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Terapeutic of the Use of Chewing Gum in their Different Presentations to Minimizel to Inertia and Sleep Deprivation

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1. Overview

1.1. Introduction: Sleep is defined as the natural, periodic, and reversible decrease in perception of the external environment, with the preservation of a certain degree of reactivity to the environment and autonomous functions. Sleep consists of 2 phases, REM phase and NREM phase, these phases alternate at night in the form of five to six cycles; of which the NREM phase is 75% present and the REM by 25%.

1.2. Theoretical Mark: Caffeine is an easily available short-acting stimulant that has been shown to reduce some of the deficits associated with sleep loss. With the rubber mark the absorption is carried out on the oral mucosa, which generates a greater bioavailability of the active substance and an immediate mechanism of action. The effective response dose can range from 100 mg to 200 mg and the effect arises from 6 min of administered the active substance. It is important to note that the caffeine dose in chewing gum is directly proportional to the effects on sleep inertia, as well as the duration and maintenance thereof.

1.3. Discussion: Being able to analyze the mechanisms of action of caffeine on sleep inertia, helps us to make a comparison of caffeinated gum vs placebo (simple chewing gum). Chewing generates performance maintenance over simple and complex tasks for a short period of time and improves alertness, with caffeine these same effects are prolonged for longer.

1.4. Conclusion: Caffeinated gum is an effective therapeutic presentation on sleep inertia. The dose for a positive response ranges from 75 to 200 mg depending on the circumstances of sleep restriction. That is, thanks to the effects generated by chewing on the state of alertness and cognition and the perennialization and duration of them by caffeine.

2. Introduction

Sleep disorders cause alterations in the quality of life of each patient. At least two-thirds of those with chronic degenerative diseases are affected by sleep disorders, the most common being the female sex.

Many individuals are subjected to night work where a constant state of alertness is required and scientifically it has been proven how this has an impact on the quality of life of each of the employees; because sleep is one of the most indispensable pillars of daily life, as it maintains critical aspects of cognition for optimal mental performance, as well as in the mood, alertness and performance during working days and activities of daily life.

Awakening in an abrupt way implies something known as "sleep inertia", which is characterized by impaired performance and subjective lack of alertness for a transient period, which hardly progresses to good cognition.

It is well known that chewing facilitates concentration, maintains

alertness and improves performance in cognitive tasks, but the question is how effective is the effect of chewing a simple chewing gum vs to one containing caffeine? Therefore, one of the objectives of this research work is to analyze the effects of chewing a simple chewing gum to one containing caffeine, verify the effectiveness of reversing the sleep inertia of each of them and know the mechanism of action, pharmacokinetics, bioavailability, and absorption of a caffeinated gum during sleep deprivation.

3. Theoretical Mark

Normal sleep progresses in various stages: NREM (Nonrapid Eye Movement) phase and REM (Rapid Eye Movement) phase. These cycles alternate at night in the form of 5 to 6 cycles. In 75% of normal night sleep is NREM and 25% REM.

3.1. Phase Brake

It happens every 90 minutes or so. It is characterized by zero muscle tone, presence of active sleep, as cerebral electrical activity is maximum while the body is at full rest, rapid eye movements, heart rate as well as respiratory have irregular signs, evidence of increased basal metabolism and the amount of gastric juice [1].

3.2. Nrem Phase

Also known as "deep sleep", it facilitates body rest and consists of 3 phases.

3.2.1. Phase N1 (Surface Sleep): very light sleep stage, lasting several minutes. It is characterized by a slight decrease in heart rate, breathing, muscle tone, general state of deep rest, relaxed and drowsy, keeping active the ability to perceive external stimuli.

3.2.2. Phase N2 (Surface Sleep): characterized in EEG by sleep spindles and k complexes. Its duration is 10 to 15 minutes. At this stage, the muscle tone relaxes even more, slightly decreases body temperature and respiratory and heart rate, disappearing the movements of the eyes.

3.2.3. Phase N3 (Deep Sleep): characterized by an overall slowing of the electrical path and the appearance of slow waves and high voltage (deltas) whose total duration must be greater than 20% and less than 50% of the plot. Sensory perception decreases markedly, as well as heart and respiratory frequencies. Muscle relaxation intensifies. It is harder to wake the subject, and if he does, he is disoriented and confused. It is the fundamental stage for the subject to rest subjectively and objectively.

This research work was carried out based on various medical studies, which addresses from the rate of absorption, bioavailability, pharmacokinetics of caffeine in chewing gum, the effects of chewing, how caffeine reverses sleep inertia, assess cognitive performance, mood, and alertness after administering caffeinated gum to composition, formulation and design of this chewing gum studied.

It will also include a systematized form each article selected to carry out a bibliographic review and thus carry out a complete study of the effects and efficacy of caffeinated gum to minimize sleep inertia, based on the scientific evidence of some experimental studies in which there is certainty of efficacy of it, since caffeine is involved in the autonomous nervous system and exerts its effects by acting as an adenosine receptor antagonist.

Focus is an essential part of human life, as it is the pillar to be able to perform any cognitive activity, maintain an effective and constant performance to successfully complete actions of daily life and working days. Fatigue can cause various complications and over time can affect the health of the individual, as well as lead to a reduction in efficiency during the day and the increase in the incidence of any type of accidents [2].

Caffeine is an odorless white powder that can have different molecular presentations, can range from an anhydride substance to containing a water molecule. Caffeine is a methylxanthin that inhibits the enzyme phosphodiesterase, generating an antagonistic effect on the central receptors of adenosine, this adenosine occurs during daily activities and binds to its receptors, generating a feeling of fatigue and consequently a sleep induction. Due to the similarity of adenosine with caffeine, the latter takes place in the receptors of adenosine and thus prevents the transmission of the fatigue signal generating that the person can continue the realization of their daily and working activities for a longer period, since it contrarily generates a feeling of insomnia. Caffeine is a Central Nervous System (CNS) stimulant that can promote wakefulness and increase mental activity. In addition, it can stimulate the respiratory center, increase the frequency and depth of breathing and increase total muscle work. Caffeine is usually consumed and/or commonly administered as a liquid substance, although there are other types of presentations such as tablets or capsules. A novel new way to consume caffeine is through chewing gum which in turn can provide additional benefits, some of them are:

- Absorption is carried out through the oral mucosa, resulting in greater bioavailability of the active substance at the systemic level.
- Effective and immediate mechanism of action (oral mucosa).
- It is easy to use and is suitable even for pediatric patients or patients with difficulty swallowing tablets or tablets.
- It generates fewer side effects as the active substance is released proportionally to chewing.
- Primary liver metabolism of the active substance is avoided as they are absorbed directly by the oral mucosa.
- Lower risk of overdose from chewing effect.

Chewing is a physiological motor activity that involves many neural pathways, this action is associated with increased blood flow at the brain and orofacial level which in turn involves effectiveness in increasing alertness, physical well-being and improving memory performance.

The active substance (caffeine) of chewing gum is released proportionally to chewing, this in turn is absorbed through the oral mucosa and another percentage of it is swallowed as a bolus with saliva, reaches the gastrointestinal tract and because caffeine is soluble, the absorption rate is faster compared to that of the tablet. In addition, it is important to mention that controlling the release of caffeine in chewing gum is for a long time and improves the variability of drug release and retention times, these other advantages being this new form caffeine administration.

It is important to note that the effectiveness of this chewing gum with the active substance that is caffeine, has to be argued based on studies that corroborate such effectiveness, such is the case of the P300 signal that is obtained thanks to an electroencephalogram, this signal is a neural record that is projected as a positive deflection and in turn measures the potential of presence, magnitude, topography and duration of cognitive function signaling. The signal is acquired more strongly around the parietal electrodes, although it has been suggested that there are also interactions between the frontal and temporal regions. Recent studies comment that this P300 wave is composed of 2 secondary waves known as "P3A and P3B signals", these components individually respond to different stimuli and it has been suggested that the P3A wave originates from frontal attention mechanisms directed by stimuli during task processing, while P3B originates from the parieto-temporal activity associated with memory attention and processing.

The potential related to the P300 signal had shortened latency after chewing gum, and the frontal and temporal beta power increased when chewing chewing gum after performing a sustained attention task. The quantitative effects on EEG of chewing gum without cognitive performance appear to be moderated by taste, suggesting that chewing gum may alter alertness in the absence of cognitive performance.

Working under pressure, i.e., in setback, was associated with increased activity in the anterior cingulate cortex and left frontal convolution, where the motor neural regions of alertness and executive tasks are located. This same effect was found when chewing gum without taste or smell, suggesting that the motor activity of chewing may be a key factor in explaining these results, however it is unclear whether a higher level of motor activity in chewing will increase the associated effects, as there is evidence that more vigorous chewing or increased resistance to chewing does not moderate the effects on memory , the fact that chewing gum can increase arousal, therefore reaches a maximum peak and descends and in turn decreases cognitive function in performing tasks that require attention (increase heart rate and beta power during surveillance), this suggests that it is more plausible that a more vigorous chewing can have a greater effect on attention in the short term than in memory.

That is, chewing alone generates a perennialization of the performance of a simple task as a result of a motor activity reflects that it is generated in the body in the face of sleep deprivation, but this does not mean that this performance is maintained. One study shows that administering only 200 mg of caffeine in conjunction with chewing gum further improves the performance of simple and complex activities and/or tasks, but also improves alertness compared to chewing without the active substance. In turn, the period of pre-acceptance and autonomous cardiac activity remain unchanged during chewing with or without caffeine, generating a response reflected in the increase in parasympathetic activity with changes at the level of RR intervals in the EEG, the latter mentioned above are predictors of speed and accuracy in the most complex cognitive tasks during sleep deprivation, alertness, and performance maintenance during performance.

Some other studies show as evidence that the use of caffeine in chewing gum is also just as effective in depriving sleep in the face of a post-table; in a double-blind study with 15 adults as participants, they were given this chewing gum containing 100 mg of caffeine at the hour and 6 hours after waking up vs to placebo, they were subsequently assigned psychomotor tasks in the face of surveillance at 0, 6, 12 and 18 minutes. The test qualifier was conducted based on the speed of response and the number of hits during testing. Among the results it was observed that 100 mg of caffeine did not fully restore performance, but showed an improvement in response rate by 85% compared to placebo 73%, since the effect of caffeine was evident at 6 min after waking up, which continued to improve performance until 18 minutes, that is, the results indicate that 100 mg of caffeine substantially attenuates sleep inertia in the face of a sudden awakening for a noticeable period of time, but that at higher doses (200 mg) the inertia of sleep is expected to antagonize more easily in its entirety for a more prolog ago period.

4. Discussion

The purpose of this article is to evaluate based on a collection of articles the efficacy of caffeine as an active substance in a new therapeutic presentation vs placebo, studying the pharmacokinetics, bioavailability, and half-life of caffeine. Among the bibliographic reviews that were addressed for the realization of this article, it is evident that caffeine in chewing gum is a novel and new presentation that is effective to counteract sleep inertia, improving alertness, cognition and maintaining performance during simple and complex activities of daily life. It is important to note that the effects of caffeine are directly proportional to the dose administered in patients as well as in the route of administration. Chewing a chewing gum without the active substance (placebo) later generates performance maintenance as well as alertness with the difference that these effects occur over a very short period [3].

5. Conclusion

Caffeine is an odorless powder that inhibits the enzyme phosphodiesterase, which generates an antagonistic effect on the central

receptors of adenosine resulting in antagonism of the transmission of the fatigue signal, promoting wakefulness and increasing mental activity. The effect of chewing is associated with increased orofacial blood flow that increases alertness, physical well-being, and memory performance. A combination of chewing gum with caffeine potentializes and synergizes the effects that chewing itself generates, resulting in a new, novel and effective therapeutic presentation on sleep inertia, as it is easy to use and its absorption is done through the oral mucosa, which generates greater bioavailability of the active substance and an immediate mechanism of action, in turn these effects are present for an extended period since caffeine within chewing gum is released proportionally to chewing. Caffeine can provide better alertness and performance at doses of 75 to 150 mg after acute sleep restriction and at doses of 200 to 600 mg after one night or more of sleep loss. Caffeine is unlikely to have negative effects on sleep that follows 8 hours or more after administration. However, frequent use of caffeine can lead to tolerability and withdrawal syndrome.

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