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The effect of cannabidiol (CBD) on simple and complex reaction times

MARTIN ŠKOPEK, JOSEF HEIDLER, JAN HNIZDIL, JIŘÍ ŠULC

Abstract

Introduction. CBD activates many different receptors in the body and thus has a wide range of effects, including relief from anxiety and depression, sedative effects, a calming and relaxing effect, antipsychotic effects, help with insomnia and relief of chronic pain. Aim of Study. The aim of our work was to determine the effect of the reaction time of an individual depending on a visual stimulus when applying a dietary supplement with a 10% CBD content. Material and Methods. This study addresses the improvement of an individual's reactivity after ingestion of a food supplement – 10% CBD Enecta oil, and whether there is an improvement in reactivity after ingestion. In doing this work we wanted to expand existing studies on food supplements and prove that oil with a 10% content of this substance affects the response time. Results. Between the measured values in SRT (simple reaction time) after ingestion of oil with a 10% CBD content and the placebo, we found that there is no significant difference between them (p = 0.293). For CRT (complex reaction time) we found that there was also no significant difference between the measured values after ingestion of the oil with a 10% CBD content and the placebo (p = 0.057). The results show that there was no significant difference in the reaction time between the measured values of SRT and CRT. Conclusions. We concluded that the dietary supplement from this substance did not prove to be a stimulant when tested for simple and complex reaction times. After ingestion, there was no expected reduction in reaction time in most test subjects. In view of this deduction, we cannot recommend this product as a suitable means for achieving faster or slower responses to a visual stimulus with the help of authorized substances, which could then be used in various sports or in driving.

KEYWORDS: CBD, t-test, simple reaction time, complex reaction time, CBD oil.

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Corresponding author: martin.skopek@ujep.cz

Jan Evangelista Purkyně University, Department of Physical Education and Sport, Ústí nad Labem, Czech Republic

Introduction

Cannabidiol (CBD) is a phytocannabinoid, i.e. a substance found in Cannabis plants, that lacks the psychoactive effects of Δ9-tetrahydrocannabinol (THC) [3, 4, 5]. CBD is often described as the second most abundant substance in cannabis after THC or tetrahydrocannabinol, but in reality its level depends on the specific strain of cannabis as they all have a different cannabinoid profile [1]. The most significant difference between these cannabinoids is the fact that, unlike THC, CBD does not cause any psychoactive effects [5]. There are two central cannabinoid receptors in the human body, CB1 [12] and CB2 [14]. THC binds to and activates the cannabinoid receptor CB1 in the body, causing euphoria. CBD does not favour either of these receptors, as it binds to both. However, CBD does not activate CB1, it only weakly binds and alters its structure, which will prevent THC from binding to it and causing its activation. Therefore, CBD is non-psychoactive [4, 5, 10].

CBD activates many different receptors in the body and thus has a wide range of effects, including relief from anxiety and depression, sedative effects, a calming and

relaxing effect, antipsychotic effects, help with insomnia and relief of chronic pain [4, 5, 10]. When receptors are activated, they cause analgesic and sedative effects, soothe pain, reduce respiration, and may have a positive effect on anxiety and depression [11, 16]. Further studies showed that cannabinoid-based compounds which participate in the key steps, carry endocannabinoids based on their potential abilities to reduce the motor effects or provide neuroprotections that then directly affect the structures of the basal ganglia [6].

Unlike its psychoactive counterpart (THC – tetrahydrocannabinol), CBD has negligible side effects [8]. We found no effects among them that would affect essential vital functions. These are the effects that commonly occur in the case of almost all pharmacological products [12]. Moreover, they are not strong at all and affect a small percentage of people, so it could be said that they are preferably an exception. Moreover, even in this small percentage of people these effects appear only if the compound is applied in a disproportionately high dose [4, 7].

Interestingly, although CBD is a new substance, and further research is still being conducted, there are already many commercially available products that contain this substance. In today's hectic times, when people are facing increasing demans and challenges, they have to do more work and faster. There is a need to maintain consistently great performance levels and surprisingly, the number of people who actively take care of their bodies and what they eat is growing. They are willing to spend more money on natural, organic products, as they are more confident that the consumption of these products will not introduce harmful chemicals into their bodies. We think that in the future, with increasing studies and promotion in the media, interest in buying and using CBD products could increase, but so far the price is too high and knowledge concerning these products is low. The real advantage is that they are available in different variants, so consumers can choose the one that suits them best. They may be used both at home and on the road. A wide range of CBD-containing products is commercially available, including e.g. oils, sweets, capsules, teas, pastes, liquids, crystals, chewing gum and tinctures [10, 16, 18].

Based on the knowledge gained from the publications used for our study, we found that CBD and other substances contained in the Enecta CBD oil affect our body in a relatively wide range [3, 5, 11]. Cannabinoids bind to particular receptors in the body, mainly in the brain, and affect a range of functions through the endocannabinoid system. All the substances contained in CBD oil work in a kind of synergy and together bring effects such as soothing, relaxing, relieving pain, anxiety, depression or stress [3, 5].

According to the manufacturers of CBD products, one should feel relaxed and calm after applying the oil [18]. As some of the substances in the CBD oil cause muscle relaxation and promote sleep [11], it was assumed in this study that the oil would also affect a person's reaction time. On the other hand, the effects of CBD are implied in relatively vague hypotheses and not based on the results of precise analyses, methodologies and factors determining positively or negatively the effect of this extract. For this reason, we decided to contribute this research to solve this problem.

Aim of Study

The aim of our work was to determine the effect of the reaction time of an individual depending on a visual stimulus when applying a dietary supplement with a 10% CBD content.

Material and Methods

Participants

The study involved 16 participants (men) ages 21-24 (Table 1), based on two measurements during one week. All participants were in good physical shape and healthy during testing without any subjective issues; however, no kinesiology analysis of the test subjects was included in the study. The overall data sample was obtained via purposeful selection.

Table 1. Basic characteristics of the tested group

Basic characteristics	Age/SD [years]	Height/SD [m]	Weight/SD [kg]
	22.7/0.8	178.1/8.6	75.7/6

Note: SD – standard deviation

Procedure

The experiment was conducted twice, with a one-week interval between measurements. Individuals always abstained for 48 hours from substances that have a compelling character (e.g. caffeine, taurine, etc.). The participants were asked not to perform physically or mentally demanding activities the day before and after the measurement. This was due to a possible reduction in attention, which could subsequently affect the speed of reaction. They were asked to observe an ideal sleep time of 7-8 hours the day before the measurement. Fatigue and excipients could affect the measurement results.

The participants were administered a dose sublingually (under the tongue) of the tested oil produced by the manufacturer (Enecta), in which the recommended dose was 0.11 ml (11 mg), which corresponds to 4 drops of CBD oil. Placebo was administered in the same manner under the test subject's tongue – 4 drops of oil (0.11 ml). (The placebo sample produced contained 18 g of olive oil, 6 g of Iberogast, 1 g of dried wormwood. Iberogast and wormwood were added to mimic the very pronounced specific and bitter taste of CBD oil). This composition had the same taste as the CBD oil or at least very similar. The participants were instructed that it was essential to hold the sample under their tongue for at least 60 seconds before swallowing. This was to ensure a faster absorption of the substance.

Thirty minutes after applying the oil, the participant was tested with a reactometer for simple and complex reaction times. This time was chosen based on the recommendation of the CBD oil manufacturer. After one week the second test was conducted; the test subject ingested the opposite pattern of CBD oil or the placebo. All measurements were performed under standardized conditions in the KTVS UJEP laboratory in Ústí nad Labem based on the recommendations from the Balko research study [2].

When measuring the simple response time to a visual stimulus, the participant was sitting in an immovable chair at a table (eyes 60 cm away from the monitor) with the preferred hand 4 cm above the plate. His gaze was directed at the monitor. At various intervals after the start of the test a green circle symbol was displayed in the centre of the monitor on a white background. At each display the participant had to respond by touching the plate 20 times in a row. When measuring the complex reaction time, the procedure was identical, with the difference only in the number of plates and the types of symbols displayed. The tested person had to respond to the type of symbol by pressing the assigned plate, also 20 times in a row.

The plates were arranged in a square with a four-centimetre gap. The first plate represented a red square, the second a green circle, the third a blue triangle and the fourth a yellow cross. The stimulus was always displayed in the centre of the monitor, similarly as it was when testing the simple response time. In this test both hands were used with a starting position of 4 cm above the worktop, the left hand being 3 cm from the left plates and the other hand 3 cm from the right plates. A reactometer and the Fitro Agility Check & Reaction 2.0 software (Fitronic, s. r. o.) were used for the measurement of the reaction itself.

The installed software generated stimuli in the range of 500-3000 ms on the computer monitor and recorded the reaction time of the participant (contact with the plate). Errors were not included in the resulting data.

For the simple reaction time the range of a valid experiment was set at 100-1500 ms, while for the complex reaction time it was 150-2000 ms. The tested participants were not affected by any interfering elements during the measurement

Data collection and analysis

When testing the normality of the data using the Shapiro–Wilk test it was found that the measured values for simple and complex reaction times have an average frequency distribution, and therefore parametric methods of statistical analysis were applied. For statistical data processing a paired t-test was used, which compares the dependent selections. The level of statistical significance was set at $p < 0.05$ [9, 13].

Results

This chapter presents the measured results from testing simple and complex reaction times using a reactometer. Figure 1 shows the measured results of the simple reaction

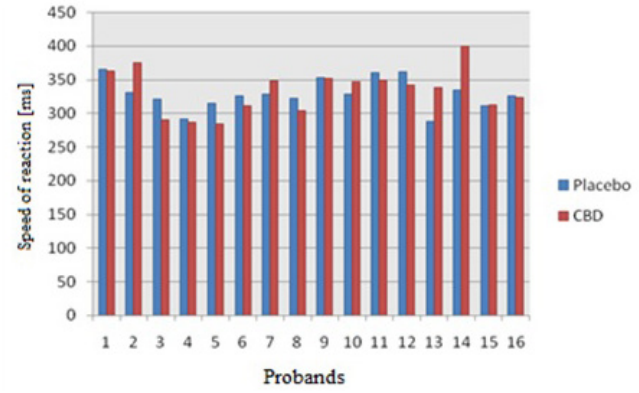

Figure 1. Simple reaction time

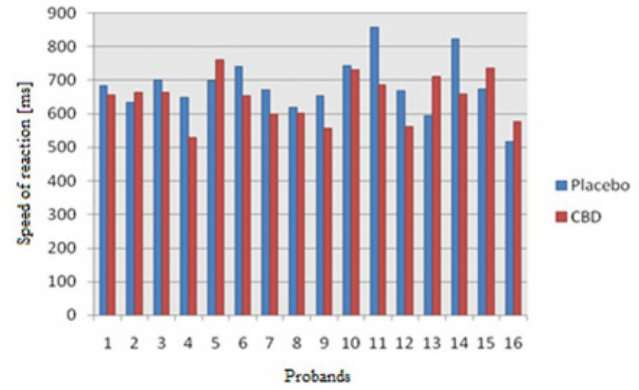

Figure 2. Complex reaction time

time (medians) for individual participants after ingestion of 10% CBD oil and the placebo. Figure 2 shows the measured results for the complex reaction time.
Between the measured values of SRT (simple reaction time) after ingestion of oil with a 10% CBD content and the placebo no significant differences were found between them ($p = 0.293$). The results are given in Table 2.
For CRT (complex reaction time) also no significant differences were recorded between the measured values after ingestion of the oil with a 10% CBD content and the placebo ($p = 0.057$). Material significance was not calculated based on statistical findings.

Table 2. Reaction time following the consumption of placebo and oil containing 10% CBD

	Placebo [med]	10% CBD [med]	p
SRT	333.125	329.187	0.293
CRT	646.812	682.812	0.057

Note: SRT – simple reaction time; CRT – complex time reaction, p – probability of an error in rejecting the null hypothesis

The above results show that there was no significant difference in the reaction time between the measured values of SRT and CRT, for which the effect of the test substance was determined.

Discussion

After the calculations it turned out that there was no significant statistical change in any of the monitored variables. For this reason we can further conclude that a 10% CBD oil extract cannot reduce the response time to a visual stimulus after ingestion both at simple and complex reaction rates. We can therefore confirm that the product cannot be used as a stimulant of the reaction time. We did not compare the results with other similar research due to the lack of scientific work dealing with our topic. Research on CBD focuses mainly on the effects on human health (treatment of diseases, etc.) and not on reaction time.
Reaction studies have been performed on other substances such as caffeine [15] and taurine [17]. Interestingly, no similar conclusions were reached for these substances. Of course, we are aware that we cannot draw clear conclusions concerning the product from this study. The results in individual tests could be influenced by other variables influencing the performance of an individual, e.g. by the psyche of individual participants. It would undoubtedly be necessary to repeat or confirm this testing at least once more on a larger sample of participants to confirm the result. However, this finding is undoubtedly exciting.

Conclusions

We wanted to find out if in our study the reaction time can be influenced depending on a visual stimulus when applying a food supplement with a 10% CBD content. We concluded that the dietary supplement from this substance did not prove to be a stimulant when tested for simple and complex reaction times. After ingestion there was no expected reduction in the reaction time in most test subjects. In view of this conclusion we cannot recommend this product as a suitable means for achieving faster or slower responses to a visual stimulus with the help of authorized substances, which could then be used in various sports or in driving.

Conflict of Interests

The authors declare no conflict of interest.

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