

Football training program and injury prevention program WTA: a season of analysis with IT management Weakrisk Sportsolutions in Italian elite football players third division (Serie C).

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Abstract:

Purpose: The aim of this study is analyze the relationship with training program and injury prevention program in professional football players during competitive season in AJ Fano Calcio 1906 srl (Italian 3rd Division Serie C, 2019-2020). In fact, it is very important for the team to try to minimize or greatly reduce the incidence of injuries to ensure a better choice of players available to the coach according to the match. Our analysis will try to better understand the importance of creating an adequate postural set up by optimizing the functioning of the muscle kinetic chains, during the pre-training phase. Twenty eighth (n=28) elite football players took part in this study (age 21.4±3.3; body weight 79.7±3.4 ; height 182.4±5.5 ; fat mass 9.2±1.9 ;), without goalkeepers. In pre-season (4 weeks, from July to August) and during a season (December) the players performed yo yo intermittent recovery test level 2 (IR2), to evaluate aerobic and anaerobic performance before the start of season. At same time the players performed jump test (SJ, CMJ, CMJAS, JUMPS 15''), with Optojump Microgate (Microgate, Bolzano, Italy). Every player has been analyzed with K-GPS Live 50Hz (K-Sport Universal STATS, Montelabbate (PU), Italy) and Polar Team System PRO 2 (Polar Electro, Finland, OY) to recorder maximal heart rate during an intermittent test and official match. Every player has done from July (start pre-season) to February (in season), 300 sessions of WTA primitive prevention training program before and after training to prepare muscle chains to daily workout, 244 training during this period. Pre and post training program, performed on a daily basis, highlighted that AJ Fano Calcio 1906 srl, total incidence injury is 3.14/1000h, training incidence injury is 1.34/1000h and match incidence injury is 23.6/1000h, respectively - 23.4% to UEFA data total incidence injury (4.1/1000h), -46.4% to UEFA data training incidence injury (2.5/1000h) and 22.3% to UEFA data match incidence injury (19.3/1000h). In fact, this improvement in match injury (contact and non-contact), probably due, to difference level of football players: in professional third division there are players that have a reduced coordination and intervention times compared to top level players. This element is clear also in different energy cost (%ED) from different players level during official matches: first division (21.7±0.7%) vs third division (27±2.5%) (ES=3.05, p<0.05). This event represent energy expenditure during a match: third division has low physical, technical and tactical quality compare first division pro and players have high energy expenditure levels. Probably our hypothesis on this type of prevention program (primitive WTA) should be used already started youth to prepare muscle chains and improve coordination and movements in future athletes to reduce injuries.

KeyWords: prevention, training, GPS, postural setting, muscle chains.

Introduction

Soccer is an intermittent sport characterized by about 1200 acyclical and unpredictable changes in activity (each lasting from 3 to 5 s) involving, among others, 30 to 40 sprints, more than 700 turns and 30 to 40 tackles and jumps [1,2]. This team sport involves periods of high-intensity activity, interspersed with lower intensity actions, as well as technical and tactical components (Sparkes et al., 2018). Recent studies have pointed out that soccer players cover between 8000 m and 14000 m during a match (Aguiar et al., 2012) showing that several physical skills such as running, kicking, dribbling and tackling can affect soccer player's performance [3,4]. These efforts increase the physical demands of the players and contribute to characterize soccer, as a sport with high metabolic and physiological demands (Iaia et al., 2009; Arslan et al., 2017). Moreover, computerized time motion and video analyses have revealed that top class football players perform 2 to 3 km of high-intensity running (>15 km/h) and about 0.6 km of sprinting (>20 km/h). In addition, the less successful teams exhibit greater decrements in the total speed distance covered during the match, suggesting the importance to perform high intensity activities through football specific exercises (Iaia M. et al., 2009). In the last few years, different

training methods such as endurance training, high-intensity interval training (HIIT) and strength training have been proposed to develop physical, technical and tactical skills (Hammami et al., 2017) [5,6]. A number of studies have examined the effect of performing high-intensity training through football-specific exercises, showing that is possible to achieve an elevated exercise intensity using the ball, as demonstrated by elevated heart rates, marked blood lactate accumulations and high rate of perceived exertions (Iaia et al., 2009). The ability to perform intense exercise is a key component of performance in a football game. Studies have demonstrated that both male and female top-class football players perform considerable more high intensity running and more sprinting in a game compared to elite players at a lower competitive standard. The difference is mainly due to the players at the higher level carrying out a higher number of intense runs, which is related to a better ability to recover from intense exercise. Fatigue development in a game can be evaluated by fluctuations in high intense exercise throughout the game. In the most intense intervals during a game, a player can experience fatigue temporarily and needs to recover before other sequence of intense actions can be performed with a high quality (Bangsbo J. et al. 2018,2019). This is illustrated in figure 2 which shows high intensity running of a male elite player during a game divided into 5-minute periods. After the three most intense 5-minute intervals shown in blue, this player does considerable less high speed running in the following 5-minutes (highlighted in red) as he has to recover from the intense exercise in the demanding game-periods. This type of temporary fatigue is different from the fatigue towards the end of a game and requires different testing modes. The faster a player recovers the quicker the player can repeat another bout of intense exercise. Thus, the recovery capacity of a player should be evaluated to determine the ability to do football-specific intense exercise. In a football game the high intense running bouts range from 5-70 meters, but the majority of these runs are less than 20 meters. In addition, the player should be able to accelerate, decelerate and change direction, which are essential variables in intense football runs and need to be included in a football-specific test. Most of the high intense running bouts in a game at an elite level are performed at speeds between 14-21 km/h, which means that running at these speeds must be challenged in an intense intermittent test for football players[7,8]. This program is based on dynamic movement to activate muscles kinetics chains. Infact this muscle activation it allows to have better physical efficiency during the training (e.g. aerobic and anaerobic training), because there is a better muscles stretching than it activates muscles chains. Infact 30% of strength of a muscle is directed by the fascia (chain) which is fundamental to provide the intermuscular coordination necessary to recruit (for functional groups) the force itself. [9,10].

Materials and Methods

Twenty eighth (n=35) elite football players took part in this study (age 21.4±3.3; body weight 79.7±3.4; height 182.4±5.5 ; fat mass 9.2±1.9 ;), without goalkeepers. All athletes are elite players by Italian football championship. In order to be included in the study subjects had to 1) ensure regular participation in all the training sessions, 2) have competed regularly during the previous competitive season, and 3) possess medical clearance. Before entering the study, participants were fully informed about the study aims and procedures, and they provided written informed consent before the testing procedure. The study protocol was conformed to the code of Ethics of the World Medical Association (Declaration of Helsinki). The professional soccer team trained for approximately 1h five times per week (always on Monday, Tuesday, Wednesday, Thursday and Friday) plus the official match played on Saturday or Sunday.

The study was conducted during the competitive season 2019-2020 (i.e. from July to February) and we examined and recorded during this period 244 workout and 319 sessions of WTA primitive prevention training program before and after training to prepare muscle chains to daily workout and all days if necessary we have recorded injuries. Our database is Weakrisk Sportsolutions (Bergamo, Italy). The players physical activity during the matches and each training session was monitored using portable global positioning system (GPS) technology live 50 Hz (GPS, K-Sport, Universal STATS Montelabbate, PU, Italy) positioned on the upper back in a pocket of a custom made vest (K-Sport/STATS Vest). Several studies have investigated the validity and reliability of GPS devices for measuring movements and speeds (Rampinini et al., 2015), and as reported in a recent studies, a sample rate of 20 Hz is sufficiently accurate to quantify the very high intensity, acceleration and deceleration running phases in team sports. Furthermore all data have been recorded in Weakrisk Sportsolutions (Bergamo, Italy) for training analysis, the same for every physical problem, this database it owns an Injury Analysis and statistical analysis to count problem during training and match. (Tab.1, 2, 3, 4).

The protocol was characterized by WTA functional primitive prevention program before the training and after training (cool down), 66 hours 17 minutes 13 seconds (15.39%) total daily workout, 319 training sessions (6 times per week). All prevention training session WTA primitive has been recorded in database Weakrisk Sportsolutions (Bergamo, Italy), to analyze minutes, number of sessions, type of exercises and percentage of use. Players absence it was the first leg 0.5 players for match, in second leg 0.0 players for match. All championship Italian 3rd division (Serie C), it was 0.4 players for match. (Fig.1.). We analyzed variables with d-Cohen (effect size; ES), to compare between 2 different Equivalent Distance Percentage (%ED). An alpha level of p< 0.05 was chosen. The statistical analyses were performed with SPSS (SPSS, Inc., Chicago, IL, USA). Data are presented as absolute value and different percentage. Effect size dimension is low from 0 to 0.4, moderate from 0.5 to 0.6 and large from 0.7 to 1.0.

Results

Pre and post training program, performed on a daily basis, highlighted that AJ Fano Calcio 1906 srl, total incidence injury is 3.14/1000h (Fig.2.), training incidence injury is 1.34/1000h (Fig.3.) and match incidence injury is 23.6/1000h (Fig.4.), respectively -23.4% to UEFA data total incidence injury (4.1/1000h) (Fig.2.), -46.4% to UEFA data training incidence injury (2.5/1000h) (Fig.3.) and 22.3% to Uefa data match incidence injury (19.3/1000h)(Fig.4.). Infact, this improvement in match injury (contact and non-contact), probably due, to difference level of football players: in professional third division there are players that have a reduced coordination and intervention times compared to top level players. This element is clear also in different energy cost (%ED) from different players level during official matches: first division (21.7±0.7%) vs third division (27±2.5%) (ES=3.05, p<0.05)(Fig.5). Instead not availability and availability players AJ Fano Calcio 1906 was 2.36% vs 97.64% respectively (Fig.6). This event represent energy expenditure during a match: third division has low physical, technical and tactical quality compare first division pro and players have high energy expenditure levels. Probably our hypothesis on this type of prevention program (primitive WTA) should be used already started youth to prepare muscle chains and improve coordination and movements in future athletes to reduce injuries. According to our research the key element for reduce injuries or prevent them is the constancy of daily workout.

Tab.1. Injuries Severity AJ Fano Calcio 1906 srl season 2019-2020 (by Weakrisk Sportsolutions)

INJURIES SEVERITY	INJURIES (n)	DAYS	%
Excluded flu, internal med., other	34	283	72.34%
Injury Total Average Days Absence		6.85	
Injury Severity Average Days Absence		49	
Injury Severity Sum Days		98	
N° injuries > 14 days joints	1	27	2.13%
N° injuries > 14 days muscle	1	38	2.13%
Reinjury early < 2 months	0	0	0.00%
Reinjury late tra 2 e 12 months	1	6	2.13%
Reinjury delayed >12 months	1	4	2.13%
Players(n)	35		

Tab.2. Injuries Number AJ Fano Calcio 1906 srl season 2019-2020 (by Weakrisk Sportsolutions)

INJURIES NUMBER	INJURIES (N)	DAYS	%
Slight (1-3 days)	22	44	47%
Minor (4-7 days)	14	64	30%
Moderate (8-28 days)	9	116	19%
Severe (>28 days)	2	98	4%
Total	47	322	100%
N° Training Injuries	20	124	42.6%
N°Match Injuries	14	159	29.8%
Flu Diseases	1	1	2.1%
Internal Med Diseases/Other	12	38	25.5%
Players(n)	35		

Tab.3. Injury Exposure AJ Fano Calcio 1906 srl season 2019-2020 (by Weakrisk Sportsolutions)

Injury Exposure	Minutes	Hour
Total Exposure Time	25879	431.3
Training Exposure Time	22627	377.1
Match Exposure Time	3252	54.2
Ratio (TET/MET)	7.0	7.0
Training incidence injury/1000h	1.32	
Match incidence injury/1000h	23.57	
Total Incidence Injury/1000h	3.11	
moderate and severe incidence injury/1000h	0.33	

Tab.4. Injuries Number AJ Fano Calcio 1906 srl season 2019-2020 (by Weakrisk Sportsolutions)

SEASON	2019/2020 (JUL 19-MAR 20)
INJURIES (N)*	48*
INJURY DAY LOST (N)	334
% NOT AVAILABILITY	2.36
% AVAILABILITY	97.64
* INCLUSIVE ILLNESSES AND INTERNAL MEDICINE	

Discussion

Probably our hypothesis on this type of prevention program (primitive WTA) should be used already started youth to prepare muscle chains and improve coordination and movements in future athletes to reduce injuries.

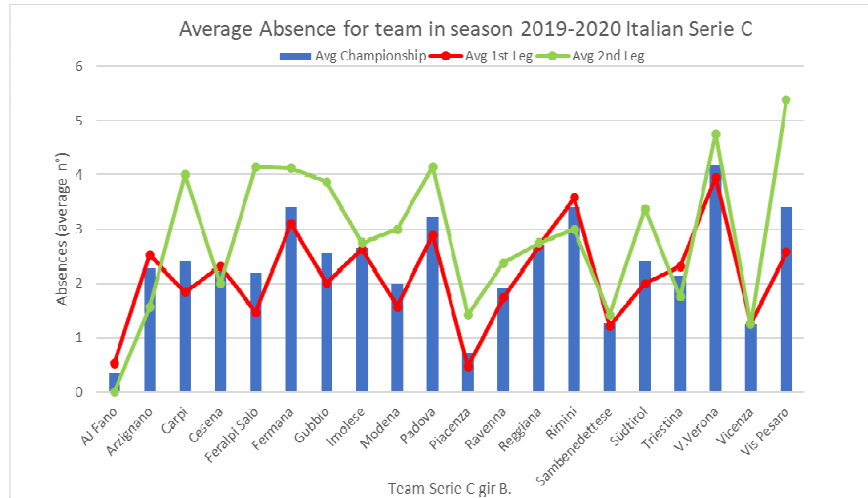


Fig.1. Average absence for team in season 2019/2020 Italian Serie C (Group B) (by Weakrisk Sportsolutions)

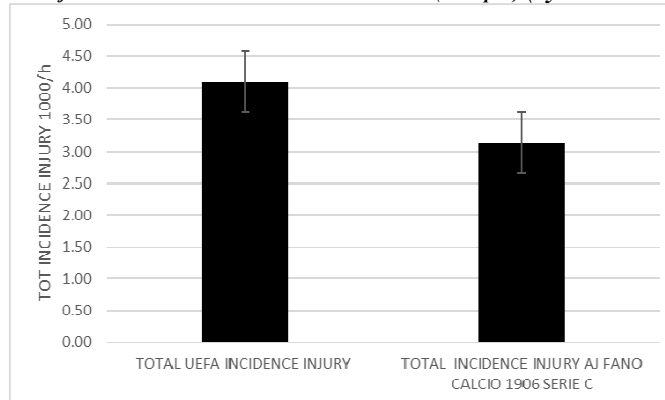


Fig.2. Total incidence injury 1000/h UEFA vs AJ Fano Calcio 1906 (% diff. -23.40%; p<0.05* statistically significant)

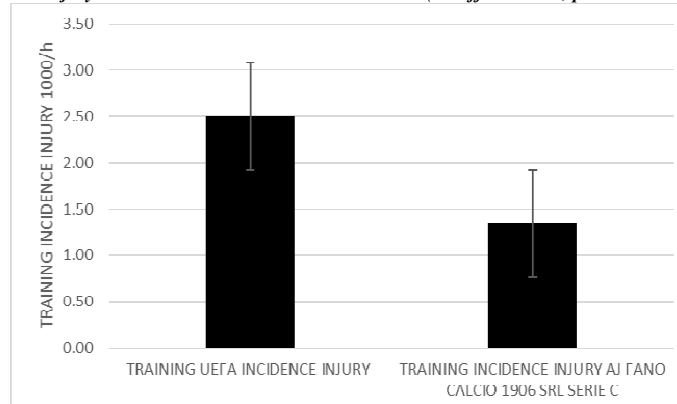


Fig.3. Training incidence injury 1000/h UEFA vs AJ Fano Calcio 1906 (% diff. -46.40%; p<0.05* statistically significant)

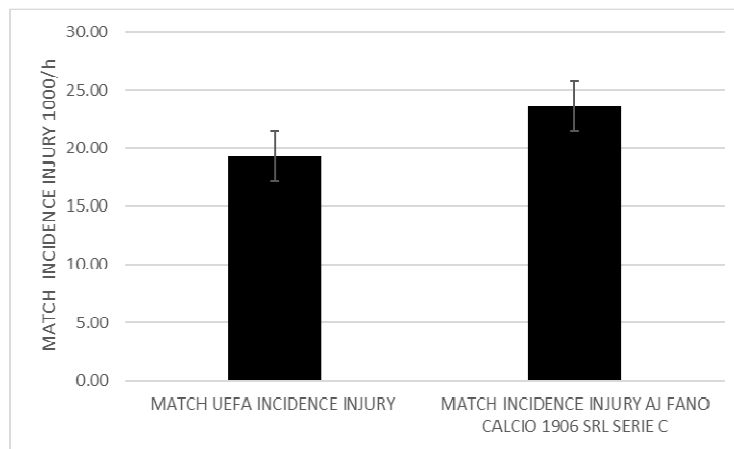


Fig.4. Match incidence injury 1000/h UEFA vs AJ Fano Calcio 1906(% diff. 22.30%; $p<0.05^*$ statistically significant)

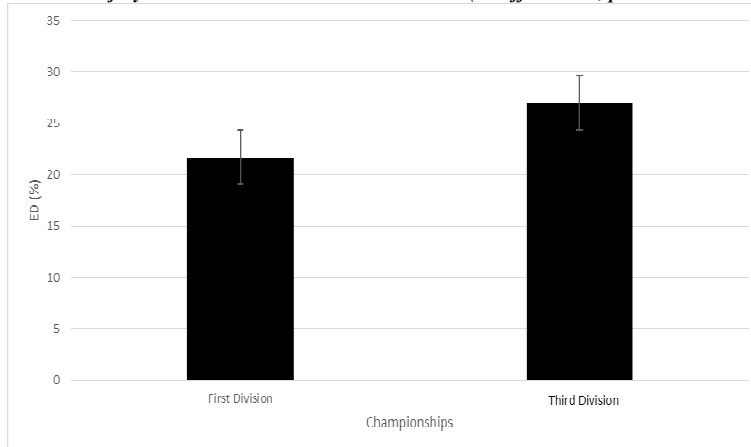


Fig.5. %ED First division vs AJ Fano Calcio 1906 (ES=3.05, $p<0.05^*$ statistically significant)

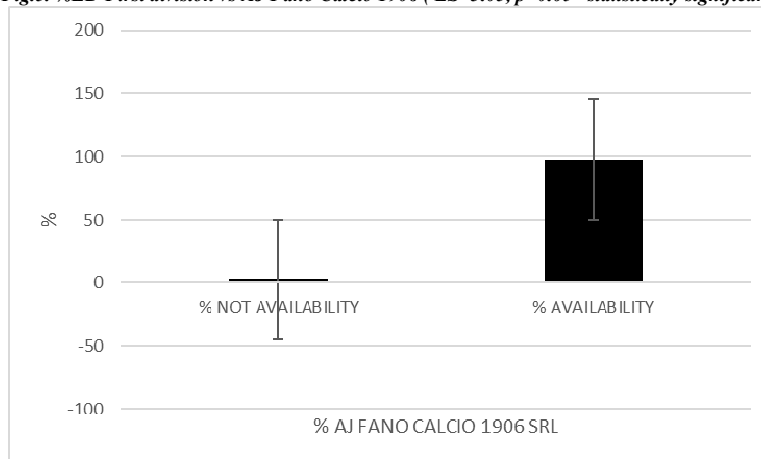


Fig.6. % Not availability and availability players AJ Fano Calcio 1906 (2.36% vs 97.64%; $p<0.05^*$ statistically significant)

Conclusion

To establish effective prevention programs, it is essential to identify the risk factors associated with their occurrence. The results of this study suggest that maintaining consistency in coaching contributed to reducing the number of muscle strain injuries. Therefore, increased attentiveness on the part of trainers and medical teams during coaching transitions and to the impact of new training regimens is necessary to decrease injury risk in professional football. For example is important to perform before and after training, functional primitive movement WTA with joint mobility to prepare and activate muscles chains, in which the proprioceptors reside. An other element, very important is to create a database and recorded every aspect from training. It's necessary to know, as well as training load analysis, number, minutes, percentage of every training session: What was done and how we did it and how much. We believe that know absence for official match create a great information for staff and allow to quantify healthcare cost for company: more players are injured

more medical costs increase. This prevention program in our case allowed to reduce total incidence injury compared with UEFA training study data (Ekstrand J. et al.; 2002;2019), from 23.4%. An aspect for this program is to be constant in workout daily program to achieve results.

Conflict of interest: No conflict interest

Author Contributions:

Conceptualization: Giovannelli M., Izzo R.
 Methodology: Izzo R., Giovannelli M.
 Validation: Izzo R., Cejudo A, Raiola G.
 Formal analysis: Giovannelli M., Sainz De Baranda P.
 Investigation: Giovannelli M., Cejudo A.
 Resources: Giovannelli M.
 Data curation: Chinè V., Sainz De Baranda P., Raiola G.
 Writing, original draft preparation: Giovannelli M., Izzo R.,
 Writing, review and editing: Izzo R., Giovannelli M.

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Declaration of interest statement

For this study there is no conflict interest. The study protocol was conformed to the code of Ethics of the World Medical Association (Declaration of Helsinki).

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