Use of nutritional supplement to improve performance in professional soccer players: A case report

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ABSTRACT

The aim of the study was to investigate the intake percentage and the satisfaction level of some nutritional supplements used by professional soccer players. Twenty-nine professional soccer players (age: 24.6 ± 5.2 years, body weight: 79.2 ± 4.9 kg, body height: 1.83 ± 0.05 m) belonging to a team of Serie A were interviewed on: frequency of use, tolerability, and acceptance of the supplements (creatine, β-alanine, whey protein, nitrates, vitamin D3, caffeine) proposed by the nutritionist team. This survey revealed a great inter-individual variability on the intake of the proposed supplements. All respondents (n = 29) said they take cholecalciferol (vitamin D3), 17 out of 29 creatine, 14 out of 29 whey protein, and 10 out of 29 dietary nitrates. No participants declared to assume β-alanine or caffeine anhydrous. Cholecalciferol resulted the most accepted supplement, followed by creatine and whey protein. Study participants prefer to take dietary nitrates through the consumption of vegetable juices, primarily from fennel and celery juice, and only two out of twenty-nine regularly taking concentrated beet juice. Since none of the twenty-nine participants interviewed uses β-alanine and caffeine in anhydrous form, the daily contribution of caffeine is mainly guaranteed by the consumption of coffee.

Keywords: Soccer; Supplementation; Physical exercise; Muscle; Nutrition.

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INTRODUCTION

Nutritional supplements, also defined dietary supplements or simply supplements, are substances used to provide an adequate quantity of basic nutrients in case of insufficient intake of the latter in the usual diet (Gagnier, 2012). It is relevant to highlight that supplements are not necessary in a healthy, varied and balanced diet (Bianco et al., 2015).

In the presence of a deficiency of an essential vitamin or mineral, the level of these latter can be adjusted by changing the diet. However, the level of an essential nutrient may not increase with food intake and a nutritional supplement assumption may be useful ("Nutrition for football: the FIFA/F-MARC Consensus Conference," 2006).

In the Directive 2002/46/CE, pursuant to the Legislative Decree 21 May 2004 n. 169 of the Italian sectoral legislation, nutritional supplements are defined as: "Food products intended to supplement the common diet and which constitute a concentrated source of nutrients, such as vitamins and minerals, or of other substances having a nutritional or physiological effect, in particular, but not exclusively, amino acids, essential fatty acids, fibres and extracts of vegetable origin, both mono-composed and multi-composed, in pre-dosed forms" ("Integratori alimentari e Linee guida ministeriali (LGM)," 2002).

Nutritional supplements are subject of argumentation and debate among athletes and coaches regards improving training adaptations, sport performances and recovery times (Jeukendrup, 2017; Mazzeo et al., 2013). There are different types of supplements and each has a different effect on the physiological functions of the body and, for this reason, athletes from different sports use the most appropriate ones based on the sport they practice (Knapik et al., 2016; Olsson et al., 2019; Vitale and Getzin, 2019). However, the use of supplements in sports should be used as integration of the daily diet and not used as a food substitute.

Nutritional supplements are produced in several forms as tablets, capsules, gels, liquids, or powders. Dietary supplements in athletes are allowed only for oral assumption and any other administration is prohibited (Kerksick et al., 2018).

As for nutritional supplements in sports, it is worth mentioning that it should comply with the World Anti-Doping Agency (WADA) code, based on the concept of "safe and clean", which means free of prohibited substances.

The aim of this study was to investigate the amount of assumption and the satisfaction level of some nutritional supplements used by professional soccer players.

METHODS

Participants

Twenty-nine professional soccer players of a Serie A team (age: 24.6 ± 5.2 years, body weight: 79.2 ± 4.9 kg, body height: 1.83 ± 0.05 m; n = 3 goalkeepers; n = 6 defenders; n = 6 wing back; n = 6 wide midfielders; n = 2 central midfielders: n = 1 winger; n = 5 strikers) were included in the study by interviewing them about the frequency of use, tolerability, and acceptance of the supplements (creatine, β-alanine, whey protein, nitrates, vitamin D3, caffeine) proposed by the nutritionist team.

Statistical analysis
In order to describe the survey responses of the participants, percentages of the categorical variables were calculated.

RESULTS

Data analysis from the participants' responses obtained from the survey showed a great inter-individual variability of use and satisfaction level of the supplements proposed by the nutritionist team.

The most used and the most accepted supplement (100% positive responses to both questions) was cholecalciferol (vitamin D3). It was administered once a week (after morning training, during team lunch) in the winter months. The aforementioned supplement is followed by the use and acceptance preference of creatine monohydrate (59%), whey protein (48%) and dietary nitrates present in fennel and celery juice (34%) and only two out of twenty-nine regularly taking concentrated beet juice (Figures 1 and 2). None of the twenty-nine participants interviewed declared to assume β-alanine or caffeine in anhydrous form. The caffeine intake is mainly guaranteed by the consumption of coffee (Figures 3 and 4). The daily distribution of coffee consumption revealed that study participants prefer to take coffee for breakfast (20 out of 22) and before training (14 out of 22), while only 1 participant is used to take coffee after training (Figures 5 and 6).

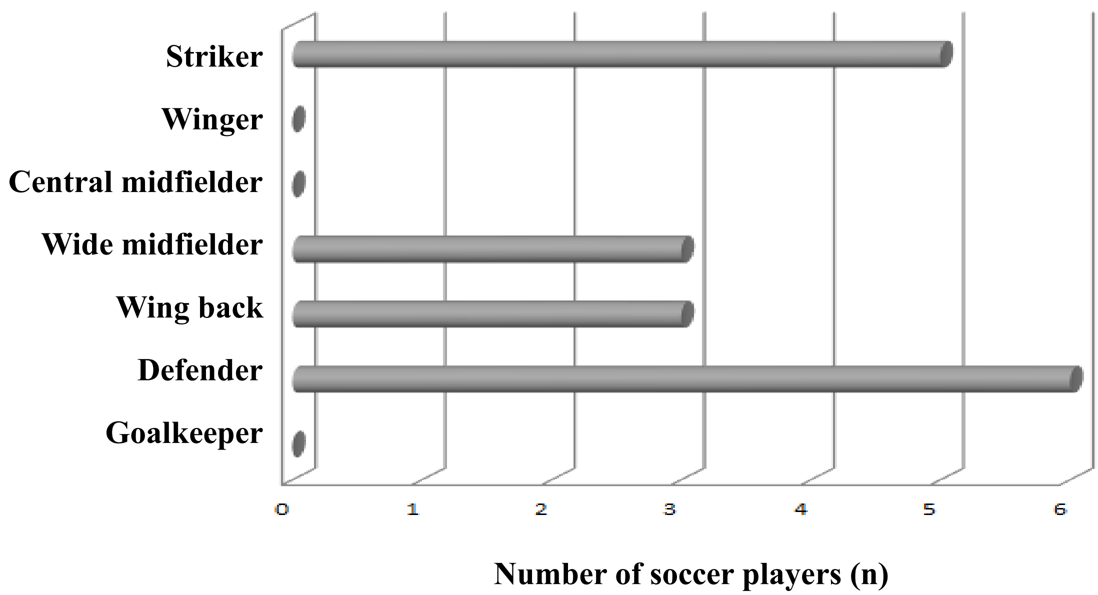

Figure 1. Creatine monohydrate consumption (n = 17).

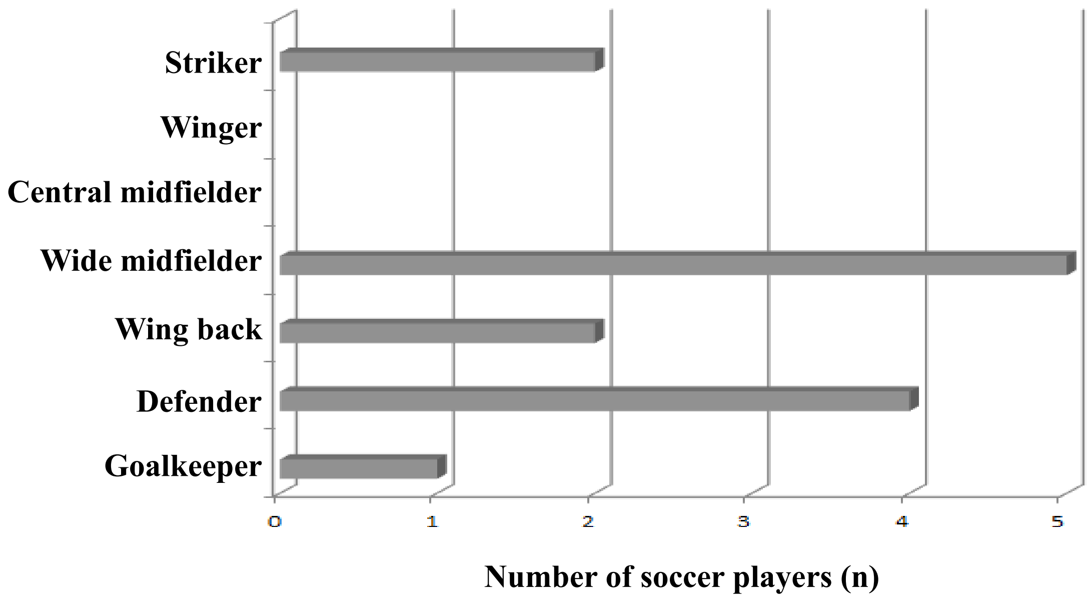

Figure 2. Whey protein consumption (n = 14).

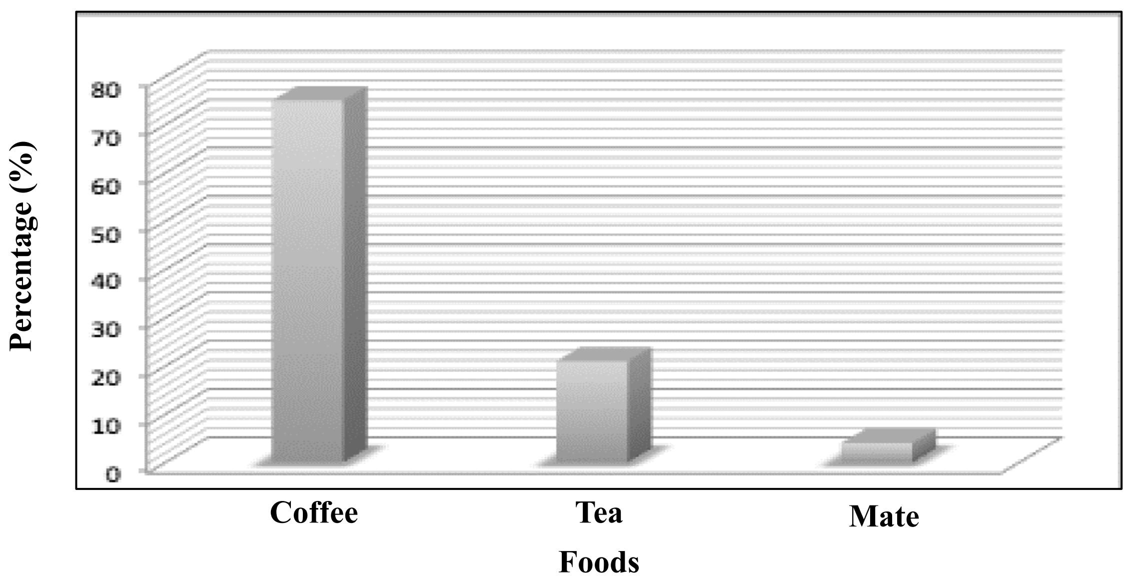

Figure 3. Caffeine consumption by all the sample.

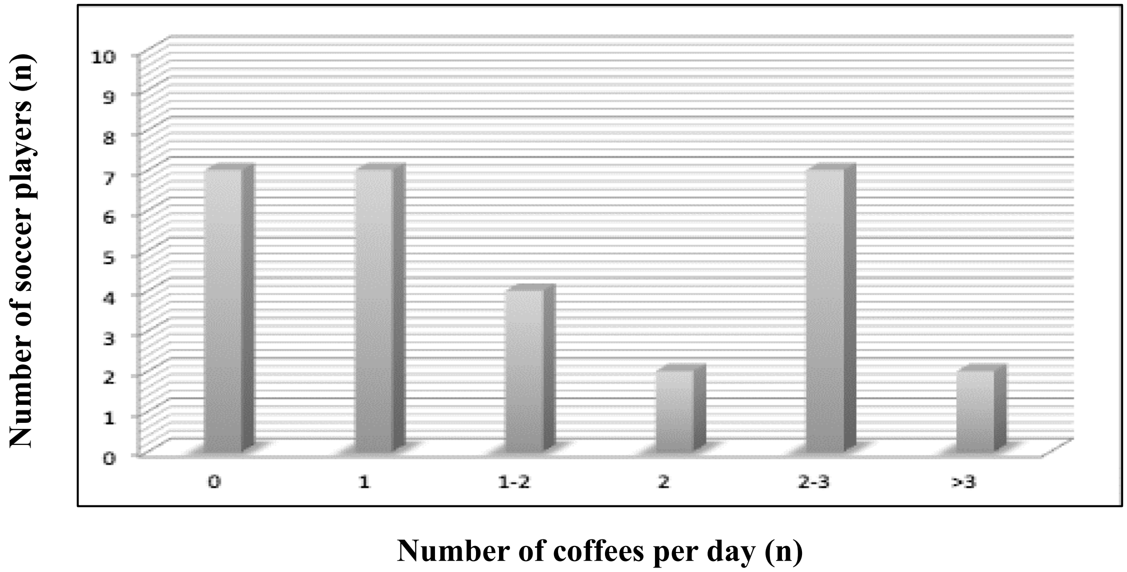

Figure 4. Daily coffee consumption by all the sample.

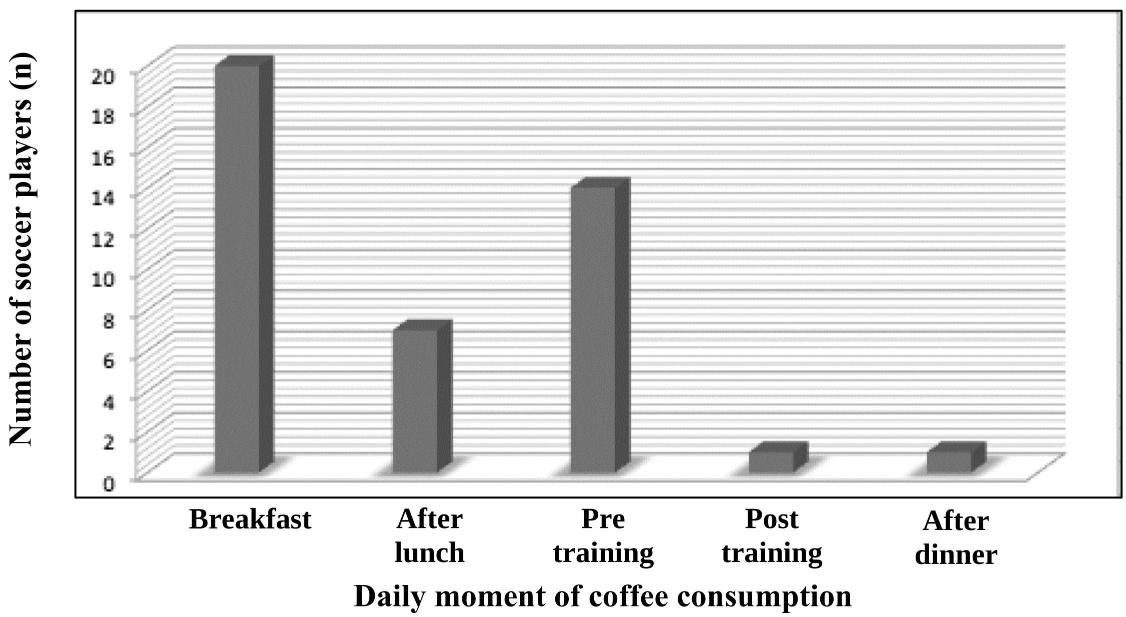

Figure 5. Daily moment of coffee consumption by all the sample.

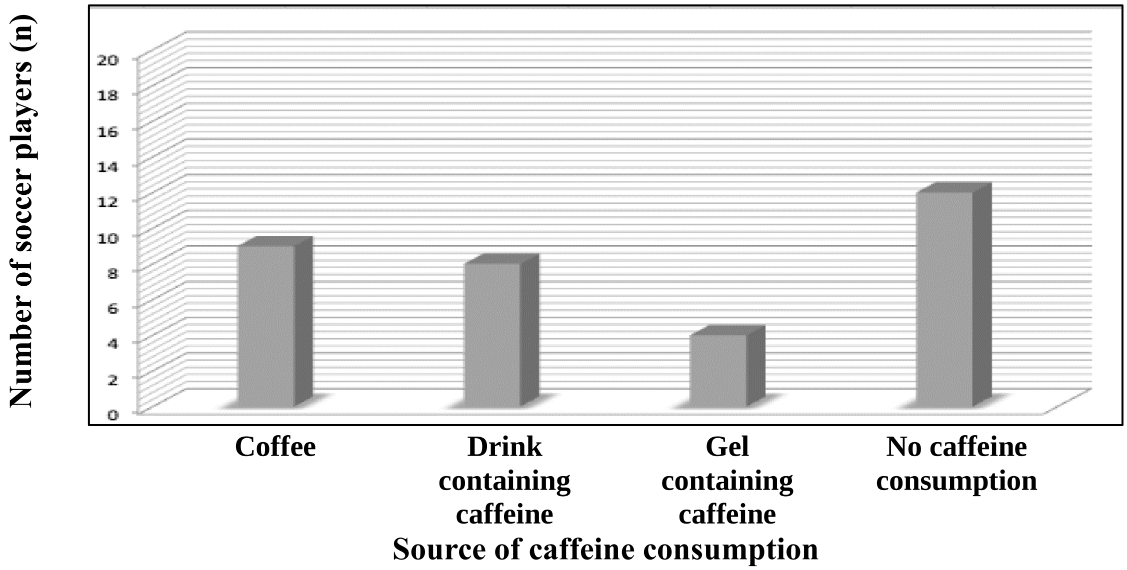

Figure 6. Source of caffeine consumption during pre-match (n = 24).

Table 1. Nutritional supplement used by all the sample.

Nutritional supplement	N consumers	% consumers	N no-consumers	% no-consumers
Creatine monohydrate	17	59%	12	41%
β-alanine	0	0%	29	100%
Nitrates (concentrated beet juice)	2	7%	27	93%
Nitrates (fennel and celery juice)	10	34%	19	66%
Whey Protein	14	48%	15	52%
Caffeine anhydrous	0	0%	29	100%
Caffeine (coffee, tea, mate)	29	100%	0	0
Cholecalciferol	29	100%	0	0%

Legend. n, number; %, percentage.

DISCUSSION

The aim of the study was to investigate the intake percentage and the satisfaction level of some nutritional supplements used by professional soccer players belonging to a team of Serie A. Based on the survey responses of the participants our findings showed a great inter-individual variability.

Cholecalciferol, commonly known as vitamin D3, resulted the most used nutritional supplement among participants. It is a compound physiologically produced by ultraviolet irradiation of the skin (endogenous production) and/or introduced as such exogenous, is hydroxylated in the liver in the 25-25 OH-D position, by the mitochondria enzymes. The discovery of the vitamin D receptor in human skeletal muscle led researchers to study the potential role of this vitamin in the regulation of protein synthesis and muscle function, and therefore the implications on training adaptations. The attention to vitamin D is particularly relevant considering that many athletes, including professional soccer payers, suffer from vitamin D deficiencies in the autumn and winter months (Morton et al., 2012). During this period of year, the absence or low availability of UV radiation of adequate wavelength reduces the cutaneous endogenous production of previtamin D3 (Webb and Holick, 1988). To cope with this condition, supplementation with vitamin D3 (cholecalciferol) to promote the synthesis of calcitriol is commonly used (Behrouzi et al., 2018). In order to promote training adaptations and maintain adequate bone and immune system health, it is recommended to dose the marker 25 (OH) D3 concentration in athletes and correct any deficits during those periods of reduced exposure to sunlight (Close et al., 2013).

The 59% of participants included in the study declared using creatine. In the human body, the largest store of creatine (about 95% of total creatine) is in the skeletal muscle (Wyss and Kaddurah-Daouk, 2000). The exogenous introduction of creatine is guaranteed by the consumption of fish and meat. However, it is relevant to note that creatine requirements are associated to the assumption of macro and micronutrients, often not appropriate and that justify the use of exogenous supplement. In soccer, creatine supplementation is also of particular importance in view of the fact that phosphocreatine deposits decrease significantly during a game (Krustrup et al., 2006). In particular, creatine supplementation improves performance in repeated and short-term shots and reduces recovery periods (Casey et al., 1996). It is important to underline that not all soccer players tolerate and respond to the same creatine dosage and, in general, to most supplements. Therefore, to equivalent dosages do not correspond the same increase in deposits and the equal improvement in performance. In daily practice, therefore, it is fundamental to customize the creatine integration plan for each individual athlete taking into consideration the different periods of the season, the type of the training sessions, the objectives to be achieved, and above all the characteristics of the player.

As for proteins assumption, the percentage of participants responded using whey protein was 48%. Although not considered ergogenic supplements for athletic performance, their ingestion during the first post-exercise phase increases the synthesis of skeletal muscle proteins, thus facilitating post-exercise muscle remodelling processes. During training and after the matches, protein drinks are used because, as is known, proteins in liquid form guarantee a faster amino acidaemia than proteins in solid form. After high intensity exercise several physiological processes occur (Francavilla et al., 2015; Proia et al., 2019). Reintegration is a fundamental behaviour in response to athletes' fatigue status. Above all, athletes appreciated proteins in liquid form because of mostly of them, after a game, refuse any solid food.

Among the nutritional supplement used, our sample reported to prefer dietary nitrates present in fennel and celery juice (34%) and only two out of twenty-nine regularly taking concentrated beet juice. Dietary supplementation of inorganic nitrates has receiving particular attention due to the effects of nitric oxide on several physiological functions. Indeed, it is widely recognized the influence on the regulatory role of blood flow, the absorption of muscle glucose and the contractile properties of skeletal muscle (Jones, 2014). Physiologically, the human body is able to synthesize nitric oxide through the oxidation of L-arginine facilitated by the nitric synthase enzyme. In order to provide a constant and standardized dosage of nitrates by increasing the availability of downstream nitrites, most researcher groups used standard doses of beet juice (0.5 L, equivalent to 5 mmol nitrates). Most studies reported that the ingestion of nitrates contained in the juice was able to reduce blood pressure, diminish oxygen consumption for a given workload and improve the ability to perform both running and cycling sports at different intensity (Bailey et al., 2009; Lansley et al., 2011; Vanhatalo et al., 2010). More recently, Haider and Folland (2014) observed that a 7-day nitrate load (9.7 mmol / day) in the form of concentrated beet juice was able to improve the contractile properties of human skeletal muscle in vivo, as highlighted by the improvement of the excitation-coupling mechanism at low stimulation frequencies. Furthermore, an improved ability to produce explosive force after supra-maximal stimulation was observed (Haider and Folland, 2014). The optimal dose to facilitate the ergogenic effects of nitrates is currently unknown. Some researchers observed a decrease in blood glucose during exercise in subjects who had ingested the juice, suggesting an increase in muscle use of the juice and a saving in glycogen. Furthermore, the improvement in performance in subjects who had taken concentrated beet juice could be due to the maintenance of membrane excitability due to the low plasma concentration of potassium during exercise. The limit of these "drinks" concerns the quantity of nitrates taken which is not standardized but for which we have already activated a project to quantify the nitrates present (unpublished data).

No participants of the sample recruited declared to assume β-alanine or caffeine anhydrous. β-alanine is used to increase carnosine reserves in order to potentially improve high intensity performance. Caffeine deserves wider consideration (Messina et al., 2015).

Based on the scientific literature, in order to quickly increase carnosine deposits, it is recommended a higher dosage of β-alanine (3-6 g / day for 3-4 weeks) followed by a maintenance dosage (> 1.2 g / day). It is important to recall that to minimize the symptoms of paraesthesia, soccer players can benefit from the consumption of slow-release β-alanine formulas by dividing the total daily dose into micro doses to be taken during the day. In our experience "on the field" this supplement is not well accepted by athletes: the players, usually, refuses to take a supplement in the form of a capsule to improve performance.

Through this survey we studied the intake of caffeine (from coffee consumption) by the footballers who participated in our study. Our results have shown that they drink coffee mainly at breakfast and before training. Caffeine is a molecule that is lipophilic enough to cross all biological membranes. Its absorption, after oral intake of drinks containing caffeine, is rapid and is completed in about 45 minutes; the plasma peak is reached in a time interval between 15 minutes and 2 hours. However, several factors and / or pathologies can influence gastric emptying (slowing it down) thus modifying the pharmacokinetics of caffeine. Although ergogenic mechanisms are still considered elusive, most researchers agree on the predominant mechanism of caffeine as a modulator of the central nervous system. Caffeine, easily transported through the blood-brain barrier, can act as an adenosine antagonist, causing greater excitement, promptness and attention, it can increase the concentrations of important neurotransmitters by improving motivation (Maridakis et al., 2009) and the athlete's performance (Mohr et al., 2011). Post-exercise caffeine ingestion may help promote recovery and performance during a subsequent training session to be performed on the same day, although not all researchers observed an enhancing effect on the performance after the ingestion of caffeine (Beelen et al., 2012). Although substantial evidence exists to support caffeine ingestion for improvement on performance, not all athletes respond equally to caffeine assumption and negative symptoms such as tachycardia, irritability, tremor, confusion, reduced concentration (Graham and Spriet, 1995) and impair sleep quality (Drake et al., 2013) can often occur. Many studies have reported no changes in the sweating rate, in the total percentage of water lost and in the water balance due to the consumption of caffeine (Francavilla et al., 2017). The role of caffeine in sport it was widely examined in a recent study (Goldstein et al., 2010).

CONCLUSIONS

The supplementation administered by the nutritionists of this professional soccer team and investigated in this case report showed a balanced intake of creatine, β-alanine, protein, nitrates, vitamin D3, caffeine. This approach is useful because of it was integrated to the daily diet and not applied as food replacement.

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