covered per minute and covered at different intensities similar to those found in professional Brazilian athletes during official matches. No significant correlations were observed between physical and technical performance during matches; however, correlations obtained from technical variable unsuccessful kicks with physical variables total distance covered, distance covered at high intensities are considered as “strong”, suggesting that the effectiveness of finalizations is influenced by the match intensity.

COMPLIANCE WITH ETHICAL STANDARDS

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Ethical approval

Ethical approval was obtained from the Human Research Ethics Committee of Federal University of Santa Catarina and the protocol (no. 63054516.0.0000.0121) was written in accordance with standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors have no conflict of interests to declare.

Author Contributions

Conceived and designed the experiments: JB, JD. Performed the experiments: JB, JD, DR. Analyzed the data: JB, JD, FAM, VPS. Contributed with reagents/materials/analysis tools: FAM, JFS, CA, VPS. Wrote the paper: JB, JD, FAM, JFS, CA.

REFERENCES

1. Dogramaci SN, Watsford ML, Murphy AJ. Time motion analysis of international and national level futsal. J Strength Cond Res 2011; 25(3): 646-51.
2. Barbero-Álvarez JC, Soto VM, Barbero-Álvarez V, Granda Vera J. Match analysis and heart rate of futsal players during competition. J Sports Sci 2008; 26(1): 63-73.
3. Dogramaci SN, Watsford ML. A comparison of two different methods for time-motion analysis in team sports. Int J Perform Anal Sport 2006; 6(1): 73-83.
4. Bueno MJO, Caetano FG, Pereira TJ, Souza NM, Moreira GD, Nakamura FY, Cunha SA, et al. Analysis of the distance covered by Brazilian professional futsal players during official futsal matches. Sports Biomech 2014; 13(3): 230-40.
5. Castagna C, D'Ottavio S, Granda Vera J, Barbero-Álvarez JC. Match demands of professional Futsal: A case study. J Sci Med Sport 2009; 12(4): 490-4.
6. Dogramaci SN, Watsford ML, Murphy AJ. Activity Profile Differences Between Sub-elite Futsal Teams. J Sports Med Phys Fitness 2015; 8(2): 112-23.
7. Milioni F, Vieira LH, Barbieri RA, Zagatto AM, Nordsborg NB, Barbieri F, dos-Santos JW, et al. Futsal match-related fatigue affects running performance and neuromuscular parameters but not finishing kick speed or accuracy. Front Physiol 2016; 7(7): 518.
8. Caetano FG, Bueno MJO, Nakamura FY, Cunha SA, Moura FA. Characterisation of the sprints performed by professional futsal players during official matches. J Appl Biomech 2015; 31(6): 423-9.
9. Costa I, Greco P, Garganta J, Costa V, Mesquita I. Ensino-aprendizagem e treinamento dos comportamentos tático-técnicos no futebol. Rev Mackenzie Edu Fís Esporte 2010, 9 (2): 41-61,
10. Miloski B, Pinho JP, Freitas CG, Marcelino PR, Arruda AF. Quais ações técnico-táticas realizadas durante as partidas de futsal podem discriminar o resultado de vitória ou derrota? Rev Bras Edu Fís Esporte 2014; 28(2): 203-9.
11. Makaje N, Ruangthai R, Arkarapanthu A, Yoopat P. Physiological demands and activity profiles during futsal match play according to competitive level. J Sports Med Phys Fitness Fitness 2012; 52(4): 366-74.
12. Serrano J. The importance of sports performance factors and training contents from the perspective of futsal coaches. J Hum Kinet 2013; 38: 151-60.

13. Vieira LHP, Doğramaci SN, Barbieri RA, Moura FA, Andrade VL, Cesar GM, et al. Preliminary results on organization on the court, physical and technical performance of Brazilian professional futsal players: comparison between friendly pre-season and official match. Motriz 2016; 22(2): 80-92.
14. Carling C, Dupont G. Are declines in physical performance associated with a reduction in skill-related performance during professional soccer match play? J Sports Sci 2011; 29(1): 63-71.
15. Figueroa PJ, Leite NJ, Barros RML. Background recovering in outdoor image sequences. Image Vision Comput 2006; 24(4): 363–74.
16. Hopkins WG. A new view of statistics, 2002. (http://www.sportsci.org).
17. Krustrup P, Mohr M, Amstrup T, Rysgaard T, Johansen J, Steensberg A, et al. The Yo-Yo intermittent recovery test: Physiological response, reliability and validity. Med Sci Sports Exerc 2003; 35(4): 697-05.
18. Dal Pupo J, Detanico D, Santos, SG. The fatigue effect of a simulated futsal match protocol on isokinetic knee torque production. Sports Biomech 2014; 13: 332-40.
19. Twist C, Eston R. The effects of exercise-induced muscle damage on maximal intensity intermittent exercise performance. Eur J Appl Physiol 2005; 94: 652–58.
20. Bangsbo J, Norregaard L, Thorsoe F. Activity profile of competition soccer. Canadian J Sports Sci 1991; 16: 110-16.

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