Braz J Otorhinolaryngol. 2014;80(3):226-230

Brazilian Journal of
OTORHINOLARYNGOLOGY
www.bjorl.org

ORIGINAL ARTICLE

Effect of caffeine on cervical vestibular-evoked myogenic potential in healthy individuals☆

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Received 11 August 2013; accepted 1 February 2014

KEYWORDS
Vestibular evoked myogenic potentials;
Caffeine;
Vertigo;
Dizziness

Abstract
Introduction: Caffeine is the most common psychoactive drug in use around the world and is found at different concentrations in a variety of common food items. Clinically, a strong association between caffeine consumption and diseases of the vestibular system has been established. Cervical vestibular-evoked myogenic potential (cVEMP) is an electrophysiological test that is used to assess the sacculocollic pathway by measuring changes in the vestialibulocollic reflex.
Aim: The present study aimed to evaluate the effect of an acute dose of caffeine on the vestibulocollic reflex by using cVEMP.
Method: A prospective experimental study was performed in which healthy volunteers were submitted to the test before and after the intake of 420 mg of caffeine. The following parameters were compared: p13 and n23 latencies and p13-n23 amplitude.
Result: No statistically significant difference was found in the test results before and after caffeine use.
Conclusion: The vestibulocollic reflex is not altered by caffeine intake.

PALAVRAS-CHAVE
Potenciais evocados miogênicos vestibulares;
Cafeína;
Vertigem;
Tontura

O efeito da cafeína no potencial evocado miogênico vestibular cervical em indivíduos saudáveis

Resumo
Introdução: A cafeína é a droga psicoativa mais consumida no mundo e está contida, em diferentes concentrações, em diversos alimentos consumidos no dia a dia. Clinicamente, nota-se um envolvimento importante do seu consumo com as doenças do sistema vestibular. O VEMP cervical é um exame eletrofisiológico que avalia a via sáculo-cólica, determinando alterações no reflexo vestíbulo-cólico.
Objetivo: O objetivo deste trabalho é avaliar a interferência do uso agudo de cafeína no reflexo vestíbulo-cólico através do cVEMP.
Método: Foi realizado um estudo experimental prospectivo, no qual voluntários saudáveis se

☆Please cite this article as: Sousa AMA, Suzuki FA. Effect of caffeine on cervical vestibular-evoked myogenic potential in healthy individuals. Braz J Otorhinolaryngol. 2014;80:226-30.

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1808-8694/$ - see front matter
http://dx.doi.org/10.1016/j.bjorl.2014.02.004

submeteram ao exame antes e depois do uso de 420 mg de cafeína, sendo comparados os seguintes parâmetros: latência de p13 e de n23 e interamplitude p13-n23.
Resultado: Após a comparação dos dados não houve diferença estatisticamente significante entre os exames antes e após o uso da droga.
Conclusão: Não foi observada influência da cafeína no reflexo vestíbulo-cólico.

Introduction

Caffeine is the psychoactive drug most widely consumed worldwide.[1,2] Like theophylline and theobromine, it is an alkaloid from the group called methylxanthines, differing from these substances by the presence of a third methyl group, identified as 1,3,7-trimethylxanthine.[3] At different concentrations, caffeine is present in several substances consumed in daily life: coffee, green tea, chocolate, cola drinks, guarana, yerba mate, among others (Table 1).[4,5]

Table 1 Main types of foods and beverages containing caffeine.

Item (milliliters – mL)	Caffeine content (milligrams - mg)
Tea (227 mL)	
Weak	25
Medium	42
Strong	51
Coffee (227 mL)	
Instant	45
Brewed	111
Cola drinks (330 mL)	35
Energetic drinks (240 mL)	80
Milk chocolate bar (9 g)	6
Dark chocolate bar (9 g)	20

After its oral ingestion, the molecule is rapidly absorbed by the gastrointestinal tract, reaching peak plasma concentration in 15 to 60 minutes,[6-8] with a half-life of 2.5 to 10 hours.[8] In moderate doses, caffeine promotes a sense of well-being, reduces fatigue, improves motor skills and increases alertness and attention.[9] However, at higher doses, the drug can cause anxiety, panic attacks, hallucinations, irritability, and can have a negative action on motor control and quality of sleep.5 Moderate consumption (200-300 mg/day) in healthy individuals is not associated with significant adverse effects.[4]

Doses above 600 mg/day are considered excessive and abstinence symptoms can occur after abrupt withdrawal, although these symptoms have been reported even with low-dose consumption (50-150 mg/day).[10] After ingestion of one cup of coffee (approximately 100 mg of caffeine) there is an increase in caffeine levels of 1-2 mg/g in the blood. The lethal blood level is 80-100 mg/g, that would require an intake of at least five grams of caffeine, which suggests a fairly wide range of safety.[7]

Once ingested, caffeine is distributed homogeneously in the different organ systemsincluding the central nervous system (CNS), where it operates by blocking adenosine receptors, mainly the type A1 and A2a.[9] Adenosine, in turn, is a neuromodulator that acts, along with other agents, to reduce nerve conduction velocity.[8]

Thus caffeine, with its antagonistic effect on adenosine receptors, increases this conduction velocity. Among other mechanisms, phosphodiesterase inhibition is attributed to caffeine, as well as the sensitization of ryanodine receptors for calcium release and, finally, GABA receptor antagonism.[3]

Caffeine is metabolized by the liver and excreted by the kidneys with less than 5% being excreted in an unaltered form.[8]

The cervical vestibular evoked myogenic potential (cVEMP) is a short-latency electrophysiological inhibitory potential used for the assessment of the vestibular system through electromyography of the sternocleidomastoid muscle evoked by sound stimuli, bone vibration or electrical stimulation. This test has been used in practice to evaluate the vestibulocollic reflex (VCR) and assess the integrity of the sacculo-collic pathway: saccule, inferior vestibular nerve, vestibular nucleus, medial vestibulo-spinal pathway, nucleus and accessory nerves and sternocleidomastoid muscle.[11-14]

The cVEMP exhibits a biphasic waveform, of which the first peak is positive and called p13, and the second peak is negative, and called n23. Three main parameters are evaluated: p13, n23and p13-n23 amplitude. The latter should be measured not as an absolute value, but as a relative value compared to the contralateral side or the ipsilateral side in different moments.[15] This is because the absolute values of p13-n23 vary according to the degree of muscle contraction, to the conduction and placement of the electrodes and the to the intensity and frequency of stimulus presentation.[11,16,17]

The literature shows increased cVEMP amplitude after the administration of furosemide and glycerol in patients with endolymphatic hydrops.[18-20] This is objectively determined by the calculated change index (CI).