Effect of the level of physical fitness and game participation on attitudes toward doping of elite U-20 soccer players

Report to
World Anti-Doping Agency

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Project summary

Several studies have reported that prohibited substances are being used by young people with an increasing trend. Over 60% of them participate in competitive sports. The majority of participants in these studies were high school or university students from a variety of sports. However, during competition or during games of high importance where athletes are under pressure to perform their best, the number of doping cases and the use of dietary supplements increase significantly. During 2002 and 2006 FIFA World Cup 35% of the football players used dietary supplements before the match and 43% during the tournament. In addition, Canadian athletes used more than 4 dietary supplements per person during the Sydney Olympic Games. There are also reports of high legal and illegal supplements and medications during very demanding sports such as during Tour De France. However, although most prevention studies have focused on social and psychological factors affecting doping behaviour, to our knowledge, no studies have examined a possible link between low physical capacity compared to the demands of the sport and doping attitude of athletes, especially on young athletes who are on the final selection step before signing professional contracts. Under-20 (U-20) talented soccer players from top soccer clubs will participate in the study, since there are in the final selection step, and some of them will sign professional contracts. In addition, soccer, requires high physical demands since, during a competitive match, elite players cover an average of 10-13km at approximately 85-90% of their maximum heart rate (HRmax) [4, 13] which corresponds to approximately 75-80% of maximal oxygen uptake (VO_2max). Since they are in the final academy level they are under pressure to succeed and they also face the high physical demands of the game. Therefore, the purpose of the study was to examine doping and supplementation attitude and belief in young talented athletes who compete at high level during adolescent and they are under pressure to succeed. It was hypothesized that U-20 talented soccer players with limited physical capacity will have significantly more positive doping and supplementation attitude and belief compared to more fit players. Also, players with limited competition participation during in-season will have significantly more positive doping and supplementation attitude and belief compared to starters. During in-season all soccer players will exhibit more positive doping and supplementation attitude compared to their early preseason attitude.

The main findings of the present project were:

I. U-20 soccer players are generally not tolerant in relation to doping attitudes. However, small differences were found between different groups indicating that differences in physical performance parameters and/or game participation lead some players to be a little more permissive toward doping compared to others.
II. High VO_2max starters and non-starters have higher PEAS score compared to low VO_2max starters and non-starters.
III. High V_{OBLA} starters have significantly lower PEAS score compared to all other groups (high V_{OBLA} non-starters, low V_{OBLA} starters and low V_{OBLA} non-starters).
IV. Non-starters tend to have higher PEAS compared to starters.
V. High VO_2max non-starters tend to have higher PSS compared to high VO2max starters. Low VO_2max starters tend to have higher PSS compared to low VO_2max non-starters.
VI. High V_{OBLA} players tended to have higher PSS score compared to low V_{OBLA} players

Research problem/research question

The increasing use of prohibited substances among male athletes during adolescence is well documented. The time period between 17 and 20 years of age, is very important in the professional career of a young talented soccer player, since during this period some of the talented players are offered professional contracts and become part of the professional team. Also, during this period, the talented soccer players participate in official and friendly competitions organized by national or international organizations (e.g. FIFA) and during the games coaches and scouters from all over the world evaluate the athlete's overall performance. Therefore, it is critical for U-20 (ages between 17 and 20 years) soccer players to perform their best during competition. Using computerized game video analysis and laboratory testing, it has been demonstrated that low physical capacity, fatigue and limited participation will not allow a soccer player to fully demonstrate his technical and tactical skills during the game and performance will suffer especially in the second half of the game[13, 26]. In addition, limited participation in national or international competition, may limit the talented athlete's chances for a professional career. During adolescence, the use of prohibited substances among male athletes is well documented. While there are various reasons for the increased use of prohibited substances, several studies using questionnaires have demonstrated that the need for performance improvement and participation in competition are critical factors in an athlete's decision to use prohibited substances or dietary supplements [3, 12]. To our knowledge, although several studies have examined the attitude toward doping in young athletes using questionnaires [16, 17, 24] there are no studies to date examining the relationship between low physical capacity, early fatigue onset or reduced participation in competition games and doping or supplementation attitude in young talented soccer players during this critical period for their future career. Therefore, the purpose of the study is to examine if lower levels of physical capacity and increased levels of fatigue affect doping and supplementation attitude and belief of U-20 talented soccer players. A secondary objective is to evaluate the doping and supplementation attitude and belief of soccer players with limited game participation compared to starters. A third objective is to examine the differences in behaviour during the soccer season. The main research questions to be answered are: a) What is the doping and supplementation attitude and belief of talented U-20 soccer players with lower than average physical capacity and higher levels of fatigue compared to their (more fit) teammates? b) What is the doping and supplementation attitude and belief of talented U-20 soccer players with limited participation in competition compared to starters? c) How does the doping and supplementation attitude and belief changes from preseason training to in-season competition in these players?

Review of scientific literature

The use of performance enhancing substances (prohibited substances and dietary supplements) is a common phenomenon in the world of sports. Several authors have attempted to identify the risk factors or predictors for this phenomenon since understanding the aetiology of such behaviour will allow the implementation of more effective doping prevention programs. Backhouse et al.[3] examined doping attitude and beliefs across nutritional supplement users and nonusers in a sample of competitive athletes using an online questionnaire. They found that self reported doping use was 3.5 times more prevalent in nutritional supplement users than nonusers among competitive athletes. Although this study supports the theory that use of legal dietary supplements may place an athlete at an "at risk" group for transition toward doping, it does not explain the reasons for such behaviour. Bloodworth et al.[7] examined attitude toward doping and supplementation in British athletes who were part of the "Talented Athlete Scholarship Scheme" using anonymous questionnaire. Results showed that among male athletes, the belief about the necessity of using supplements to be successful recorded the highest significant association with augment strength. Also, those participants who were convinced of the necessity of supplementation for sporting success were more likely to express more permissive beliefs for performance enhancing substances. Sporting success was also a driving factor in the use and intention to use performance enhancing substances by young athletes in a study conducted by Goulet et al[12]. They studied 3573 athletes from various sports or athletes who took part in civic or school leagues in Canada. They found a significant relationship between performance enhancing substances use and intention to use, suggesting that young athletes who felt that performance enhancing substances will help them improve to a higher level, will be inclined to develop the intention to use them. Other studies indicate increased use of legal or illegal medications or supplements during international sport events. During the Olympic Games in Sydney almost 80% of the athletes used some form of medication [10] and during the Olympics in Athens the positive doping results were doubled[29]. During FIFA Soccer World Cup in 2006, 43% of all players had taken dietary supplements during the tournament and almost 1 in every 3 players (35.4% on average) used dietary supplements before the match [28]. In addition 69% of the participants used medications during the tournament and 43% used medication prior to a match. Therefore, based on the literature, it appears that during competition, the combination of the pressure to win and the financial or career motives may alter the doping and supplementation attitude of many elite athletes. However, although all elite athletes may feel some pressure to win and may have some financial or social motives in important competitions, the reasons why some of them have more positive attitude toward supplementation compared to others in the same team, remain unknown. It appears that although winning may influence what athletes think about doping, it does not necessarily relate to their doping behaviour. Petroczi [24] showed that only expressed belief had a significant link to doping behaviour. Therefore, doping belief measures (along with performance enhancing attitude measures) may provide additional information concerning components that may influence doping behaviour in elite athletes.

Anshel[1] noted that athletes feel the external pressure to win in the form of warning about exceptionally good opponent. This finding indicates that level of physical capacity of an athlete before or during important competition periods, may have an impact on the degree of pressure he feels and on his doping and supplementation attitude. However, to our knowledge, there are no studies to investigate if reduced physical capacity and muscle fatigue have a significant impact in an athlete's attitude toward doping and supplementation during important periods in his career. The high physical demands of a specific sport or competition may exert additional pressure in an athlete for the use of legal or illegal performance enhancing substances. For example, high level soccer performance requires technical, tactical, mental skills as well as physical capacities. During a competitive match, elite players cover an average of 10-13km [4,19] at approximately 85-90% of their maximum heart rate (HRmax) [4,13] which corresponds to approximately 75-80% of maximal oxygen uptake (VO_2max)[2]. During the last 10 years an increasing emphasis is placed on physical capacities soccer players, since it was found that the most successful teams had greater physical capacities compared to less successful teams [16,27].

However, many authors argue that the use of prohibited substances starts during adolescence [8, 11, 32] and more than sixty percent of users were engaged in competitive sports. Therefore the purpose of the study is to examine doping and supplementation attitude and belief in young talented athletes who compete at high level during adolescent and they are under pressure to succeed. U-20 from soccer players from top European soccer clubs, are an excellent sample to study since they are elite soccer athletes, who are in the final step before signing a professional contract and their performance during this period is a decisive factor for their future career.

Research hypotheses

U-20 talented soccer players with limited physical capacity will have significantly more positive doping attitude and belief compared to more fit players. Also, players with limited competition participation during in-season will have significantly more positive doping and supplementation attitude and belief compared to starters. During in-season all soccer players will exhibit more positive doping and supplementation attitude and belief compared to their early preseason attitude.

Research design/approach to the problem

A total of 115 male soccer players from the U-20 team of five professional soccer clubs agreed to participate in the study. Goalkeepers, injured players at the time of testing, and those that missed more than 7 days of training in a 4 week period prior to testing were excluded from the study. Furthermore players that were unavailable for the second test due to loan/transfer to another club were also excluded from the study. The participating clubs were selected based on two following criteria: 1) The U-20 team was placed among the top 6 clubs in the nation during the 2011-2012 soccer season. The second criterion to be met is one of the following two criteria: 2a) The professional team of the soccer club was ranked within the top 3 in the country and participate in FIFA Competitions (Champions League or Europa League) during the last 3 years or 2b) The U20 team had a long history of developing successful professional soccer players who were then transferred to higher ranked professional soccer clubs. The 2a and 2b criteria were selected in order to study U-20 players who will have a strong motive (career motive and financial) to maximize their performance and become part the professional team. Players from U-20 soccer teams instead of individual U-20 soccer players were selected to participate in the study, in an attempt to minimize the effect of external factors (e.g. different training program, competition levels, etc) on the results. All players in each participating team are trained in a similar way, they compete in similar level and they have similar motives. All participants performed lab physical tests to examine physical fitness (aerobic capacity) and fatigue levels (early fatigue onset) two times within the year (early pre-season and during mid-season).

Aerobic capacity was evaluated based on VO_2max and velocity at VO_2max (vVO_2max). Early onset of fatigue was evaluated based on lactate curve analysis using velocity at 2 different lactate concentrations (velocity at 4 mM lactate and velocity at 5 mM lactate)[18] as well as the velocity at lactate threshold (vOBLA, velocity at which lactate starts to accumulate in blood). Although all players trained under similar conditions, based on our experience it was expected that during the first testing in early pre-season, most players will be within team average. However, some players in each team had low aerobic capacity (at least 10% lower compared to team average) and/or early onset of fatigue (5% lower running velocity at 4 and 5 mM lactate compared to team average). We believe that genetics, training background and training volume/intensity/frequency during off-season were the main reasons for the observed differences. During in-season, although all players trained together, differences in aerobic capacity and fatigue were observed mainly due to differences in competition participation (starters vs. non-starters) and due to differences in intensity by which each player performed daily training.

In order to test our hypotheses, maximal oxygen uptake (VO_2max), velocity at maximal oxygen uptake (vVO_2max), velocity at lactate threshold (vLT), and velocities at fixed blood lactate concentration of 4 mM (V4) and 5 mM (V5) were determined using a single incremental treadmill test with simultaneous respiratory gas exchange analysis and blood lactate measurements. In order to obtain reliable measures for the respiratory variables and blood lactate values, incremental test design (e.g stage duration) was selected according to proposed recommendations[5]. Experimental testing took place in two laboratories (one at Ioannina Medical School, and one at SportsClinic, Thessaloniki) using the same equipment at an ambient temperature of 20 to 22°C. All participating teams were tested within 2 consecutive weeks, from 9am to 3pm depending on the number of players from each team. The same testing schedule was used for all participating teams. Therefore circadian rhythm had probably the same impact on every team. All testing was conducted during the first two weeks of the preseason training period and was repeated five months later. During the last day prior to testing all participants performed 20-30 min of moderate intensity running. Due to different starting dates in each team, testing was not performed during the same week of the month, but all players were tested in the same period of the soccer season.

All players were familiar with the procedures, discomforts and possible risks of the maximal testing procedure since these types of tests are commonly used for monitoring soccer player performance. However, for those who were not familiar with the procedures a 15 minute familiarization procedure was performed prior to testing. Furthermore before commencement of testing all subjects were again informed about the experimental procedures, fill out a medical questionnaire and signed a consent form according to the Declaration of Helsinki. Ethical approval application was submitted by the Institutional Review Board of Human Subjects.

Subjects reported to the laboratory having abstained from caffeine for 4 hours and without vigorous training for 48h. They had also been given instructions to follow a high carbohydrate meal (60% carbohydrates, 300-400kcal) 4 hours prior to testing. Height and weight was measured using calibrated statiometer and scale (Seca, Germany). Percent fat was assessed using a skinfold caliper (Lange, Beta Technology, California, USA) and calculated based on the 7-site Jackson and Pollock formula[14].

Before warm-up resting lactate was measured. During warm-up subjects performed 3 minutes walking at self-selected pace and 5 minutes jogging on a treadmill (Technogym Runrace 1200, Italy) at a speed of 8kmh^{-1} where heart rate and lactate were measured. Then, subjects performed an incremental exercise test with expired gas and heart rate analysis (CPX Ultima Series, Medical Graphics, USA) to volitional exhaustion to determine VO_2max, vVO2max, vLT, V4, and V5. Prior to each test, all analyzers were calibrated according to manufacturer instructions. The initial speed was set at 10 kmh^{-1} and increased by 2 kmh^{-1} every 3 minutes until volitional exhaustion [5]. At the end of each 3-minute stage subjects grasped the side bars of the treadmill and moved their feet on the sides of the treadmill belt. Capillary blood samples were then be collected and analyzed for lactate (Lactate Scout, Roche Diagnostics, Germany). Subjects recommenced running within 20 sec. Criteria for VO_2max were (a) plateau in VO_2 (an increase <2.1 mlkg^{-1}min^{-1} despite an increase in running speed), (b) RER > 1.10, (c) HR +/- 5% of age predicted HRmax and (d) maximal blood lactate after exercise (LAmax) >8 mmoll^{-1}. In all cases at least 3 out of 4 criteria were required. Blood lactate values was plotted against speed and the data were fitted using a 3rd degree polynomial curvilinear regression. The D-max method was used for LT determination [9]. The reliability of the D-max method has been assessed elsewhere and appears to be the most sensitive and valid measure of LT velocity in endurance runners [23]. Furthermore V_4 and V_5 were calculated using the 3rd degree polynomial equation.

Within 2 weeks following the laboratory testing date subjects were instructed to fill in a specific questionnaire which contained three (3) parts: 1) a demographic section 2) a questionnaire regarding doping and supplementation attitudes and 3) a questionnaire to measure attitude and expectations of competitive sports participation. The same questionnaire was completed by athletes after each laboratory testing (2 times during the year). To ensure that fatigue or intensity of training did affect results, resting levels of blood lactate were measured before distribution of questionnaires and soccer trainers were instructed to avoid exercise training intensity above 85% of HRmax for at least 36 hours prior to this procedure. After completion of the second test, the coaching staff of each team provided total playing time for each player during a competitive half-season. Players were ranked as starters if the had played in >65% of the total playing time. Non-starters had participated in < than 65% of the total playing time.

Doping and supplementation attitudes were assessed using the Performance Attitude Scale (PEAS). PEAS uses a 17- item, 6-point Likert type scale. The PEAS total score ranges from 17 to 102 giving a theoretical average of 59.5[20]. Previous studies have shown that PEAS is a reliable method for assessing self-declared attitude toward doping. The Cronbach's alpha values range from 0.79 to 0.91[25]. In addition, attitude and expectations from competitive sports participation was examined using the Perfectionism in Sport Scale (PSS). PSS is a 24 item; 5-poing Likert type scale, with Cronbach's alpha coefficient for this scale is 0.80. The score ranges from 24 to 120[1]. Doping Use Belief (DUB) statements were also used to hypothetically estimate doping behaviour, as described by Petroczi[24]. Coded numbered questionnaires were used to ensure anonymity of the results. Only the Principal Investigator (PI) and research assistants knew which player names matched the codes of each questionnaire.

Statistical analysis: Based on our hypotheses the dependent variables of the present study were PEAS, PSS and DUB scores with one within-subjects factor (season: pre-season/mid-season). Independent variables were aerobic capacity (high vs. low VO_2max and high vs. low vVO_2max), fatigue onset (high vs. low V4, high vs. low V5, high vs. low vOBLA) and playing time (starters vs. non starters). To test our hypotheses we used a 3-way ANOVA with aerobic capacity/fatigue onset and playing time as between subjects' factor and season as within-subjects' factor. Significant main effects and interactions were investigated with a Fisher least significant differences post hoc test. The level of significance was set at $\alpha = 0.05$. Based on sample size estimation, a sample size >70 subjects was required for statistical power >80%. Results are mean±standard deviation unless stated otherwise.

Results

From the original sample of 115 players we excluded 12 goalkeepers, 9 players were unavailable for the mid-season test due to loan/transfer to another club, 5 players were injured at the mid-season test or had missed >7 days of training in a 4 week period prior to testing. From the remaining 89 players, 17 were excluded from the analysis since both their aerobic capacity and their fatigue onset were within total sample average. Thus the final sample consisted of 72 players. Based on the individual playing time, players were subsequently divided into starters (n=37) and non starters (n=35 group). The questionnaires scores and physical performance variables of the total sample is presented in TABLE 1.The questionnaires scores and physical performance variables of the starters and non-starters groups are presented in TABLE 2 and TABLE 3 respectively.

TABLE 1. Total sample (n=72) questionnaires scores and physical performance variables during pre-season (pre) and mid-season (mid) testing.

PEAS		DUB		PSS		VO_2max		vVO_2max		V4		V5		vOBLA	
Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid
37 ±10	35 ±9	1 ±1	1 ±1	77 ±10	79 ±8	58.6 ±4.2	57.8 ±3.9	16.7 ±1.4	17.1 ±1.1	13.8 ±1.3	14.5 ±0.9	14.5 ±1.2	15.2 ±0.9	12.9 ±1.0	13.6 ±0.8

TABLE 2. Starters (n=37) questionnaires scores and physical performance variables during pre-season (pre) and mid-season (mid) testing.

PEAS		DUB		PSS		VO_2max		vVO_2max		V4		V5		vOBLA	
Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid
35 ±11	34 ±8	1 ±2	0 ±1	76 ±12	80 ±9	58.6 ±4.5	58.1 ±4.1	17.0 ±1.1	17.3 ±0.9	13.9 ±1.0	14.7 ±1.0	14.6 ±1.0	15.3 ±0.8	13.1 ±0.8	13.8 ±0.7

TABLE 3. Non-starters (n=35) questionnaires scores and physical performance variables during pre-season (pre) and mid-season (mid) testing.

PEAS		DUB		PSS		VO_2max		vVO_2max		V4		V5		vOBLA	
Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid	Pre	Mid
39 ±10	37 ±9	1 ±1	1 ±1	78 ±8	79 ±7	58.8 ±3.9	57.4 ±3.7	16.4 ±1.6	16.9 ±1.3	13.6 ±1.5	14.4 ±1.0	14.3 ±1.4	15.1 ±1.0	12.7 ±1.1	13.4 ±0.9

Median values for the physical performance variables of the average sample values were used to split the total sample into high and low subgroups. Subsequently we examined the effect of aerobic capacity/fatigue onset and playing times on attitudes toward doping.

Effect of high vs. low aerobic capacity (based on VO_2max) and playing time (starters vs. non-starters) on attitudes toward doping, doping belief and expectations from sports participation

The median value for VO_2max was 58.7 ml·min^{-1}·kg^{-1} and there were 33 players with high aerobic capacity (VO_2max >58.7 ml·min^{-1}·kg^{-1}) and 39 players with low aerobic capacity (VO_2max ≤58.7 ml·min^{-1}·kg^{-1}). For the high aerobic capacity group, 18 out of 33 (54.5%) players were starters and 15 out of 33 (45.5%) were non-starters. For the low aerobic capacity group, 19 out of 39 (48.7%) players were starters and 20 out of 39 (51.3%) were non-starters. Thus there were four groups: Group A = high VO_2max - starters (n=18), Group B = high VO_2max - non-Starters (n=15), Group C = low VO_2max - starters (n=19) and Group D = low VO_2max - non Starters (n=20). The results for the effects initial aerobic capacity (VO_2max) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation are presented in TABLE 4, TABLE 5 and TABLE 6 respectively.

TABLE 4. Main effects and interactions for PEAS score. Significant main effects and interactions are indicated by *.

Effect	F	p
aerobic capacity	7.493	0.008*
playing time	3.52	0.06
aerobic capacity*playing time	0.116	0.735
season	1.597	0.211
season*aerobic capacity	0.011	0.916
season*playing time	0.063	0.802
season*playing time*aerobic capacity	0.911	0.343

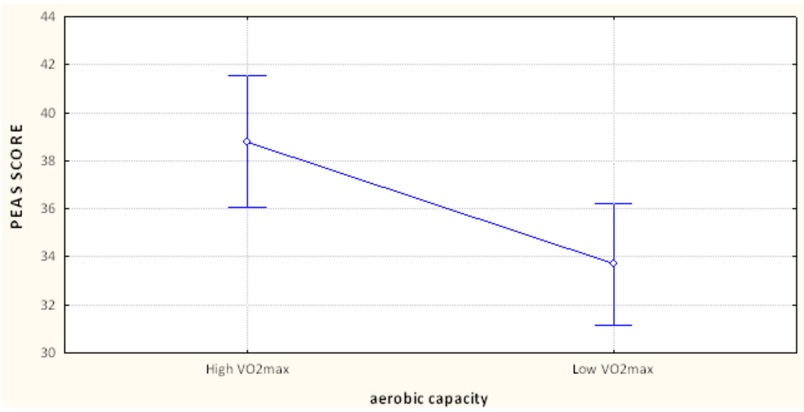
TABLE 5. Main effects and interactions for DUB score. Significant main effects and interactions are indicated by *.

Effect	F	p
aerobic capacity	0.974	0.327
playing time	0.00	0.989
aerobic capacity*playing time	1.498	0.225
season	0.893	0.348
season*aerobic capacity	0.731	0.396
season*playing time	0.246	0.621
season*playing time*aerobic capacity	0.097	0.756

TABLE 6. Main effects and interactions for PSS score. Significant main effects and interactions are indicated by *.

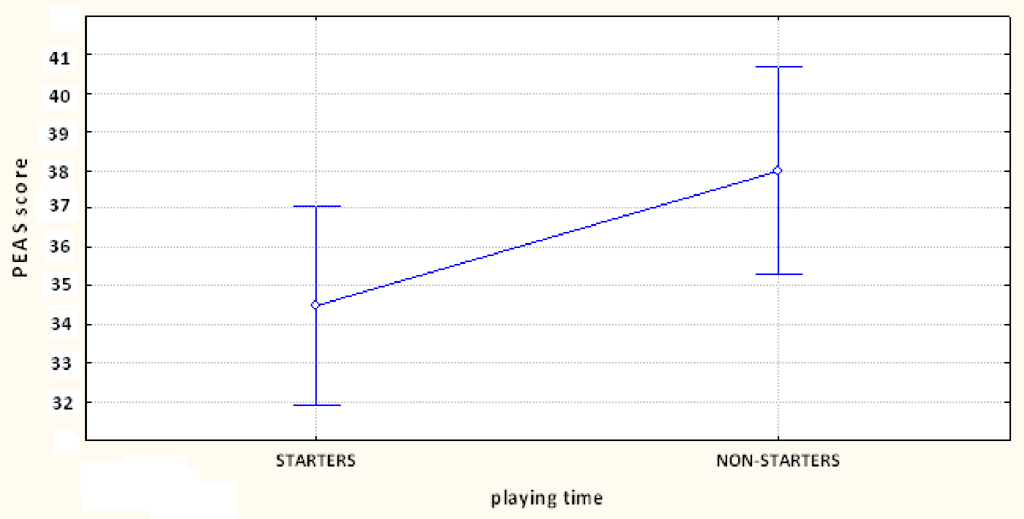
Effect	F	p
aerobic capacity	0.022	0.881
playing time	0.130	0.720
aerobic capacity*playing time	3.975	0.05
season	1.960	0.166
season*aerobic capacity	0.127	0.722
season*playing time	2.057	0.156
season*playing time*aerobic capacity	2.294	0.134

Results indicated that there was a significant main effect for aerobic capacity (VO_2max) [F=7.493, p=0.008] on PEAS score (TABLE 4). High VO_2max players had significantly higher PEAS score compared to low VO_2max players (38.7 vs. 33.7) (Graph 1).



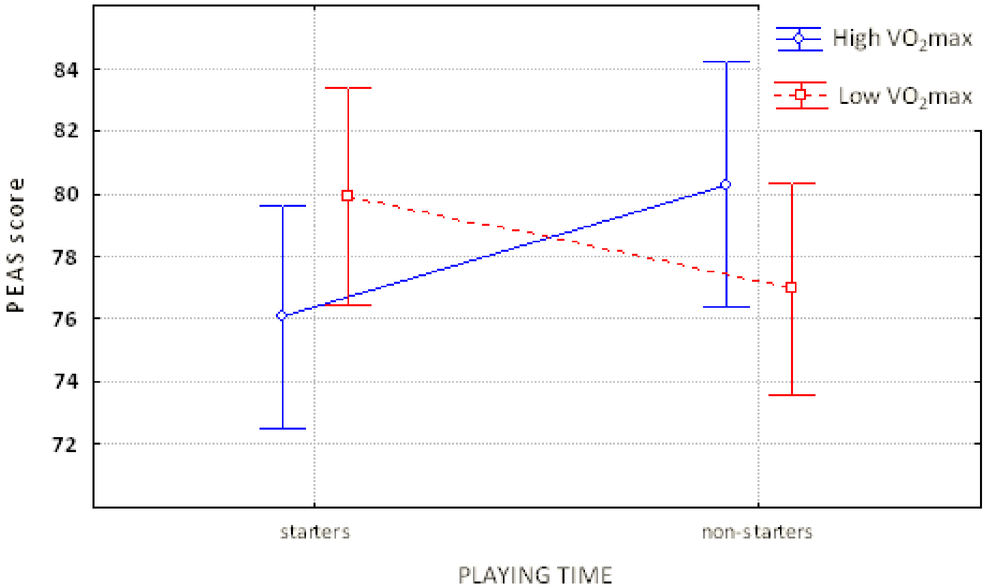
Graph. 1 Main effect for aerobic capacity (VO_2max) on PEAS score.

There was a trend for playing time [F=3.519, p=0.06] on PEAS score. Non-starters tended to have higher PEAS score compared to starters (38.1 vs. 34.6) (Graph 2).



Graph 2. Trend for playing time on PEAS score.

There was not any significant main effect or interaction on DUB scores (TABLE 5), however there was a trend for aerobic capacity and playing time on PSS score [F=3.975, p=0.05] (TABLE 6). Specifically in the high VO_2max group starters tended to have lower PSS score compared to non-starters (76.1 vs. 80.3), while the opposite occurred in the low VO_2max group with starters having a tendency for higher PSS score compared to non-starters (Graph 3).



Graph 3. Trend for aerobic capacity and playing time on PSS score.

Effect of high vs. low aerobic capacity (based on vVO_2max) and playing time (starters vs. non-starters) on attitudes toward doping, doping belief and expectations from sports participation

The median value for vVO_2max was 16.5 km · h^{-1} and there were 33 players with high aerobic capacity (vVO_2max >16.5 km · h^{-1}) and 39 players with low aerobic capacity (vVO_2max ≤16.5 km · h^{-1}). For the high aerobic capacity group, 20 out of 33 (60.6%) players were starters and 13 out of 33 (39.4%) were non-starters. For the low aerobic capacity group, 17 out of 39 (43.6%) players were starters and 22 out of 39 (56.4%) were non-starters. Thus there were four groups: Group A = high vVO_2max - starters (n=20), Group B = high vVO_2max - non-Starters (n=13), Group C = low vVO_2max - starters (n=17) and Group D = low vVO_2max - non Starters (n=22). The results for the effects initial aerobic capacity (vVO_2max) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation are presented in TABLE 7, TABLE 8 and TABLE 9 respectively.

TABLE 7. Main effects and interactions for PEAS score. Significant main effects and interactions are indicated by *.

Effect	F	p
aerobic capacity	1.296	0.259
playing time	2.215	0.141
aerobic capacity*playing time	0.124	0.726
season	1.721	0.194
season*aerobic capacity	0.071	0.791
season*playing time	0.091	0.764
season*playing time*aerobic capacity	0.089	0.766

TABLE 8. Main effects and interactions for DUB score. Significant main effects and interactions are indicated by *.

Effect	F	p
aerobic capacity	0.423	0.517
playing time	0.042	0.838
aerobic capacity*playing time	2.095	0.152
season	0.784	0.379
season*aerobic capacity	0.001	0.977
season*playing time	0.237	0.628
season*playing time*aerobic capacity	0.605	0.440

TABLE 9. Main effects and interactions for PSS score. Significant main effects and interactions are indicated by *.

Effect	F	p
aerobic capacity	0.050	0.823
playing time	0.129	0.721
aerobic capacity*playing time	2.092	0.153
season	1.688	0.198
season*aerobic capacity	0.450	0.505
season*playing time	2.049	0.157
season*playing time*aerobic capacity	0.532	0.468

Results indicated that there were no effects or interactions of aerobic capacity (based on vVO_2max) and playing time on attitudes toward doping, doping belief and expectations from sports participation.

Effect of late vs. early fatigue onset (V_4) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation

The median value for V_4 was 14.1 km · h $^{-1}$ and there were 33 players with late fatigue onset and thus high V_4 (V_4 >14.1 km · h $^{-1}$) and 39 players with early fatigue onset and thus low V_4 (V_4 ≤14.1 km · h $^{-1}$). For the late fatigue onset group, 18 out of 33 (54.5%) players were starters and 15 out of 33 (45.5%) were non-starters. For the early fatigue onset group, 19 out of 39 (48.7%) players were starters and 20 out of 39 (51.3%) were non-starters. Thus there were four groups: Group A = late fatigue onset (high V_4) - starters (n=18), Group B = late fatigue onset (high V_4) – non Starters (n=15), Group C = early fatigue onset (low V_4)- starters (n=19) and Group D = early fatigue onset (low V_4) - non Starters (n=20). The results for the effects of fatigue onset (V_4) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation are presented in TABLE 10, TABLE 11 and TABLE 12 respectively.

TABLE 10. Main effects and interactions for PEAS score. Significant main effects and interactions are indicated by *.

Effect	F	p
fatigue onset	0.239	0.626
playing time	3.203	0.07
fatigue onset*playing time	2.371	0.128
season	1.525	0.221
season* fatigue onset	1.706	0.196
season*playing time	0.085	0.771
season*playing time*fatigue onset	0.204	0.653

TABLE 11. Main effects and interactions for DUB score. Significant main effects and interactions are indicated by *.

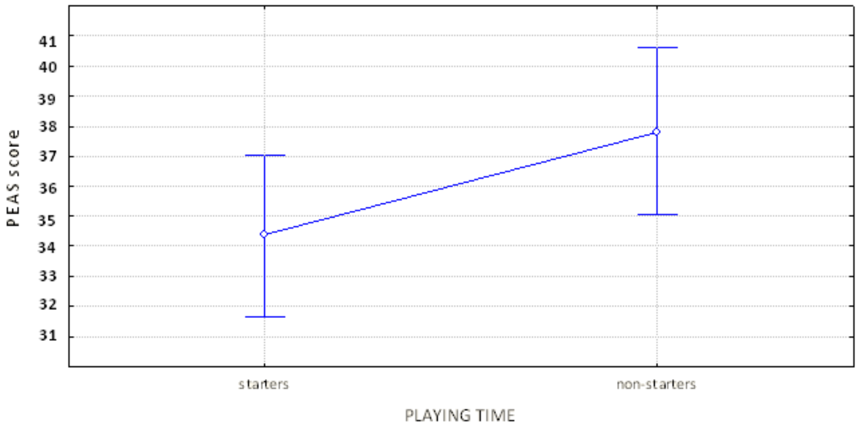
Effect	F	p
fatigue onset	0.342	0.561
playing time	0.004	0.949
fatigue onset*playing time	0.551	0.461
season	1.028	0.314
season* fatigue onset	0.111	0.740
season*playing time	0.226	0.636
season*playing time*fatigue onset	0.761	0.386

TABLE 12. Main effects and interactions for PSS score. Significant main effects and interactions are indicated by *.

Effect	F	p

fatigue onset	1.576	0.214
playing time	0.135	0.714
fatigue onset*playing time	1.322	0.254
season	2.032	0.159
season* fatigue onset	0.602	0.440
season*playing time	1.755	0.190
season*playing time*fatigue onset	0.017	0.896

Results indicated that there was a trend for playing time on PEAS score [F=3.203, p=0.07]. Specifically non-starters tended to have higher PEAS score compared to starters (37.9 vs. 34.4) (Graph 4).Results also indicated that there were no main effects or interactions of fatigue (based on V_4) and playing time on doping belief and expectations from sports participation.



Graph 4. Trend for playing time on PEAS score.

Effect of late vs. early fatigue onset (V_5) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation

The median value for V_5 was 14.7 km · h $^{-1}$ and there were 31 players with late fatigue onset and thus high V_5 (V_5 >14.7 km · h $^{-1}$) and 41 players with early fatigue onset and thus low V_5 (V_5 ≤14.7 km · h $^{-1}$). For the late fatigue onset group, 18 out of 31 (58.1%) players were starters and 13 out of 31 (41.9%) were non-starters. For the early fatigue onset group, 19 out of 41 (46.3%) players were starters and 22 out of 41 (53.7%) were non-starters. Thus there were four groups: Group A = late fatigue onset (high V_5) - starters (n=18), Group B = late fatigue onset (high V_5) – non Starters (n=13), Group C = early fatigue onset (low V_5)- starters (n=17) and Group D = early fatigue onset (low V_5) - non Starters (n=22). The results for the effects of fatigue onset (V_5) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation are presented in TABLE 13, TABLE 14 and TABLE 15 respectively.

TABLE 13. Main effects and interactions for PEAS score. Significant main effects and interactions are indicated by *.

Effect	F	p
fatigue onset	0.445	0.507
playing time	2.651	0.108
fatigue onset*playing time	0.191	0.663
season	1.534	0.220
season* fatigue onset	1.030	0.314
season*playing time	0.096	0.758
season*playing time*fatigue onset	0.514	0.476

TABLE 14. Main effects and interactions for DUB score. Significant main effects and interactions are indicated by *.

Effect	F	p
fatigue onset	0.461	0.499
playing time	0.027	0.870
fatigue onset*playing time	0.697	0.407
season	0.877	0.352
season* fatigue onset	0.036	0.849
season*playing time	0.287	0.594
season*playing time*fatigue onset	1.002	0.320

TABLE 15. Main effects and interactions for PSS score. Significant main effects and interactions are indicated by *.

Effect	F	p

fatigue onset	0.127	0.722
playing time	0.142	0.707
fatigue onset*playing time	1.017	0.317
season	2.057	0.156
season* fatigue onset	0.107	0.745
season*playing time	1.635	0.205
season*playing time*fatigue onset	0.002	0.960

Results indicated that there were no effects or interactions of fatigue onset (based on V_5) and playing time on attitudes toward doping, doping belief and expectations from sports participation.

Effect of late vs. early fatigue onset (V_{OBLA}) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation

The median value for V_{OBLA} was 13.1 km · h $^{-1}$ and there were 35 players with late fatigue onset and thus high V_{OBLA} (V_{OBLA} >13.1 km · h $^{-1}$) and 37 players with early fatigue onset and thus low V_{OBLA} (V_{OBLA} ≤13.1 km · h $^{-1}$). For the late fatigue onset group, 21 out of 35 (60.0%) players were starters and 14 out of 35 (40.0%) were non-starters. For the early fatigue onset group, 16 out of 37 (43.2%) players were starters and 21 out of 37 (56.8%) were non-starters. Thus there were four groups: Group A = late fatigue onset (high V_{OBLA}) - starters (n=21), Group B = late fatigue onset (high V_{OBLA}) – non Starters (n=14), Group C = early fatigue onset (low V_{OBLA}) - starters (n=16) and Group D = early fatigue onset (low V_{OBLA}) - non Starters (n=21). The results for the effects of fatigue onset (V_{OBLA}) and playing time (starters/non-starters) on attitudes toward doping, doping belief and expectations from sports participation are presented in TABLE 16, TABLE 17 and TABLE 18 respectively.

TABLE 16. Main effects and interactions for PEAS score. Significant main effects and interactions are indicated by *.

Effect	F	p

fatigue onset	0.651	0.423
playing time	2.728	0.103
fatigue onset*playing time	5.340	0.024*
season	1.579	0.213
season* fatigue onset	1.063	0.306
season*playing time	0.022	0.882
season*playing time*fatigue onset	0.003	0.958

TABLE 17. Main effects and interactions for DUB score. Significant main effects and interactions are indicated by *.

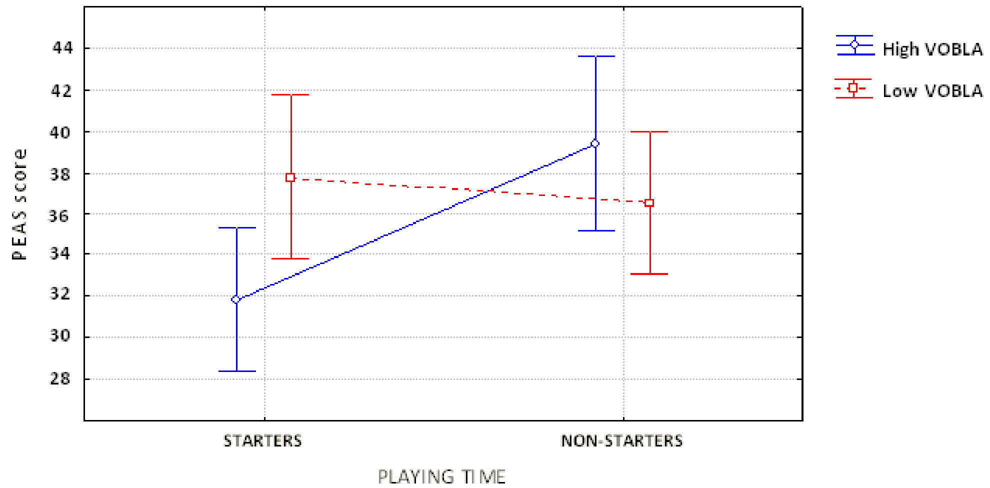
Effect	F	p
fatigue onset	0.818	0.369
playing time	0.017	0.896
fatigue onset*playing time	0.134	0.716
season	0.802	0.374
season* fatigue onset	0.005	0.943
season*playing time	0.204	0.653
season*playing time*fatigue onset	0.567	0.454

TABLE 15. Main effects and interactions for PSS score. Significant main effects and interactions are indicated by *.

Effect	F	p
fatigue onset	3.287	0.07
playing time	0.282	0.597
fatigue onset*playing time	0.859	0.357
season	1.832	0.180
season* fatigue onset	1.077	0.303
season*playing time	2.127	0.149
season*playing time*fatigue onset	0.405	0.527

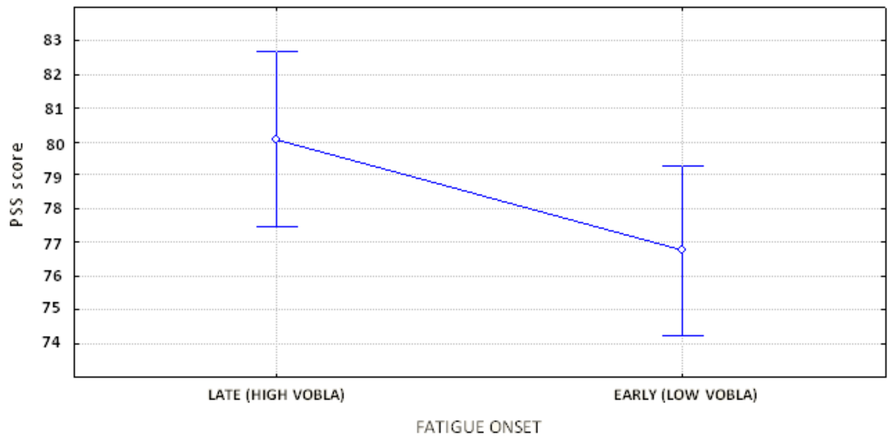
Results indicated that there was a fatigue onset*playing time interaction for V_{OBLA} and playing time on PEAS [F=5.34, p=0.024]. Specifically high V_{OBLA} starters had significantly lower PEAS score compared to other groups (high V_{OBLA} starters: 31.8, high V_{OBLA} non-starters: 39.4, low

V_{OBLA} starters: 37.8, low V_{OBLA} non-starters: 36.5). High V_{OBLA} non-starters, low V_{OBLA} starters and low V_{OBLA} non-starters did not differ in their PEAS scores (Graph 5). There were no effects or interactions of fatigue onset (based on V_{OBLA}) and playing time on doping belief.



Graph 5. Fatigue onset*playing time interaction on PEAS score.

Finally there was a trend for fatigue onset based on V_{OBLA} on PSS score [$F=3.287$, $p=0.07$]. Specifically high V_{OBLA} players tended to have higher PSS score compared to low V_{OBLA} players (79.8 vs. 76.1, $p=0.07$) (Graph 6).



Graph 6. Trend for fatigue onset on PSS score.

Discussion

The purpose of the present study the purpose of the study was to examine doping and supplementation attitude and belief in young talented athletes who compete at high level during adolescent and are under pressure to succeed. It was hypothesized that U-20 talented soccer players with limited physical capacity will have significantly more positive doping and supplementation attitude and belief compared to more fit players. A second hypothesis was that players with limited competition participation during in-season will have significantly more positive doping and supplementation attitude and belief compared to starters. Finally a third hypothesis was that during in-season all soccer players will exhibit more positive doping and supplementation attitude compared to their early preseason attitude.

The major findings of the present project were:

VII. Given the overall PEAS scores of the sample during pre-season (37±10, range 18-66) and mid-season (35±9, range 19-56) we conclude that U-20 soccer players are generally not tolerant in relation to doping attitudes. However, small differences were found between different groups indicating that differences in physical performance parameters and/or game participation lead some players to be a little more permissive toward doping compared to others. These differences are outlined below.

VIII. High VO_2max starters and non-starters have higher PEAS score compared to low VO_2max starters and non-starters.

IX. High V_{OBLA} starters have significantly lower PEAS score compared to all other groups (high V_{OBLA} non-starters, low V_{OBLA} starters and low V_{OBLA} non-starters).

X. Non-starters tend to have higher PEAS compared to starters.

XI. High VO_2max non-starters tend to have higher PSS compared to high VO2max starters. Low VO_2max starters tend to have higher PSS compared to low VO_2max non-starters.

XII. High V_{OBLA} players tended to have higher PSS score compared to low V_{OBLA} players

Our results partly refuted our first hypothesis. We hypothesized that players with limited physical capacity will have significantly more positive doping and supplementation attitude and belief compared to more fit players. Our results demonstrated that high aerobic capacity (high VO_2max) players have higher PEAS score compared to low aerobic capacity (low VO_2max) players, while late onset of fatigue (high V_{OBLA}) in starters is associated with lower PEAS score compared to all other groups. These results indicate a somewhat contradictory effect of physical capacity on attitudes towards doping, with high aerobic capacity being associated with a more permissive attitude towards doping while late fatigue onset in starters being associated with a less permissive attitude toward doping.

In order to elucidate the potential reasons explaining the linkage between high VO_2max and high PEAS scores we examined the response patterns of VO_2max in all four groups during the season (data not shown). Starters with high VO_2max did not differ from non-starters with high VO_2max and starters with low VO_2max did not differ from non-starters with low VO_2max throughout the season. However, VO_2max significantly decreased from pre-season compared to mid-season for both starters and non-starters with high initial VO_2max values (>58.7 ml·min^{-1}·kg^{-1}) while it remained unchanged for both starters and non-starters with low initial VO_2max values (≤58.7 ml·min^{-1}·kg^{-1}). During pre-season VO_2max values in the three professional Greek soccer leagues range between 56.4-58.8 ml·min^{-1}·kg^{-1} [33], where in the present study the corresponding values for the starters and non-starters in the high aerobic capacity group were 61.4 and 59.5 ml·min^{-1}·kg^{-1} respectively, indicating that these players had already an aerobic capacity comparable to mid-season values of well trained professionals [15]. However, these youngsters were not able to maintain such high levels of aerobic capacity and their mid-season values were significantly reduced compared to the pre-season values, while the opposite is true for professional players[15]. It should be acknowledged that during the past 10 years there is greater focus on the development of the physical capacities in soccer players mainly because it has been reported that successful teams have greater values compared with less successful teams [4, 16, 26]. In fact VO_2max is considered the most important component of aerobic endurance performance, and most soccer studies have extensively examined differences in VO_2max among teams of different levels. It has been reported that in elite soccer, VO_2max values greater than 60 ml·min^{-1}·kg^{-1} are a pre-requisite in elite soccer and that in some cases team ranking may be explained by differences in VO_2max [4, 16]. It could be speculated that players on the high VO_2max group placed a greater attention on the development of their aerobic capacity already from pre-season which may also explain why both sub-groups did not differ in PEAS score at a time where selections regarding the starters/no-starters had not been made. For that reason greater PEAS scores in the high aerobic capacity group at pre-season may indicate that these players may be more permissive in doing “what ever it takes” to maintain or even increase what appears to be an asset for soccer performance. Furthermore the reduction in mid-season VO_2max values could also justify a higher mid-season PEAS score for both the starters and non-starters as a “means” of obtaining back the lost performance asset. Both starters and non-starters in the low aerobic capacity group showed no change in their VO_2max values from pre- to mid-season. This indicates that a low aerobic capacity did not interfere with the selection process as 19 out the 33 players in this group were regular starters.

Subsequently we also examined the response patterns of V_{OBLA} in all four groups during the season (data also not shown). Starters with high V_{OBLA} did not differ from non-starters with high V_{OBLA} and starters with low V_{OBLA} did not differ from non-starters with low V_{OBLA} throughout the season. V_{OBLA} increased significantly from pre- to mid-season. Both starters and non-starters in the late fatigue onset group (high initial V_{OBLA}) increased their V_{OBLA} values from pre- to mid-season. Furthermore both starters and non-starters in the early fatigue onset group (low initial V_{OBLA}) increased their V_{OBLA} values from pre- to mid-season. Starters and non-starters in the late fatigue onset group (high initial V_{OBLA}) had significantly higher V_{OBLA} values compared to starters and non-starters in the early fatigue onset group (low initial V_{OBLA}) at both pre- and mid-season. While previous research has focused on the importance of VO_2max as an indicator of soccer level [4, 16, 26], a recent study from our laboratory demonstrated that V_{OBLA} and not VO_2max differs significantly between three professional leagues during pre-season testing[33]. Thus, V_{OBLA} is a better indicator of training status of soccer players compared to VO_2max. The initial V_{OBLA} values for the four sub-groups in the present study were 13.6±0.3, 13.8±0.3, 12.3±0.5 and 12.0±0.9 km · h $^{-1}$, while the corresponding values for the three professional leagues in Greece are 13.2±0.7, 12.6±0.7 and 12.3±0.8 km · h $^{-1}$. Again the starters and non-starters in the late fatigue onset group (high initial V_{OBLA}) had V_{OBLA} values higher than that of first league professional players. However there was a different pattern in the V_{OBLA} response compared to that of VO_2max as all groups were able to increase their initial values. It is difficult from the present data to explain why high V_{OBLA} starters had significantly lower PEAS score compared to high V_{OBLA} non-starters, low V_{OBLA} starters and low V_{OBLA} non-starters (Graph 5). From a physiological perspective VO_2max is mainly affected by central factors, while V_{OBLA} reflects both central and peripheral adaptations and is related to higher volumes of work and more long-term training adaptations[2]. However, even if there is a link between long-term training adaptations and less permissive attitude toward doping this still can not explain the difference in PEAS score between high V_{OBLA} starters and high V_{OBLA} non-starters where V_{OBLA} values did not differ both at pre- and mid-season.

Analysis of the interaction between aerobic capacity (based on VO_2max) and playing time and between fatigue onset (based on V_4 and V_{OBLA}) demonstrated that non-starters tended to have significantly higher PEAS score compared to starters which confirms our second hypothesis.

Although these trends did not quite reach statistical significance (p values ranged from 0.05 to 0.07) they are indicative of a common direction for the observed differences. However, parallel to these trends we observed that PEAS score did not change from pre to mid-season thus refuting our third hypothesis of more permissive attitudes toward doping during mid-compared to pre-season. Thus, collectively these findings indicate that playing time per se does not influence attitudes toward doping in young soccer players. Although non-starters have higher PEAS score during mid-season which could be attributed to their limited participation in games, higher PEAS score were also noted during pre-season where selection for the teams had not been made yet.

A recent systematic review indicated that there are very few specific studies that assessed attitudes towards doping in elite athletes by means of a validated scale such as PEAS score [22]. One of the few studies that have used PEAS score was conducted by Uvacsek et al[30]. In this study, among 82 Hungarian competitive (non-elite) athletes assessed, confessed doping users (12%) scored, as expected, significantly higher on the PEAS when compared with those who reported no use of banned drugs (46.8±13.3 and 34.4±8.7, respectively). Likewise, in another study [20], which recruited 2022 amateur cyclists as a sample (confessed users =164; non-users =1858), overall scores were, respectively 48.9±16.0 and 41.0±12.0. Petroczi and Aidman[25] analyzed several samples such as elite athletes from Hungary (n= 102; confessed users = 5; non-users = 97) and obtained the following scores, respectively (39.2±17.5 vs. 35.9±10.1). According to another recently study, PEAS scores are 36.1±9.4 for the whole sample (n=72 cyclists) and range from 30.3±6.9 to 43.2±12.0 indicating in general, that Spanish cyclists of the national teams are against doping practises, though some of the teams consisting the sample are more permissive towards performance enhancement drugs use than others[21]. Our results on elite U-20 soccer players agree well with the above results and indicate that the values obtained from our sample where quite lower compared to those of confessed doping, however they do point out that even in a relatively homogenous sample, there were groups that proved somewhat more permissive to doping than others.

Finally we detected some trends regarding perfectionism in sport. More specifically non-starters in the high VO_2max group tended to have higher PSS score compared to starters in the high VO_2max group. Low VO_2max starters tend to have higher PSS compared to low VO_2max non-starters. High V_{OBLA} players tended to have higher PSS score compared to low V_{OBLA} players. We believe that since high VO_2max and non-starters were both factors associated with more permissive attitude toward doping, then this could explain why high VO_2max non-starters had higher PSS scores compared to high VO_2max starters. Perfectionism particularly characterizes an athlete who sets excessively high, unrealistic goals or views success solely in terms of winning, as opposed to mastering skills or making personal best performances. This athlete is likely to be more at risk for doping. On the other hand however on the low VO_2max group there was an opposite trend which can not be explained by the above hypothesis. Finally the above hypothesis can not explain why high V_{OBLA} players tended to have higher PSS score compared to low V_{OBLA} players, especially since most players of high V_{OBLA} group were starters (21 vs. 14) which had the lowest PEAS scores compared to all other groups. Clearly more research is needed to confirm if there is a clear relationship between perfectionism in sport and physical fitness parameters.

The present study is not without limitations. It is clear that work based on questionnaires covering a banned practice has a potential limitation since answers may be deliberately false as the participants questioned may not wish to reveal that they or their teammates use PED, even if anonymity and confidentiality are guaranteed. A bigger sample size could be more representative, although we believe that the quality of the selected participants is high: U-20 squads of 5 different professional soccer clubs. All U-20 squads were placed among the top 6 clubs in the nation during the 2011-2012 soccer season. Furthermore the professional teams of the soccer clubs were either ranked within the top 3 in the country and participated in FIFA Competitions (Champions League or Europa League) during the last 3 years or had a long history of developing successful professional soccer players who were then transferred to higher ranked professional soccer clubs

We believe that descriptive studies to design effective intervention programs should be carried out by means of the same tools used in the present project. Thus, the PEAS questionnaire could be used as a standard measurement to assess attitudes towards doping in young soccer players so that data are more reliable and valid, and practical applications can be developed efficiently. To further focus on soccer we suggest, that a similar project like the present one could implement observations on attitudes toward doping on younger developmental teams within the same club (e.g U-20, U-17, U-15) as well as the professional team of the club in order to establish whether there is a uniform anti-doping policy within a soccer club or whether professionals differ from their younger counterparts. This will enable the development of specific programs and other activities for prevention and fight against the phenomenon of doping.

References

1. Anshel, M., and H.J. Eom. Exploring the dimensions of perfectionism in sports. Int J Sports Psychol. 34, 255-271, 2003.
2. Astrand, P.O., K. Rodahl, H.A. Dahl, SB Stromme. *Textbook of work physiology: physiological bases of exercise.* Windsor (Canada): Human Kinetics, 2003.

3. Backhouse, S.H., L. Whitaker, and A. Petroczi. Gateway to doping? Supplement use in the context of preferred competitive situations, doping attitude, beliefs, and norms. Scand. J. Med Sci Sports, p 1-9, 2011.
4. Bangsbo, J. The physiology of soccer with special reference to intense intermittent exercise. *Acta Physiol Scand (Suppl)* 619:1-156. 1994.
5. Bentley, D.J., J. Newell, and D. Bishop. Incremental test design and analysis: implications for performance diagnostics in endurance athletes. *Sports Med* 37:575-586. 2007.
6. Bishop, D., D.G. Jenkins, and L.T. Mac Kinnon. The relationship between plasma lactate parameters, W_{peak} and 1-h cycling performance in women. *Med Sci Sports Exerc* 30:1270-1275. 1998.
7. Bloodworth., A.J., A. Petrozci, R. Bailey, G. Pearce, and M.J. Namee. Doping and supplementation: the attitudes of talented young athletes. Scand. J. Med Sci Sports, 1-9, 2010
8. Calfee, R., and P. Fadale. Popular ergogenic drugs and supplements in young athletes. Pediatrics, 117:e577-e589, 2006
9. Cheng, B., H. Kuipers, A.C. Snuder, H.A Keizer, A. Jeukendrup, and M.Hesselink. A new approach for the determination of ventilatory and lactate thresholds. *Int J Sports Med* 13:518-522. 1992.
10. Corrigan, B. and Kaziaouskas, R. Medication use in athletes selected for doping control at the Syndney Olympics (2000). Clin J Sport Med (2003; 13:33-40).
11. Gomez., JE. Performance-enhancing substances in adolescent athletes. Tex Med 98:41-6, 2002.
12. Goulet, C., P. Valois, A. Buist, and M. Cote. Predictors of the use of performance enhancing substances by young athletes. Clin. J. Sports Med. 20., (4), July 2010.
13. Helgerud, J., L.C. Engen, U. Wislof, and J. Hoff. Aerobic endurance training improves soccer performance. *Med Sci Sports Exerc* 33:87-97. 2001.
14. Jackson, AS and Pollock, ML. Practical assessment of body composition. Physician Sports Med 13: 76–78, 1985.
15. Kalapotharakos VI, Ziogas G, Tokmakidis SP. Seasonal aerobic performance variations in elite soccer players. J Strength Cond Res 25:1502-1507, 2011

16. Kalapotharakos, V.I., N. Strimpakos, I. Vithoulka, C. Karvounidis, K. Diamantopoulos, and E. Carpeli. Physiological characteristics of elite professional soccer teams of different ranking. *J Sports Med Phys Fitness* 46:515-519. 2006.
17. Lentilon-Kestner, V. and F. Ohl. Can we measure accurately the prevalence of doping? Scand J Med Sci Sports 21: 132-142, 2011.
18. McMillan K, Helgerud J, Grant SJ, Newell J, Wilson J, Macdonald R, Hoff J. Lactate threshold responses to a season of professional British youth soccer. Br J Sports Med. 2005 Jul;39(7):432-6.
19. Mohr, M., P. Krustrup, and J. Bangsbo. Match performance of high standard soccer players with special reference to development of fatigue. *J Sports Sci* 21:519-528. 2003
20. Morente-Sanchez J, Freire C, Ramırez-Lechuga J, Zabala M. Attitudes towards doping in participants of a popular long-distance road cycling event according to their doping behavior: users vs non-users. Book of Abstracts of the 17th Annual Congress of the ECSS 4–7 July 2012 Bruges-Belgium 270–271, 2012.
21. Morente-Sanchez J, Mateo-March M, Zabala M. Attitudes towards Doping and Related Experience in Spanish National Cycling Teams According to Different Olympic Disciplines. PLoS ONE 8(8): e70999, 2013.
22. Morente-Sanchez J, Zabala M. Doping in Sport: A Review of Elite Athletes' Attitudes, Beliefs, and Knowledge. Sports Med 43: 395–411, 2013.
23. Nicholson, R.M., and G.G. Sleivert. Indices of lactate threshold and their relationship with 10-km running velocity. *Med Sci Sports Exerc* 33:339-342. 2001.
24. Petroczi, A. Attitudes and doping: a structural equation analysis of the relationship between athletes' attitudes, sport orientation and doping behavior. Substance Abuse Treatment Prevention and Policy, 2:34, p1-15, 2007
25. Petroczi., A. and E. Aidman. Measuring explicit attitude toward doping: review of the psychometric properties of the Performance Attitude Scale. Psychol Sport Exerc. 10:390-396. 2009.
26. Rampinini, E., A. Bosio, I. Ferraresi, A. Petruolo, A. Morelli, and A. Sassi. Match-Related Fatigue in Soccer Players. Med. Sci. Sports Exerc., Vol. 43, No. 11, pp. 2161–2170, 2011.
27. Stolen, T., K. Chamari, C. Castagna, and U. Wisloff. Physiology of soccer: an update. *Sports Med* 35:501-536. 2005.

28. Tscholl P., A. Junge, and J. Dvorak. The use of medication and nutritional supplements during FIFA World Cups 2002 and 2006. Br J Sports Med 2008; 42;725-730, 2007.
29. Tsivou, M. Kioukia-Fougia N., Lyris, E., Aggelis, Y., Fragkaki A., Kiousi, X., Simitsek A., Dimopoulou H., Leontiou, IPM., Stamou M., Spyridaki MH., Georgakopoulos C. An overview of the doping control analysis during the Olympic Games of 2004 in Athens, Greece. Analyt Chim Act, 555:1-13 2006
30. Uvacsek M, Nepusz T, Naughton D, Mazanov J, Ra´nky M, et al. Self-admitted behaviour and perceived use of performance-enhancing vs. psychoactive drugs among competitive athletes. Scand J Med Sci Sports 21: 224–234, 2011
31. Wisloff U., J. Helgerud, and J. Hoff. Strength and endurance of elite soccer players. Med Sci Sports Exerc 30:462-467. 1998.
32. Yesallis CE, and M.S. Bahrke. Doping among adolescent athletes. Clin Endocrin Metabol 14:25-35; 2000.
33. Ziogas GG, Patras KN, Stergiou N, Georgoulis AD. Velocity at lactate threshold and running economy must also be considered along with maximal oxygen uptake when testing elite soccer players during pre-season. J Strength Cond Res 25:414-419, 2011.

Appendix 1

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Research Project: "Effect of the level of physical fitness and game participation on attitudes toward doping of elite U-20 soccer players"

CONFIDENTIALITY AND ANONYMITY

Based the research design questionnaire responses will be compared to physiological parameters and level of game participation. In addition, differences in responses will be compared in a repeated measures design. Therefore, the identity of the subjects will only be known to Principal Investigator (Dr, Georgios G. Ziogas), and to the Research team (Research Assistants). It will not be revealed to other agencies, persons, or organizations.

Questionnaires and data sheets will include a numeric code for each subject instead of the name of the participant. Names of the participants will not be written in any publication or presentation arising from the study. All the information will be presented as group data. If a team member (e.g. the director of a team) requires access to the data, he will come under the terms of the study, including confidentiality agreements.

Questions are encouraged and should be directed to Dr. Georgios G. Ziogas, on +30-2310365012 or ziogas14@yahoo.gr

Appendix 2

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Research Project: "Effect of the level of physical fitness and game participation on attitudes toward doping of elite U-20 soccer players"

INFORMED CONSENT FOR AN EXERCISE TEST

1. Purpose and Explanation of the Exercise Testing

You will perform an exercise test in an indoor exercise testing facility as part of a research study which examines the "Effect of the level of physical fitness and game participation on attitudes toward doping of elite U-20 soccer players". The exercise intensity will begin at a low level and will advance in stages until you reach your maximum capacity. We may stop the test at any time because of signs of fatigue or changes in your heart rate or symptoms you may experience. It is important for you to realize that you may stop when you wish because of feelings of fatigue or any other discomfort.

2. Attendant Risks and Discomforts.

There exists the possibility of certain changes occurring during the test. These include abnormal blood pressure, fainting, irregular, fast or slow heart rhythm, and in rare cases heart attack, stroke or death. Every effort will be made to minimize the risks by evaluation of preliminary information relating to your health and fitness and by careful observations during testing.

3. Responsibilities of the Participant.

Information you possess about your health status or previous experiences of heart-related symptoms (such as shortness of breath with low level activity, pain, pressure, tightness, heaviness in the chest, neck, jaw, back and/or arms) with physical effort may affect the safety of your exercise test. Your prompt reporting of these and any other unusual feelings with effort during the exercise test itself, is of great importance. You are responsible for fully disclosing your medical history, as well as symptoms that may occur during the test. You are also expected to report all medications (including non-prescription) taken recently and, in particular, those taken today, to the testing staff.

4. Benefits to be expected. The results obtained from the exercise test may assist in the diagnosis of your physical capacity limitations or in evaluating your progress. Also, the result will be used in the research study.

5. Inquiries.

Any questions about the procedures used in the exercise test or the results of your test are encouraged. If you have any concerns or questions, please ask us for further explanations.

6. Use of medical records.

The information that is obtained during exercise testing will be treated as privilaged and confidential. It is not to be released or revealed to any person except the principal investigator of the study and the research assistants without your written consent. The information obtained, however, may be used for statistical analysis or scientific purposed with your right to privacy retained.

7. <u>Freedom of Consent</u>. I hereby consent to voluntarily engage in an exercise test to determine my exercise capacity and/or the state of cardiovascular health. My permission to perform this exercise test is given voluntarily. I understand that I am free to stop the test at any point, if I so desire.

I have read this form, and I understand that the procedures that I will peform and the attendant risks and discomforts. Knowing these risks and discomforts, and having had an opportunity to ask questions that have been answered to satisfaction. I consent to participate in this test.

NAME and Signature____

DATE ___________________

NAME and SIGNATURE OF THE LEGAL GUARDIAN _________________________

DATE___________________

Appendix 3

SportsClinic Thessaloniki
Egnatias 112 Pylea
Postal Code 55535
Thessaloniki, Greece
Tel. 2310365012

Research Project: "Effect of the level of physical fitness and game participation on attitudes toward doping of elite U-20 soccer players"

INFORMED CONSENT FOR QUESTIOANNAIRE

I am a member of a research team headed by Dr. Georgios G. Ziogas. We are conducting a research project to study the "Effect of the level of physical fitness and game participation on attitudes toward doping of elite U-20 soccer players". Following the maximal exercise testing that you underwent last week, we ask you to voluntarily fill in two questionnaires. The first is about your general doping attitude (PEAS) and the second is about your attitude and expectations from competitive sports participation (PSS). If you agree to participate in this part of the study, please tick the box at the end of this page. This will allow you to give consent but will protect your anonymity. Please return the completed consent form and the completed questionnaires to the investigator. For your convenience, we attach two copies of this form, and you can retain one for your records. Data from this study will be reported to Antidoping World Agency (WADA) and will be presented in international and national conferences. However, no individual data will be utilized. Please answer each question as honestly as possible. There are no right or wrong answers.

All participation is voluntary. You can withdraw from the study at any time. If you do take part, you should retain a copy of this letter. If you have any worries or questions, do not hesitate to talk to a research team member. We will be happy to answer any questions you may have.

I agree to participate in the study outlined above. I understand the nature of the study and I have the opportunity to raise any queries. I understand that consent is voluntary and by returning the survey I am agreeing to its content being included in the study. I also understand that any information collected may be published in reports and scientific journals and may be presented at relevant conferences.

I CONSENT TO TAKE PART IN THE STUDY ☐ (please mark your agreement)

Date:_____________________________________

Appendix 4

Sports Clinic Thessaloniki

ΟΡΘΟΠΑΙΔΙΚΟ ΑΘΛΗΤΙΑΤΡΙΚΟ ΚΕΝΤΡΟ ΙΩΑΝΝΙΝΩΝ
OAKI

SportsClinic Thessaloniki
Egnatias 112 Pylea
Postal Code 55535
Thessaloniki, Greece
Tel. 2310365012

Code number						

Questionnaire on attitudes toward doping
Performance Enhancement Attitude Scale (PEAS)

(1= Strongly disagree, 2= Disagree, 3= Slightly disagree, 4= Slightly agree, 5= Agree, 6= Strongly agree)

	Strongly disagree	*Disagree*	*Slightly disagree*	*Slightly agree*	*Agree*	*Strongly agree*
1. Doping is necessary to be competitive.	1	2	3	4	5	6
2. Doping is not cheating since everyone does it.	1	2	3	4	5	6
3. Athletes often lose time due to injuries and drugs can help to make up the lost time.	1	2	3	4	5	6
4. Only the quality of performance should matter, not the way athletes achieve it.	1	2	3	4	5	6
5. Athletes in my sport are pressured to take performance enhancing drugs.	1	2	3	4	5	6
6. Athletes, who take recreational drugs, use them because they help them in sport situations.	1	2	3	4	5	6
7. Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs.	1	2	3	4	5	6
8. The risks related to doping are exaggerated.	1	2	3	4	5	6
9. Athletes have no alternative career choices, but sport.	1	2	3	4	5	6
10. Recreational drugs give the motivation to train and compete at the highest level.	1	2	3	4	5	6
11. Doping is an unavoidable part of the competitive sport.	1	2	3	4	5	6
12. Recreational drugs help to overcome boredom during training.	1	2	3	4	5	6
13. There is no difference between drugs, fibreglass poles, and speedy swimsuits that are all used to enhance performance.	1	2	3	4	5	6

14. Media should talk less about doping.	1	2	3	4	5	6
15. The media blows the doping issue out of proportion.	1	2	3	4	5	6
16. Health problems related to rigorous training and injuries are just as bad as from doping.	1	2	3	4	5	6
17. Legalising performance enhancements would be beneficial for sports.	1	2	3	4	5	6

Appendix 5

SportsClinic Thessaloniki
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Thessaloniki, Greece
Tel. 2310365012

Code number						

Questionnaire regarding beliefs in doping use
Doping Use Belief (DUB)

Do you believe that performance-enhancing drugs/methods should be allowed for top level athletes?
Yes, without restrictions= 2
Yes, but with restrictions= 1
Absolutely not= 0

Do you believe that performance-enhancing drugs/methods should be allowed for all athletes?
Yes, without restrictions= 2
Yes, but with restrictions= 1
Absolutely not= 0

Have you ever had personal experience with banned performance-enhancing drugs and/or methods?
Yes (3),
Yes, but only for treating a medical condition (2),
No (0), I do not wish to answer (1)

Do you currently use banned performance-enhancing drugs?
Yes (3),
Yes, but only for treating a medical condition (2),
No (0), I do not wish to answer (1)

Appendix 6

SportsClinic Thessaloniki
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Code number						

Questionnaire regarding behavior and expectations from participation in competitive sport (Perfectionism in Sport Scale)

(The following questionnaire is designed to measure your attitudes to and expectations of, competitive sport participation. Circle the number, ranging from 1 to 5, that indicates your response to each question below.)

1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree

		strongly disagree		**neutral**		**strongly agree**
1	If I perform poorly in a competitive event I feel I have failed as an athlete.	1	2	3	4	5
2	I set higher goals for myself than most people.	1	2	3	4	5
3	My coach becomes angry with me or punishes me for performing less than perfectly.	1	2	3	4	5
4	When I am working on something, I cannot relax until it is perfect.	1	2	3	4	5
5	I feel very upset/angry if I make a physical or mental error during a contest/game.	1	2	3	4	5
6	I never feel that I can meet my coach's standards.	1	2	3	4	5
7	I strive for perfection in my performance.	1	2	3	4	5
8	Even while performing successfully, my coach tends to point out my mistakes during competition.	1	2	3	4	5
9	My teammates/coach/fellow competitors will think less of me if I make a mistake.	1	2	3	4	5
10	I expect higher performance in my daily tasks than most people.	1	2	3	4	5

11	My coach rarely compliments me on my performance.	1	2	3	4	5
12	If I ask someone to do something, I expect it to be done perfectly.	1	2	3	4	5
13	My coach's standards tend to be too high for me.	1	2	3	4	5
14	Before and during competition I hope I do not make any mistakes.	1	2	3	4	5
15	One of my goals is to be perfect at everything I do.	1	2	3	4	5
16	If I win a competition or generally perform well, I tend to criticize myself if I have made an error.	1	2	3	4	5
17	I can rarely meet my coach's expectations of me.	1	2	3	4	5
18	I become frustrated/angry if I make a small mistake during competition	1	2	3	4	5
19	I have extremely high goals.	1	2	3	4	5
20	My coach usually expects me to perform perfectly.	1	2	3	4	5
21	Even the smallest mistake bothers me when I am competing.	1	2	3	4	5
22	I must always be successful at everything that I do.	1	2	3	4	5
23	I analyze my mistakes over and over so that I can improve on them in the future.	1	2	3	4	5
24	No matter how well I perform, my coach asks me to perform better.	1	2	3	4	5