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Effect of acute vitamin B_6 supplementation on the performance of a kicking protocol in taekwondo athletes

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

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Abstract

Background and Study Aim: Taekwondo is a martial art of high intensity with rapid and repeated blows that require a rapid energy demand. Supplementation of vitamin B_6 can be used aiding the release of glucose and its acute effects on fighters are still scarce. The aim of this study was knowledge about the effect of supplementation with vitamin B_6 in the performance of athletes during the taekwondo kicks bandal tchagui protocol.

Material and Methods: In this study were included five taekwondo athletes, and they received vitamin B_6 or placebo. After 30 minutes, these athletes passed by a protocol of kicks bandal tchagui comprising two rounds with 1 minute. We analyzed the amount of kicks, minute ventilation, blood glucose levels and cardiovascular responses. Results are expressed as mean and standard deviation. We used the Student t-test for independent samples, considering a significant difference when $p<0.05$.

Results: There was an increase of kicks (15 kicks, ~6%) in the minute ventilation (9.6 ml/kg/min, ~9%) and blood glucose (16 mg/dL, ~15%) supplemented with the situation vitamin B_6.

Conclusions: The data from this study suggest that vitamin B_6 might be assisting in both the performance of athletes of taekwondo and the availability of glucose for energy compensation for the year, and thus aid in performance.

Key words: anaerobic exercise • bandal tchaguim • glucose • placebo • ventilation • workout

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Glucose – *noun* a simple sugar found in some fruit, but also broken down from white sugar or carbohydrate and absorbed into the body or secreted by the kidneys [26].

Ventilation – *noun* the fact that air enters and leaves the lungs [26].

Placebo – *noun* a tablet that appears to be a drug but has no medicinal substance in it used in tests and trials [26].

Kick – *verb* **1**. to strike a ball with the foot **2.** to strike something or somebody with the foot, e.g. in martial arts **3.** to make a thrashing movement with the legs, e.g. when fighting or swimming **4.** (*in cricket*) to bounce up high and quickly [26].

Kick – *noun* **1.** a blow with the foot, e.g. in martial arts **2.** a thrashing movement with the leg when swimming **3.** the striking of a ball with the foot [26].

Motor skills – *plural noun* the ability of a person to make movements to achieve a goal, with stages including processing the information in the brain, transmitting neural signals and coordinating the relevant muscles to achieve the desired effect [26].

Performance – *noun* the level at which a player or athlete is carrying out their activity, either in relation to others or in relation to personal goals or standards [26].

Anaerobic capacity – *noun* the maximum amount of energy that can be produced by anaerobic metabolism [26].

Anaerobic power – *noun* same as **anaerobic capacity** [26].

Technique– *noun* a way of performing an action [26].

Workout – *noun* a session of strenuous physical exercise or of practising physical skills as a way of keeping fit or as practice for a sport [26].

INTRODUCTION

The taekwondo (TKD) is a Korean martial art popular, with movements that require gross motor skills, and consequently a demand for quick energy for your sophisticated techniques [1]. The competition consists of three rounds of three minutes each, with 1 minute of recovery, which is performed on a mat with 64 m^2 in size. Technical training is based on the specificity, including running, jumping rope or paddle kicking, considered classic exercises [2].

Research on the physiological characteristics of athletes TKD is scarce [3]. Time analysis of the movements in correspondence with the heart rate (HR) and blood lactate response to the struggles, suggest that the fight TKD requires high demands on short-term, adequate levels of anaerobic power and capacity for rapid recovery [4].

Having a role in this process also known as vitamin B_6 (pyridoxine) is essential role in the regulation of metabolic functions important for maintaining the physical performance during activities requiring a rapid energy production [5]. The vitamin B_6 is related to a group of three components, pyridoxine, pyridoxal and pyridoxamine [6]. The Pyridoxal-5'-phosphate (PLP) is an essential cofactor that participates in the system and energy catalysis is involved with various enzymes including oxidoreductases, transferases, hydrolases, isomerases, decarboxilases, and the degradation of amino acids [7, 8] and the PLP is the catalytic active vitamin B_6.

There are studies that show the relationship between nutrition TKD athletes to maintain performance during combat [9, 10). TKD athletes can increase inventories by supplementation of vitamin B_6, aiming performance improvement due to the fighting style fast.

It has been established that plasma PLP concentrations increase during exercise [11, 12]. During the year, the PLP is a cofactor required for gluconeogenesis in the liver and glycogenolysis and glycolysis in liver and muscle [13]. In skeletal muscle, the concentrations of PLP may decrease during the year, showing the need for vitamin B_6 supplementation before exercise [13].

It has been reported that there is a decrease in physical performance due to the deficiency of vitamins necessary for energy demand in this style of fighting, demonstrating the importance of supplementation of this component to the practice of TKD [14].

The aim of this study was knowledge about the effect of acute supplementation with vitamin B_6 in the performance of athletes during taekwondo kicks *bandal tchagui* protocol.

MATERIAL AND METHODS

Participants

Five men athletes aged 17.2 ±2.9 years, were selected by experience than one year trained with an average of 4 to 5 times per week, about one and a half to two hours each workout. Were used as exclusion criterion athletes who present less than a year of practice in the form or submit any pathology.

The survey was conducted by five visits Laboratory of Exercise Physiology and Measures Assessment, by the morning, between 08:00 and 09:00 hours, with an interval of at least 96 hours, all were instructed not to make any meal preceding tests. This study is characterized with the type design randomized clinical trial controlled double blind.

All signed an informed consent approved by the Ethics Committee (p.03454).

Table 1. Clinical characterization of 5 taekwondo athletes.

Variable	Means & SD
Age (years)	17.2 ±3
Height (cm)	174 ±1
Weight (kg)	60 ±6
Fat perceptual (%)	8.60 ±2
$Vo_{2máx}$ ($ml \cdot kg^{-1} \cdot min^{-1}$)	40 ±6
SBP (mmHg)	115 ±13
DBP (mmHg)	72 ±3
HR (bpm)	73 ±5
HR max (bpm)	191 ±5
VE (l/min)	81 ±13

Abbreviations: **VO_{2max}** maximum O_2 consumption; **HR** heart rate; **SBP** systolic blood pressure; **DBP** diastolic blood pressure; **LV** minute ventilation.

Procedures

Anthropometric assessment

To determine the mass and height of the subjects, we used a mechanical scale (Welmmy®) with 100g graduation and stadiometer (Sanny®) with an accuracy of 1.0 mm. The skinfold measurements were obtained with compass Lange®. For the calculation of body density estimate, we used the equations of the sum of seven folds [15].

Physiological analysis

The heart rate was recorded from a POLAR T61 transmitter – Coded® and pulse monitor Polar® S610. Blood pressure was checked three times before the test, to take an average of rest [16], and every two minutes during exercise testing [17]. The BP was performed using a stethoscope Rapport and apparatus Premium pressure mercury column (Portection®), the auscultatory indirect manner. The test protocol used in the cycle ergometer to measure VO_{2max} was Balke Test [2], where the load was 100 Watts (600 kg.m/min) for men. The increase in intensity was accomplished by adding 50 watts every two minutes of work, even when evaluated is not capable of maintaining speed equivalent to 21.6 km/h.

During the testing device was used ventilometer brand Cefise VLA SG6® for the analysis of ventilatory responses Consumption Maximum O_2 uptake (VO_{2max}) and minute ventilation (VE) compared to the experimental conditions.

For the analysis of blood glucose, we performed a lancing 25 µL of blood after round 2 of all athletes and checked into a Glucose Accy-Chek Advantage II®.

Supplementation Protocol

Prior to each test, the subjects received capsules containing vitamin B_6 (30 mg) or placebo (capsules with flour). The subjects were submitted to two different experimental situations supplementation in order to compare the acute effect of vitamin B_6 versus placebo in the execution of a test protocol kicks, described by Bouhlel et al., [18], which marking consists of a square on the floor of size 140 x 140 cm where the athlete performed two rounds of 2 minutes each with specific shot mode (*bandal tchagui*), and a 1-minute interval between rounds. The experimental conditions were applied on different days, at least three days between one experiment to another.

Statistical analyses

Data are expressed as means, standard deviation (SD or ±). Statistical significance was determined using an unpaired Student's *t*-test. Differences were regarded as statistically significant when the $p<0.05$. All statistical analyses were performed using SPSS ver. 21 (Chicago, USA).

RESULTS

When analyzing the results of the protocol kicks *bandal tchagui*, no significant difference was found in relation to the amount of kicks in the first round between supplementation with vitamin B_6 and placebo test (Table 2). However, after the second round, the number of kicks was higher for the group supplemented with vitamin B_6 versus placebo (15 kicks, ~6%; $p<0.05$). For cardiovascular data, HR, BP, both systolic and diastolic, showed no statistical difference after the two rounds of the protocol for the supplemented group compared to the placebo

Table 2. Physiological responses during the test kicks.

Variable	Placebo (n = 5)		Vitamin B_6 (n = 5)	
	Round 1	Round 2	Round 1	Round 2
Kicks	237 ±31	217 ±19	248.4 ±14	232 ±11*
HR (bpm)	182 ±9	184 ±9	188.8 ±5	190 ±5
SBP (mm/Hg)	168 ±21	179 ±23	178 ±21	182 ±21
DBP (mm/Hg)	45 ±28	55 ±32	58 ±13	42 ±11
VE (l/min)	86 ±20	91 ±13	100.8 ±10*	101 ±10*
Glucose (mg/dl)	S/A	103 ±19	S/A	119 ±21*

*p<0.05). Abbreviations: HR heart rate; SBP systolic blood pressure; DBP diastolic blood pressure; LV minute ventilation.

group. For the data of VE, significant difference after round 1 and round 2 of the protocol kicks for vitamin B_6 supplementation compared to placebo test (9.6 ml/kg/min, ~9%; $p<0.05$). Regarding the data glycemic significant difference after the second round for the supplemented group compared to the placebo group (16 mg/dL, ~15%; $p<0.05$).

DISCUSSION

No studies were found in the literature that analyzed this type of vitamin in TKD athletes. Because there is this fact, our data are compared with other methods and the effect of vitamin B_6 on the indicators analyzed in this study. Some studies were similar, for example, Patlar et al. [5] that examined vitamin E supplementation in athletes TKD on the metabolism of these vitamins in the body against exercise-related modality.

During exercise, the body depends on the liver production of glucose, to be maintained normal glucose levels in the plasma [19]. Furthermore, supplementation may help to increase stocks of vitamin B_6 and subsequent release into the muscle during exercise [20]. As can be seen in Table 2, the plasma glucose levels are higher for supplementation with vitamin B_6 in the placebo group (16 mg/dl, ~15%) the end of the 2nd round. Okada et al. [21], in their study showed a significant decrease in plasma glucose levels in rats with vitamin B_6 deficiency in the blood relative to mice with normal vitamin concentrations. Furthermore, Leklem and Shultz [22], in their study showed an increase in plasma glucose (29 ±13 mg/dl) in young supplemented with vitamin B_6, which led to the increase of the performance after running 4500 meters.

Regarding the performance data, the amount of kicks *bandal tchagui* in 2nd round was significantly higher in the group supplemented with vitamin B_6 in the placebo group (15 kicks, ~6%). Kazemi et al. [2] demonstrated in their study that athletes seek TKD kicking offensive *bandal tchagui* on average 147 shots per round, behaving as the most widely used technique in the fight (54%).

Difference occurred in the data of VE, which was significantly higher in the group supplemented with vitamin B_6 in the placebo group (9.6 ml/kg/min, ~9%; $p<0.05$). The VE is this related to the amount of air inhaled or exhaled per minute and is used most often to measure exhaled air than inhaled [23]. Few studies have studied the effect of vitamin B_6 on aerobic capacity in athletes, and Marconi et al. [24] showed an increase of 6% in VO_{2max} in untrained subjects. In another study, vitamin B_6 when the feed was withdrawn, reduction in Vo_{2max} de 11.6% in healthy men.

Regarding the cardiovascular data, no statistical difference, and the same was shown by Cui et al. [25] when administered 250 mg vitamin B_6 intravenously has not changed the HR or PA in healthy adults.

CONCLUSIONS

Vitamin B_6 increased performance during the protocol kicks *bandal tchagui*, showing that supplementation of vitamin B_6 is a good strategy for these competitors. The present results suggest further studies analyzing different doses of vitamin B_6 and consequent increase in blood glucose levels that can increase the performance and the amount of kicks *bandal tchagui*, important in TKD fighting, which were simulated in the laboratory.

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