Original Article

Offensive and defensive efficacy among male and female elite foil fencers

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ABSTRACT

Fencing is a combat sport, where beyond physical and physiological demands, strategy and tactics are crucial factors in order to identify fencers' performance. Fencers' tactical movements can be separated in preparatory actions and final actual offensive (attacks) and defensive (parries and counter-attacks) actions. The aim of this study is to analyse the tactical choices of elite male and female qualifiers foil fencers in finals and semi-finals bouts of the 2016-17 FIE (International Fencing Federation) competitions. Attacking and defending points were recorded, compared with the type of point, the section thrusts were landed and the time period they were noted. The present study revealed significant difference between offensive and defensive efficacy in both male ($p<0.003$) and female fencers ($p=0.019$). Male fencers showed greater activation than women ($p=0.003$), finishing their bouts much earlier ($p=0.000$), since they needed less time to accomplish an actual action ($p=0.001$). In conclusion, male could be characterized as ''permanently pressing'' fencers, while female adopted a ''manoeuvring-attacking'' style, since male fencers had greater percentage of total actions on the middle section of the piste ($p=0.011$) and female fencers had greater number of defending actions on the back section ($p=0.033$), respectively. **Keywords:** Fencing; Tactics; Technique; Points; Actual actions; Sports performance.

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INTRODUCTION

Fencing is an open skilled combat sport, which is included in the Olympic program since 1896. Three types of weapon (foil, sabre and epee) can be practiced by men and women on a piste 14 m long and 1.5-2 m wide. Competitions are divided in preliminary and direct elimination bouts, which are composed of 5 thrust bouts of 3 min maximum duration and 15 thrust bouts for a maximum duration of 9 min (3 rounds of 3 min duration each, with 60 sec interval), against different opponents, respectively. If there is no winner after this procedure, on extra minute is given and whoever scores first wins the bout. In foil and sabre bouts, a right of way system determines the priority, regardless of who scored first. No point is scored when a touch is landed in a no-valid target (FIE, 2018).

Fencing is characterized by repeated short periods of high intensity actions, spaced by longer sub-maximal movements (Roi and Bianchedi, 2008). Muscular strength, power and neuromuscular coordination are important in order to perform explosive specific dynamic movements, such as fencing steps, bounces, and lunges in different directions so as to 'hit – touch' the opponent (Barth and Beck, 2007; Tsolakis et al., 2010; Turner et al., 2013). A fencer may cover a total distance of 250-1000 m during a bout. Considering foil fencers, an action may last for approximately 5 seconds with a work/rest ratio of 1:3 (Lavie et al., 1985). Roi and Bianchedi (2008), showed that the total time duration of the bouts in foil fencers was 17-34 min, with an approximate time between ''start-stop'' signals of the referee of 6-11 sec.

A variety of interrelated factors affect fencers' performance, taking into consideration different competition and training characteristics among the foil, sabre and epee (Czajkowski, 2001). Great results have been achieved by fencers with different anthropometrics characteristics. The relationship between specific anthropometric variables (lean body mass or length of upper and lower extremities), with speed development, power production, accuracy and quintessence seems to be critical for elite fencing performance (Cronin et al., 2003; Ergen et al., 1984; Szabo, 1982).

Apart from the physical and physiological fencing prerequisites, strategy and tactic (Czajkowski, 2005) play an important role too. As mentioned by Barth and Beck (2007), tactics can be described as the combination of the skilful, logical and deliberate use of the technical, physiological and psychological fencers' abilities. Fencers' performance depends to a great extent on his/her ability to choose logically and in a short time the best on-board action (Barth and Beck, 2007), always taking into account the opponents' tactics (Czajkowski, 2009).

Actions can be divided into two groups considering their purpose. The so-called ''preparatory actions'' are movements of the fencer's weapon, legs and sometimes trunk in order to disguise intentions, to feed false information, to hinder and to manoeuvre. Other actions used by fencers in order to hit or to avoid a hit are mentioned as ''actual actions'' (Wojciechowski, 1993). Actual actions are divided into offensive (attacks) and defensive actions (parries and counter-attacks). These actions are closely related to the personal traits of each fencer, characterizing his/her tactical choices and the way of making a decision, highlighting how critical they can be in elite fencing performance (Czajkowski, 2005).

In fencing, the majority of hits is landed by attacks and the proportion between the attempted and successful attacks seems to discriminate winners from losers in competitions (Williams and Walmsley, 2000) while recently, Aquili et al., (2013) identified different technical – tactical approach among men and women fencers participating in A-category and FIE (International Fencing Federation) Grand Prix competitions. So, the purpose of the present study is to analyse the actual actions of winners (male and female fencers) of the top

four finalists in each competition of the 2016-17 season. The offensive and defensive effectiveness were exported for males and females, in order to investigate in depth the specific tactical indicators and to highlight tactical gender differences in fencing performance.

MATERIAL AND METHODS

Participants

The sample consisted of 13 men aged 25.9±2.8 years and 13 women aged 25.8±3.1 years foil finalists from the FIE (International Fencing Federation) competitions which were held over the 2016-2017 season.

Measures

In each competition, winner's touches in the semi-finals (two bouts) and final (one bout) were analysed, while the average of the touches from the 3 bouts was kept for the final analysis. Eleven competitions and 33 bouts were analysed for each gender. Actions were separated into attacks and defences, while points were divided not only into valid points (For and Against) and no-valid points (Missed), but also the section of the piste (Back, Middle, Front) and the time period of the bout in which the point was gained (1st, 2nd, 3rd, Extra) were taken into account. Between each time period there was a one minute rest. Each time period lasted for three minutes, in contrast with extra time which had one minute duration (Figure 1).

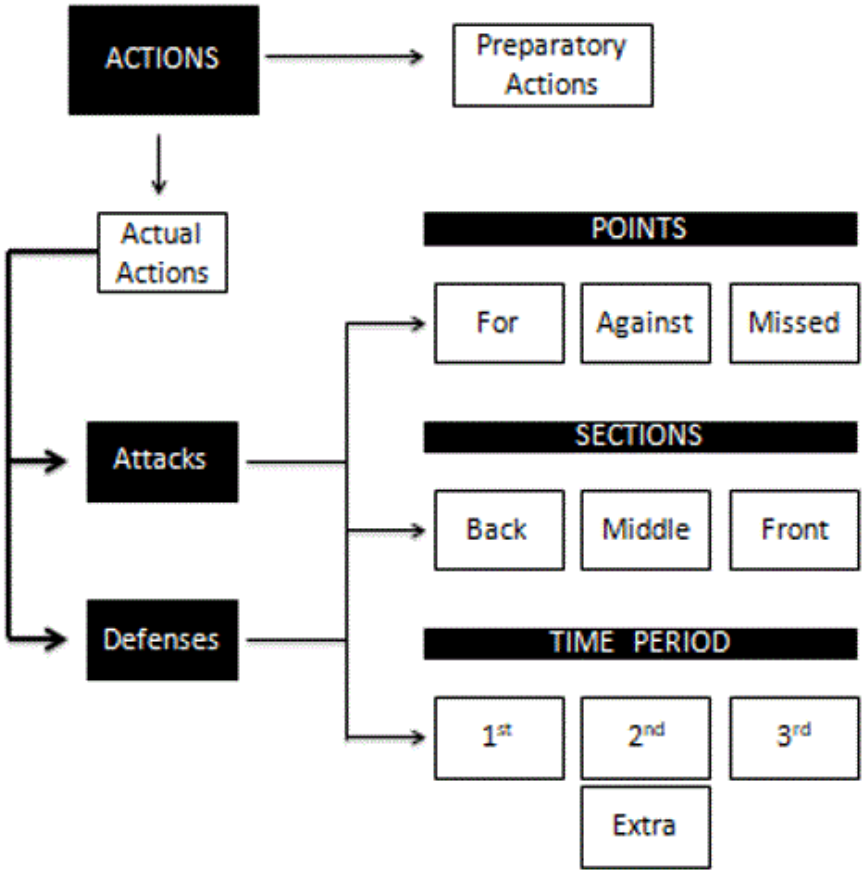


Figure 1. Separation of actual actions in relation to the Points, Sections and Time period they were made.

Procedures

The attack is the initial offensive action made by extending the arm and continuously threatening the opponent's target, preceding the launching of the lunge or fleche. In contrast, the parry is the defensive action made with the weapon to prevent an offensive action arriving (Wojciechowski, 1993). A valid touch was noted when fencer hit his/her opponent in the valid area of the specific vest which excludes the limbs and the head, while a no-valid touch was noted when it was made on a part of the body other than the target and was not counted as a valid touch, but it stopped the bout and therefore annulled all touches which were scored thereafter.

The middle section of the piste was defined by the on-guard lines on which fencers start the bout (four meters distance). The back section of the piste was defined by the on-guard line and the last rear-limit line of the fencer (five meters distance) whose tactic was analysed, while the front section of the piste was defined by the on-guard line and the last rear-limit line of his opponent (five meters distance).

The Total Time Duration (TTD) was recorded by video, from the beginning of the bout till the time that the last touch was scored. The Clear Time Duration (CTD) was recorded by the special fencing time machine on the scoreboard, while the rest period was the difference of the above mentioned times (TTD – CTD). Fencers' coefficient of attack (iA) and defence (iD) were calculated as iA = Total Attacks For / Total Attacks Against and iD = Total Defences For / Total Defences Against, and were characterized as effective only when iA and iD were above one (Wojciechowski, 1993). The average time between ''start'' and ''stop'' signal of the referee (t_F= CTD / Total Actions) and fencers' activation coefficient (K_{ACT}= Total Attacks / t_F) were calculated as mentioned by Wojciechowski, (1993). Some other variables which were used in the analysis were Total Actions (Total Attacks + Total Defences) and various percentages which were calculated relatively to the Total Actions.

Analysis

Touches were recorded via video analysis of each bout in each competition. Statistical analyses were performed using the SPSS for Windows version 23 (IBM statistics). T-tests between groups (men X women) were made in order to determine the differences between genders in each variable. T-tests within groups were made were needed in order to determine differences within actions, points, sections and time periods. Data are presented as mean ± SDs. Statistical significance was set at $p \leq 0.05$.

RESULTS

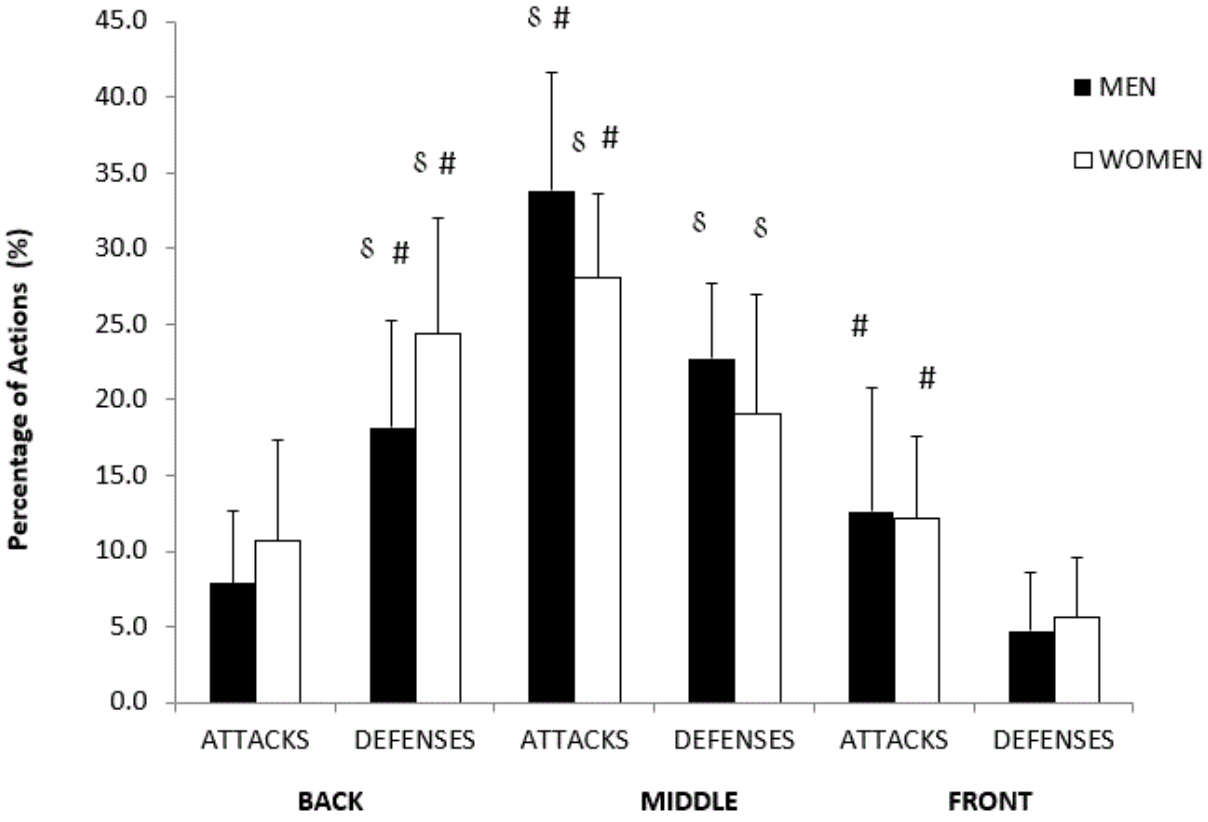
Fencers' age, attacking efficacy (iA), defensive efficacy (iD), Clear Time Duration, Total Time Duration, Rest, Work/Rest ratio, average time between start and stop (tF) and activation coefficient (Kact) are shown in Table 1.

No significant differences were observed between gender total actions. Attacks For (men: 9±1 points and women: 8±1 points) were significantly greater than Attacks Against (men: 5±2 points and women: 4±1 points, p=0.000). More specifically, it was revealed that men's Attacks For at the Middle section of the piste (6±2 points) and Attacks For in the 1st time period of the bout (8±2 points) were significantly greater than Attacks Against at the Middle (3±1 points, p=0.000) and Attacks Against in the 1st time period of the bout (1±1 points, p=0.000). Also, women's Attacks For at the Middle (4±1 points), Attacks For in the 1st (5±2 points) and Attacks For in the 2nd period of the bout (2±1 points) were significantly greater than Attacks Against at the Middle (3±1 points, p=0.000), Attacks Against in the 1st (3±1 points, p=0.004) and Attacks Against in the 2nd period of the bout (1±1 points, p=0.001).

Table 1. Fencers' characteristics (age, hand), i_A (attacking efficacy), i_D (defensive efficacy), Clear Time Duration, Total Time Duration, Rest, Ratio (work/rest), t_F (average time between ''start'' and ''stop'') and K_{ACT} (activation coefficient), (mean±SD)

	MEN	WOMEN
Age	25.9±2.8	25.8±3.1
i_A (attacking efficacy)	1.15±0.3 #	1.03±0.4 #
i_D (defensive efficacy)	0.89±0.4	0.75±0.2
Clear Time Duration (min.)	3.4±0.6*	5.3±1.2
Total Time Duration (min.)	14.1±3.3	16.2±3.1
Rest (min.)	11.1±3.4	10.5±2.5
Work / Rest ratio	0.37±0.23	0.52±0.17
t_F (average time between ''start'' and ''stop'') (min.)	0.07±0.01 *	0.10±0.03
K_{ACT} (activation coefficient) (total attacks / tF)	247.3±66.7 *	166.9±52.2

**: p<0.005 between groups; #: p<0.02 within group*



#: p<0.05 within group (same section / different action); § p<0.05 within group (different section / same action).

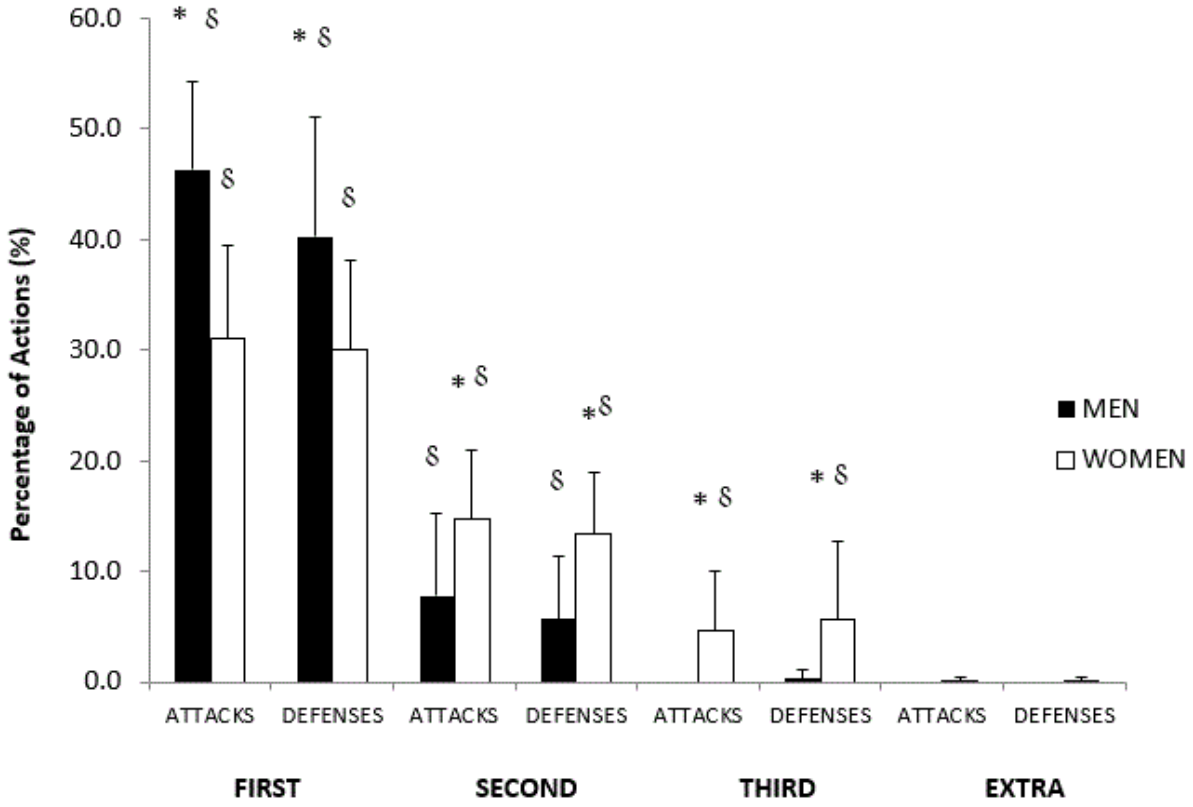
Figure 2. Percentage of different Actions (Attacks and Defences) made in different sections of the piste (Back, Middle, Front) by men and women (mean ± SD).

Concerning defensive actions, only women's Defences For (7±1 points) were significantly greater than Defences Against (5±2 points, p=0.002). Analysing their points, it was revealed that only Defences For in the

2nd time period of the bout (2±1 points) were significantly greater than the relative Defences Against 2nd (1±1 points, p=0.027) respectively.

Significant differences were also observed between attacking and defensive efficacy of both men (1.95±0.53 vs 1.2±0.45, p= 0.003) and women (2.13±0.83 vs 1.29±0.24, p=0.019). However, only men's Attacks For (9±1 points) were significantly greater than Defences For (5±2 points, p=0.013). More specifically, significant differences were also observed between men's Attacks For and Defences For (8±2 points vs 5±2 points, p=0.017) in the 1st time period of the bout. Also, men's Attacks For Middle (6±2 points) and Attacks For Front (2±1 points) were significantly greater than Defences For Middle (3±1 points, p=0.001) and Defences For Front (1±1 points, p=0.009), respectively. Additionally, men's Attacks Against Back were significantly fewer than Defences Against Back (1±1 vs 2±1 points, p=0.001).

Men's percentage Actions at the Middle section of the piste were significantly greater than men's percentage of Actions at the Back (57.6±8 vs 25.2±9.9 %, p<0.001), and men's percentage of Actions at the Front (57.6±8 vs 16.9±9.8 %, p<0.001), respectively (Figure 2).



**: p<0.05 between groups; δ p<0.05 within group (different time period / same action).*

Figure 3. Percentage of different Actions (Attacks and Defences) made in different time periods of the bout (First, Second, Third, Extra) by men and women (mean ± SD).

Furthermore, men's and women's percentage of Actions in the 1st (86.5±10.6 and 61±14.4 %, p<0.001) were significantly greater than men's and women's percentage of Actions in the 2nd (13.5±12.6 and 28.1±11.1 %), 3rd (0.3±0.9 and 10.3±10.9 %) and Extra time period of the bout (0±0 and 0.2±0.4 %), (Figure 3). Men's

percentage of Actions in the 1st time period of the bout were significantly greater than women's (86.5±10.6 % vs 61±14.4 %, $p<0.05$). More specifically, it was observed that men's Attacks in the 1st (46±8% vs 31±8%, $p=0.002$) as well as Defences in the 1st time period of the bout were significantly greater than women's (40±11% vs 30±8%, $p=0.032$), (Figure 3). Similarly men's percentage of Actions at the Middle section of the piste was significantly greater than the relative women's percentage (57.6±8 vs 47.3±9.4 %, $p<0.02$).

DISCUSSION

The main finding of the present study was that men and women followed different tactical approach at elite level. More specifically, both men and women were equally effective in attack as well as in defence, according to the results of the attacking and defending coefficient efficacy (Wojciechowski, 1993). A significant difference was observed between attacking and defensive efficacy of both men and women suggesting that attacking is the preferable tactical choice for both genders, specifically at the middle section of the piste. These findings indicate that attacking and defending abilities are highly required in both genders for elite fencing performance.

Although male and female fencers had equal attacking efficacies, men were more active finishing their bouts earlier during the 1st time period of the bout, compared to women, who needed more time to finish their actual actions confirming Aquili's, et al., (2013) observations. This finding explains the shorter start-stop period presented in men's foil, a fact that resulted in shorter actual time duration of the bout.

On the other hand, it is notable that women finish their bout in the 2nd time period displaying a greater number of preparatory actions and changing of directions ending with several attacks in order to obtain a successful hit. However due to their longer duration and the slower rhythm of the bout, women have the chance to develop also defensive abilities against the opponent, using time more effectively in comparison to men (Wojciechowski, 1993). In addition, it has been previously suggested that women are less fast and powerful than men (Tsolakis et al., 2011) and therefore cannot perform advanced first intension movements that men can perform more easily (e.g., flicks, and contrattaque). In this way, women adapt the conventional tactical moves (attack, parries or compound attack and defences instead of contrattaque) (Barth and Beck, 2007), following classical technical patterns.

Men's work/rest ratio (1:3.3) is in accordance with previous studies which displayed similar results (Lavoie et al., 1985; Pignotti and Pessina, 2013), in contrast with women's ratio (1:2) determining the different metabolic profile between genders in foil fencers. Such differences in work/rest ratio have been previously noted between genders in epee fencers (Roi and Bianchedi, 2008). Particularly, in the present study the prolonged and multiple varieties of preparatory actions used by women in order to finish their actual actions associated to submaximal intensity before their final explosive thrust taxing proportionally much more the aerobic metabolic system. On the other hand, men used shorter time between start-stop referees' signals in order to complete their actions with greater intensity, recruiting thus the anaerobic lactic metabolism function and as a consequence larger break periods between effective fighting time was needed (Roi et al., 2001).

All of the above mentioned information indicates that in modern foil fencing, attacking actual actions have priority among other common tactical options. As a result, the choice of the right moment and the aim to surprise the opponent in order to attack, are crucial factors especially in a sport characterized by intense kinaesthetic perception (Roi and Bianchedi, 2008), creating thus appropriate aesthetic constants alongside the attacking distance with respect to the opponent (Williams and Walmsley, 2000).

As previously mentioned, men's attacking efficacy was greater than their defensive efficacy. This observation according to the results of the present study could be attributed either on men's competition characteristics (quick attacks taking the priority), finishing the bout in the 1st time period, and/or on the points that men gained by attacking in the different sections of the piste. Similarly and even women's preference to play on the back section of the piste under the opponents pressure and their slower competitive rhythm compared to men, women's attacking efficacy seemed to be also greater than their defensive efficacy.

From the current evidence, male fencers could be mainly characterized as ''permanently pressing'' fencers, attempting a high degree of motivation to impose their initiative controlling the opponent immediately after referees' signal to start, seeking the time to achieve a hit. As mentioned by Wojciechowski, (1993), this kind of fencers always tries to finish their tactical offensive plans, even if they miss their first attack. In the contrary, women rather adapt a ''manoeuvring-attacking'' style, since such fencers use attacks by changing distance and making a lot of preparatory actions changing easily to defensive mode. Additionally, women compared to men seemed to use different sections of the piste, so they could easily change their tactical choices as mentioned before (Wojciechowski, 1993). The above gender's tactical style, highlights that women may prefer to defend after a missing attack on the back section of the piste, adapting classical conventional tactics compared to men who try to regain the priority and attack again without to decline from their pre-organized tactical decisions.

CONCLUSIONS

The results of the present study give important information to fencing coaches relating to tactical elements such preference of final actions, time motion and piste section characteristics that foil fencers achieve their points in high-level competitions. As a result coaches can easily shape their fencers' tactical training according to the contemporary training trends. Although fencers' tactical options are associated with their personality (Czajkowski, 2005, 2009), the current results revealed that clear differences existed between genders.

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