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Presentation of Content

In the first article we present, *Prevalence of Temporomandibular Disorders in two Populations, Interned and Pacients of the University 2015*, by OROZCO-RODRÍGUEZ, Angel Ruben, ROSADO-VILA, Graciella, VIDAL-PAREDES, Jorge and SANSORES-AMBROSIO, Fatima, with ascription in the Universidad Autónoma de Campeche, as following article we present, *Proprioceptive training to method adopted to prevent injuries in players of 13 years*, by BADILLO-FUENTES, Gustavo & SUAREZ-MARISCAL, Itati, with ascription in the Physioclinica Pachuca, CRIH, as following article We present, *Characterization of ambient air dust particulates deposited on Ficus leaves in the Metropolitan Area of Guadalajara, Mexico*, by PEÑA-GARCÍA, Laura, RENTERÍA, Víctor, MACIEL-FLORES, Roberto, ROBLES-MURGUÍA, Celia and ROSAS-ELGUERA, José, with ascription in the Universidad de Guadalajara, as a next article we present, *Bruxism and Headaches*, by CAPETILLO-HERNÁNDEZ, Guadalupe R., TIBURCIO-MORTEO, Leticia, TORRES- CAPETILLO, Evelyn G. and CAMARGO-LÓPEZ, Felipe, with adscription at the Universidad Veracruzana, as following article we present, *Microencapsulation and antioxidant activity of Betabel juice (Beta vulgaris),* by MARTÍNEZ-AYALA, José Leonel, REYES-MUNGUÍA, Abigail, CARRILLO -INUNGARAY, Ma. Luisa and MARTINI-MORALES, Sasi Elibeth, with ascription at the Universidad Autónoma de San Luis , as the last article we present, *Efficiency of the NBelyax nanoparticle as a disinfectant agent for a broad spectrum of surfaces in hospital environments. On-site studies in two Mexican hospitals "Hospital Tacuba" and "Dr. Fernando Quiróz General Hospital"*, by LEON-GUTIERREZ, Gabriela, ALBARRAN, Leon, LEON-GUTIERREZ, Sergio and ARTEAGA-LOPEZ, Paola R.

Content

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Prevalence of Temporomandibular Disorders in two Populations, Interned and Pacients de la University 2015

Prevalencia de Trastornos Temporomandibulares en dos Poblaciones, Cautivas y Pacientes de la Universidad Autonoma de Campeche 2015

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Abstrat

The preservation of health is of the utmost importance for personal development in our current world, there are pathologies that affect the correct functioning of the human body and therefore the health of the persons. General purpose: To determine the epidemiological profile of temporomandibular disorders in two populations: a University population and the interned subjects of a Social Readaptation Center. One of the outstanding pathologies and object of studyin the dental field are the temporomandibular disorders. The sample was obtained by means of a formula for size of finite samples because the size of both populations was known and in total there were 441. The molar ratio of group 1 was explored, with class I molar in 57.6% (110 subjects), class II in 2.1% (4 subjects) and class III in .5% (1 subject). The location of the subjects of the Autonomous University of Campeche and the inmates of Cereso is in the city of San Francisco de Campeche, capital of the state of Campeche, Mexico. This study shows that the interned population of the Social Readaptation Center was more affected than the university population.

Dental Prosthesis, Oral Health, Dental Loss

Resumen

La preservación de la salud es importante para el desarrollo personal en nuestro mundo actual, existen un sinfín de patologías que afectan el correcto funcionamiento del cuerpo humano y por lo tanto la salud de las personas. Objetivo general. Determinar el perfil epidemiológicodetrastornos temporomandibulares en dos poblaciones: una población Universitaria y los sujetos internos de un Centro de Readaptación Social. Una de las patologías sobresalientes y objeto de estudio en el ámbito odontológico son los trastornos temporomandibulares. La muestra se obtuvo por medio de la fórmula para tamaño de muestras finitas porque se conocía el tamaño de ambas poblaciones y en total fueron 441. Se exploró la relación molar del grupo 1 encontrándose clase I molar en 57.6% (110 sujetos), clase II en 2.1% (4 sujetos) y clae III .5% (1 sujeto). La ubicación de los sujetos de la Universidad Autónoma de Campeche y los internos del Cereso es en la ciudad de San Francisco de Campeche, capital del estado de Campeche, México. Éste estudio muestra que la población interna del Centro de Readaptación Social estuvo más afectada que la población universitaria.

Protesis Dental, Salud Oral, Pérdida Dentaria

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1 Introduction

The preservation of health is of utmost importance for personal development in our current world, there are endless general pathologies that affect the correct functioning of the human body and therefore the health of people. In dentistry we can find many situations that can alter the health of the organism, from mild conditions to complex situations such as temporomandibular disorders as mentioned in the literature, affect a large part of the population without distinction of race, sex and age.

The stomatognático system is formed by diverse components that working in harmony achieve one of the main functions of the human body being the mouth the main organ for the beginning of the mastication.

Ingestion, digestion, use of nutrients for the body to function properly and thus can develop; so the alteration of any of the components of this system will affect the health of the individual. Oral pathologies in the outstanding dental field are the temporomandibular disorders.

The temporomandibular joint is a bilateral articulation that guides the chewing movements having as limit the teeth is formed by several components such as: condyle, mandibular fossa, articular eminence, articular disc, muscles, tissues, these structures function normally in neuromuscular balance and can be altered; producing pain, joint noises, limitation of mandibular movements, manifestations tolerated many times by the individual without presenting consequences, but in others a series of signs and symptoms is triggered that in this way affect the patient's health.

It has been shown that factors such as anxiety and stress can trigger the development of temporomandibular disorders; In this work two populations with different stress and anxiety situations were studied, which together with particular oral conditions show the health or pathology of the joint in these subjects.

1.1 Problem Statement

According to WHO, dental caries and periodontal diseases are the two major public health problems in the world. For a long time, epidemiological studies have reported prevalence and distribution where they are related to general factors that favor it; the dysfunction of the mandibular temporoid articulation, malocclusions that has been recently increased in its prevalence, has less time of study where less research has been done in developing countries like Mexico and in captive populations being the main objective for the development of this work Okesson describes the general factors: weakened health, general diseases of muscles, joints, psychosocial psychological factors, local factors, occlusal interferences, parafunctional activities such as bruxism or traumas.

It is of utmost importance to mention that any condition of dental origin can affect the general health of people as their functionality common oral problems such as: gingivitis, dental infections, oral trauma to complex situations such as disorders of the temporomandibular joint. Faced with this situation, the affectation can generate physiological changes in the masticatory process, firstly, the distribution of the disease in different types of population should be known, differentiate the probable risk factors that lead a population to suffer disorders of the temporomandibular joint.

Von Korff et al concludes that the prevalence of temporomandibular joint pain tends to decrease with age. Emphasizing the problem in this population entails presenting an articular dysfunction that generates systemic diseases related to oral diseases that in the clinical investigations carried out in other epidemiological studies have shown. The results of this work are intended to respond to the following approach: What is the prevalence of temporomandibular disorders in two populations, captive and university?

1.2 Justification

The temporomandibular disorders every day occur more frequently and without distinction of population groups causing severe disorders in the oral system physiology, however, there are certain individuals who are more vulnerable to these conditions.

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The literature around the world reflects this problem that represents a high cost at the institutional level, so in many cases the problem is not adequately addressed. I emphasize the fact that oral health professionals will have to document to be able to make an accurate diagnosis and establish the treatment that allows the rehabilitation of the subject.

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2 Theoretical Framework

Anatomofunctional bases of temporomandibular disorders. The masticatory system is formed by teeth, bones, muscles and ligaments, with a neurological control system that regulates and coordinates all these structural components. The structure in which the craniomandibular connection is produced is called the temporomandibular joint.

The temporo mandibular joint is a synovial joint that has several characteristics. They perform arthrodial sliding movements, hinge movements that are performed in a ginglimoid plane is a bilateral joint, its articular surfaces are covered by fibrous tissue and not hyaline cartilage and acts as a guide to masticatory movements with the teeth as limit. The tempromandibular joint provides articulation between the mandible via the condyle and the cranium via the temporal bone, particularly the mandibular fossa and the articular eminence. The disc of the temporomandibular joint is between the condyle and the fossa, separating them from a direct joint. The disc is composed of dense fibrous connective tissue and divides the joint into two compartments, one upper and one lower.

The disk in turn is divided into three regions, based on its thickness and viewed from a lateral perspective: a thick anterior zone, a thin intermediate zone and a thick posterior. The temporomandibular joint is a very complex joint system, it contains two separate synovial joint cavities, which must work in unison. The fibrous capsule marks the anatomical and functional limits of the joint, encompasses the condyle and fuses with the periosteum of the condylar neck. The capsule is formed by two layers: an outer fibrous layer and an internal layer of synovial tissue, this produces the synovial fluid that has three functions: lubricant because it reduces the friction between the joint surfaces and nutrient of the avascular tissue of the joint surfaces and the disc, as well as removing detritus from joint spaces.

The temporomandibular joint has an intracapsular disc that divides the synovial cavity into two compartments that usually do not communicate. In the newborn, the disc has the same thickness, although when the temporomandibular joint begins the function, the disc adapts to the shapes of the joint surfaces during rest and movement forming a central part thinner than the ends called posterior bands, central and previous. The disc adapts to all positions of the condyle.

The temporomandibular joint is innervated by the auriculotemporal nerve that is sensitive, the masseter nerve and the posterior deep temporal nerves that are motor nerves. The temporomandibular joint is irrigated by the superficial temporal artery in the posterior part, the middle meningeal artery in the anterior part and the internal maxillary artery in the inferior part. The condyle receives vascularization of the inferior alveolar artery through the medullary spaces. These structures normally function in neuromuscular balance and can be altered, producing pain, joint noises, limited mandibular movements, being tolerated many times by the individual, without presenting consequences, but in others a series of signs and symptoms that mainly affect the muscles that are the weakest structures in the system.

Background and terminology

It is logical to assume that temporomandibular disorders have existed since the development of the human joint, but the first written records date back to the fifth century BC, when Hippocrates described a method to manually reduce dislocations of the jaw. In later centuries, various pathological conditions were occasionally described; these include trismus and ankylosis due to infection, trauma or arthritis.

These patients were treated in general by doctors of the time with various medications or devices, in the same way that similar problems were treated in other joints of the body. It was not until the last part of the 19th century that surgical methods began to be described. Over the years, disorders of the masticatory system have been identified with various terms which has generated confusion.

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History records that man initiated the management of temporomandibular disorders in ancient Egypt through the treatment of mandibular dislocations. In the year 348 BC, Hippocrates describes for the first time a case of manual reduction of temporomandibular joint dislocation very similar to the method currently used. The first surgical replacement of the articular disc is attributed to Annandale, published by the Lancet in 1887.

At the beginning of the 20th century, surgeons Lanz, Pringle and Wakeley reported improvement in the signs and symptoms of their patients by removing the intra-articular disc. In the last half of the nineteenth century Evens introduced the first device that tried to reproduce jaw movements, but it was Walker who designed a very complex articulator and facial arc to reproduce the movements of the jaw, giving rise to the beginning of what he would call gnathology. But in 1899, Snow registered his patent for the facebow and Gysi in 1910, developed the method for registering jaw movements with the now famous Gothic arch.

At the beginning of the 20th century, Balkwell, Bonwell, Bennett, Spee, Monson and Wadsworth published the occlusal concepts based on the balanced occlusion that would level muscle activity and the interaction of the resulting forces.

Many otolaryngologists and dentists described the symptoms of head, face, ear, but in 1934, James Costen described a group of symptoms referred to the ear and the temporomandibular joint and as a consequence of this work, it was called Costen syndrome. Weinmann and Sicher in 1951, classify the problems of the temporomandibular joint from a diagnostic scheme in vitamin deficiencies, endocrine disorders and arthritis.

Five years later Shwartz proposes the term temporomandibular joint dysfunction and pain syndrome for the purpose of distinguishing disorders of the muscles of mastication from organic alterations of the joint. In 1959, Shore introduces the term temporomandibular joint dysfunction syndrome. Later the term functional alterations of the temporomandibular joint by Ramfjord and Ash appears. In 1960, Bell describes a classification composed of 6 groups that recognize intracapsular and extracapsular muscle disorders.

In 1986 the International Association for the Study of Pain publishes a classification on pain conditions and of the 32 categories of pain, category III is assigned to craniofacial pain of musculoskeletal origin with two subcategories: temporomandibular pain, dysfunction syndrome, osteoarthritis of the temporomandibular joint.

Other terms described the suggested etiologic factors, such as occlusomandibular disorder and temporomandibular joint myopathy. Others highlighted pain and called pain disorders myofascial dysfunction syndrome and pain-temporomandibular dysfunction. Then comes the proposal of the term of craniomandibular disorders.

In an attempt to unify the terminology in 1991, during the tenth annual seminar of the Craniomandibular Institute, temporomandibular disorders were defined as a group of clinical problems related to the muscles of mastication, the temporomandibular joint and associated structures. Due to the importance that has been given to this problem since 1975, the American Academy of Craniomandibular and Facial Pain Disorders (AAOP) was established.

However, it was Welden E. Bell, who suggested the term temporomandibular disorders and together with the AAOP and the International Headache Society (ISH) published the classification of temporomandibular disorders that not only includes the terms related to the joints, but also classifies the functional disorders of the masticatory system 4.5.

Despite these attempts there are discrepancies and opinions against this classification. Then a group of scholars and researchers led by Samuel Dworkin and Linda LeResche from the Department of Oral Medicine at the University of Washington in Seattle, developed a classification system for temporomandibular disorders in which they included the psychosocial aspects of temporomandibular pain, naming this classification as: Diagnostic criteria for investigation of temporomandibular disorders.

CDI/TTM

Regardless of the classification used, the diagnostic complexity of the criteria referred to above is undeniable.

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Some indices have been described to measure the presence and severity of temporomandibular joint disorders. In 1969, Krogh-Paulsen, describes a clinical examination to establish the categories that precede the diagnosis of dysfunction and therefore becomes important from the preventive point of view. The examination comprises nine criteria to evaluate three components of the masticatory system: muscles, articulation and occlusal contact.

In 1970, Marti Helkimo establishes a diagnostic test to classify patients' conditions through the Index of Clinical, Anamnestic and Occlusal Dysfunction. The absence of the study of psychosocial factors, which have commonly been associated with temporomandibular disorders, seems to be a drawback of this index.

In 1985 Friction and Schiffman proposed a Craniomandibular index, which consists of two indices, that of dysfunction and that of palpation. Although many diagnostic systems have been described, currently there are two most used by researchers: the Clinical Guidance Examination proposed by Jeffrey Okesson (1996) and the CDI / TTM index proposed by Dworkin & LeResche (1992) that includes two axes of study. The axis I that includes the information of the anamnestic clinical examination and the axis II that contains the variables of the psychosocial study.

This method to diagnose temporomandibular disorders has been translated into 17 languages and is used by more than 45 researchers integrated in an international consortium with representatives in all continents and that provides through the network the tools to perform research with this diagnostic method. Currently, doctors are having much more success in the management of patients with various temporomandibular disorders. From the diagnostic point of view, since methods such as computed tomoGraphicy and magnetic resonance have been used, this has led to a clear understanding that temporomandibular disorders can arise both in the temporomandibular joint and the muscles of mastication. This provides a better knowledge of the etiology of joint pathology and consequently the application of a more conservative treatment. The medical and psychosocial management for myofacial pain, as well as the occlusal adjustment for the treatment of these disorders; On the other hand, arthroscopy and arthrocentesis have eliminated the use of surgical procedures for the treatment of disc problems65.

Definition

TMJ temporomandibular disorders are a heterogeneous group of complex disorders, of varied and multifactorial etiologies. These disorders can affect the masticatory muscles, the bone components of the temporomandibular joint (TMJ), and the soft tissue components of the temporomandibular joint, including the articular disc and its ligament attachments. Temporomandibular disorders are the most common cause of non-dentary pain in the orofacial region, patients with these disorders often present with pain in the masticatory muscles and the temporomandibular joint or preauricular area. Other symptoms may include sounds of temporomandibular srticulosis, limited or asymmetric jaw movement, headache, and earache.

The American Dental Association defines as temporomandibular disorders a group of alterations that affect the chewing muscles and their attached structures. The temporomandibular disorders represent alterations that significantly affect the individuals who suffer from them, as well as pain, which is the main reason for consultation, they involve physical disability, functional impotence and another series of physical symptoms of a general nature that are usually accompanied by emotional stress.

There is controversy about the definition of temporomandibular disorders (TMD), however, it is considered as the set of symptoms and signs present in the masticatory system. They are a group of ailments with similar signs and symptoms such as pain, joint sounds and limited jaw movement, however, they are also considered a psychophysiological disorder, although psychological or psychosocial variables are not incorporated into the schemes used to diagnose them.

This expression allows the inclusion of anxiety and depression or emotional state altered by the presence of chronic pain or chronic pain syndrome or chronic dysfunctional pain. Temporomandibular disorders can also be recognized by the presence of chronic pain conditions of the head or back that impact on the health of the subject, causing interference and limitation of the individual's daily activities caused by pain.

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With these considerations, it is important to differentiate between severe chronic, persistent and disabling pain, since pain in the structures of the temporomandibular region is the main symptom of temporomandibular disorders and that this condition interferes with the usual activities of the individual. You can consider the impact on your economic situation by losing productivity, rather than joint noises or even jaw locking. This condition is also characterized by limitation or deviation in mandibular movement, as well as crepitus or clicking during function, unrelated to alterations in growth and development, systemic diseases or trauma.

Etiology

The etiology and pathophysiology of temporomandibular disorders is poorly understood. It is generally accepted that the etiology of temporomandibular disorders is multifactorial, with the participation of a large number of direct and indirect causal factors. Among these, occlusion is frequently cited as one of the main etiologic factors that cause temporomandibular disorders.

Numerous logical and therapeutic theories are based on this supposed association and have justified the use of several therapeutic methods such as occlusal therapy with appliances, anterior repositioning devices, occlusal adjustment, restoration procedures, orthodontics and orthognathic treatment. Conversely, many types of dental interventions, including routine orthodontic treatment, have been reported as causes of temporomandibular disorders. There are factors of initiation, predisposing factors and perpetuation factors and consequently there is no single cause. Okeson identifies five factors associated with TMD: occlusal factors, trauma, emotional stress, deep pain input and parafunctional activities, but these have been the subject of much debate and enthusiastic treatment.

The predisposing factors increase the risk of suffering from temporomandibular disorders, the triggers initiate the disorder and the perpetuating ones prevent the healing and favor the progress of a temporomandibular disorder.
In the literature, five factors closely related to temporomandibular disorders are mentioned: malocclusion, facial trauma, stress, pain and parafunctional habits.

In The Technology Advancement Conference by the National Institutes of Health (NIH) on TMD (NIH, 1997) defined these disorders according to two general aspects, pain and psychosocial dysfunction. Now there seems to be more evidence that these two aspects are important, or consequently characteristics that make patients seek treatment. Because the etiology of temporomandibular disorders presents a paradigm with a 7.8 multifactorial origin, studies conducted by researchers on temporomandibular disorders have been based on clinical examination, questionnaires or 19 interviews.

De Boever (1979) reported five different theories on the etiology of temporomandibular disorders: theory of mechanical displacement, neuromuscular theory, psychophysiological theory, muscular theory and psychological theory.

Temporomandibular disorders are not considered as only one entity, they comprise several conditions of diverse etiology and pathology and with great controversy due to limited knowledge about the etiology and natural history of the disease followed by temporomandibular disorders. (Dworkin & LeResche 1992, McNeill 1993).

Okesson describes general factors such as weakened health, general muscle diseases, joints, psychological, psychosocial factors, local factors, occlusal interferences, parafunctional activities such as bruxism or traumas can affect the stomatognathic system. Many authors have found variables associated with the tempromandibular disorders. For example, the muscular force that plays a very important role in the physiology of the orofacial complex and its changes that are generated are reflected in the mandibular movement. Also, the loss of posterior teeth has been associated with temporomandibular disorders.

The malocclusions have been related to temporomandibular disorders, mainly Class II, type I of Angle. Occlusal interferences as a cause of temporomandibular disorders have been the subject of discussion among researchers, while some reject them, others point to them as causal factors or argue that there is no evidence for rejection either.

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Other studies point to a relationship between vertical overlap (TV) and horizontal overlap (TH) with TTM. Kahan et al, (1998) found that 5 mm or more of TV and HT in the study subjects was significantly more prevalent in the 12 patients with TMD. Emotional factors such as stress and anxiety have also been linked to TTM. In the case of the association of absence of posterior pieces and its effect on the temporomandibular joint. Other factors that have been related to TMD are head and neck trauma, orthodontic treatment and the:

Socio-demoGraphicic characteristic

Von Korff et al in their prospective study of depression as a risk factor, in 1016 subjects aged 18 to 44 years concludes that the presence of pain is a subsequent risk factor to develop a new pain condition. In this sample, he found that 6.5% presented chronic pain of the temporomandibular region.

In a study Bernhardt et al conclude that among the most common headaches are those of stress and migraine type and the first with a prevalence of 30% to 70% and according to its frequency relates to muscle tension and at the same time as a risk factor to trigger temporomandibular disorders.

Epidemiological data

Temporomandibular disorders are very common problems affecting approximately 1 of the 20 to 40% of the general population. The studies of Dworkin, LeResche, McNeill, Nilner, Carlsson, Magnusson, Wänman, Heikinheimo, Könönen and others have reported a prevalence of TMD greater than 50% of the general population with signs or symptoms of the temporomandibular joint, of the which only from 3% to 7% seek professional help for your problem. A considerable number of cross-sectional studies of different populations have been published since the seventies, dominating the Scandinavian countries.

The symptoms have been presented with a prevalence range of 12% to 59% and a high number of signs (28% to 93%). According to the literature, the variation in prevalence is due to the study population and the type of index to diagnose the condition.

The McNeill studies describe some risk factors such as severe open bite, horizontal overbite greater than 7mm, discrepancy between the retrusive contact position and the intercuspal position greater than 2mm, tooth loss of five or more teeth and the Unilateral crossbite in children can be associated with 16 temporomandibular disorders. But in this regard, the study by Farella et al concludes that the posterior crossbite does not seem to be associated with noises 17 of the temporomandibular joint in adolescents.
Goldstein mentions that the causes of the temporomandibular disorders vary from a trauma to an immune disease or to neoplastic growths or unknown neurobiological mechanisms.

Also mentioned are prolonged dental treatments or intubation for general anesthesia as a cause of temporomandibular disorders.

This author also mentions that the gold standard for diagnosing temporomandibular disorders are the patient's medical history, clinical evaluation and, in most cases, psychological evaluation. According to Goldstein, temporomandibular disorders occur 18 more in the female sex.

Although dental caries and periodontal disease are the most common conditions of the oral cavity, temporomandibular disorders have become an oral public health problem. The studies on temporomandibular disorders by Helkimo in 1974, showed that the presence of signs and symptoms were the same in men than in women, more recent studies have shown higher prevalence in females. (Locker & Slade 1988, Tervonen & Knuuttila 1988, Agerberg & Inkapoööl 1990, DeKanter 1990, Dworkin et al 1990, Salonen et al 1990, Magnusson et al 1990 and 2000). The majority of patients with temporomandibular disorders are aged between 18 and 45 years (Carlsson 1999) 26.

The American Academy of Orofacial Pain estimates that 40 to 75% of the population have at least one sign and that 33% have at least one symptom of temporomandibular disorders. In contrast, other authors have shown an increase in prevalence as age advances (Aberberg & Bergenholtz 1989). Other studies have shown that the symptoms of temporomandibular disorders decrease with age and the signs increase (Salonen & Hellden, 1990).

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Zazueta et al found a prevalence of 40% in a rural population of the same region. Casanova-Rosado et al reported a prevalence of 46.9% in a study conducted among university students in the state of Campeche, Mexico, both researchers used the Examination of the Identification Criteria for Temporomandibular Joint Disorders (CDI / TTM).

Goulet et al conducted a study to determine the prevalence of pain in the mandibular region in a population of 1675 subjects aged 18 years and over through a telephone survey in the province of Quebec and found that 30% of the population suffers from pain and 7% report frequent episodes. McMillan et al in another study with a telephone survey reported a prevalence of 41.6% of symptoms of orofacial pain in a population of 1222 subjects aged 18 and over in Hong Kong. It reports that the prevalence is higher in the female sex and that apparently in the young subjects the risk is increased in comparison with older adults.

Von Korff et al concluded that the prevalence of temporomandibular joint pain tends to decrease with age and that pain in women is more frequent than in men, and the prevalence of increased depression increased by 5% in people no pain at 16.5%, in people with a pain condition between the subjects. Factors that have been associated with temporomandibular treatments are sex, parafunctional habits such as bruxism, premature contact points, 18 interferences on the work side or balance, as well as the preference a subject develops for performing unilateral mastication or treatment of orthodontics.

In an Isberg study on the effect of gender and age on the prevalence of disc displacement, she reports that the female sex at adolescence is higher in a 3: 1 ratio and that women who have symptoms of displacement disc in adolescence, also presented the symptoms a decade later. In a population, women have a ratio of 2: 1 with respect to the opposite sex.

Velly et al report in their research conducted in patients aged 18 to 60 years that there is a positive association between orthodontic treatment and disc displacement and that it increases with the presence of anxiety and concludes that even grinding and clenching are factors related to temporomandibular disorders.

McNamara reports according to his research on the relationship between orthodontic treatment and temporomandibular disorders that the signs and symptoms can occur in healthy patients, they increase during adolescence until menopause, therefore, it is not related to orthodontic treatment. In general, it concludes orthodontic treatments performed during adolescence do not increase or decrease the risk of suffering from temporomandibular disorders.

Standardization

In the scientific studies it is very important the standardization of the examiners to improve the quality of dental research, called dental public health. The World Health Organization has recommended that the reliability of clinical measurements should be a fundamental part of the oral health research work and in the case of the temporomandibular joint this process is very thorough due to the number and diversity of characteristics to be determined. When carrying out the biblioGraphicical research I found that Dworkin and collaborators have suggested guidelines for carrying out reliable studies, the most important factors that are mentioned to improve the reliability are the definition of the variables and the specifications to perform the exam.

Another factor is the training and periodic recalibration of examiners. In the field of study of the temporomandibular joint, Duinkerke et. to the. reported in their work on disorders of this articulation that training and recalibration improved the reliability of the study and concluded that training is as important as clinical experience 49. As an example of the relevance of the above, Nilsson reports in his study conducted in a population of 120 adolescents with pain of the temporomandibular region, reliability and validity in the questions of the survey that the research subject answers for himself and concludes that the results increase their accuracy, if a small interval of time between the questions and the clinical examination is allowed. This author uses the Identification Criteria for Temporomandibular Joint Disorders (CDI / TTM).

The International Consortium of Identification Criteria for Temporomandibular Joint Disorders (CDI / TTM) presents its web portal with the mission of publicizing the protocol and the research method.

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In addition, it provides the protocol with the exam formats, the process for the standardization of the clinical examination, the interview and the reliability studies.

4 Methodology

El estudio se realizó con la debida autorización de los directivos de la Universidad Autónoma de Campeche y el centro de readaptación social de San Francisco Koben. La muestra se obtuvo por medio de la fórmula para tamaño de muestras finitas porque se conocía el tamaño de ambas poblaciones y en total fueron 441 sujetos.

5 Results

Of the study population of the internal subjects of Cereso (Group 1), the average age was 37 years, SD = 9.5, range from 20 to 68. 89% were men and 11% women.

Of the patient population of the Autonomous University of Campeche (Group 2) studied, the average age was 18 years, SD = 4.3, range from 14 to 42. 42.8% were male and 57.2% female. The prevalence of Temporomandibular Joint Dysfunction in group 1 is 69.6% (Graphic 1). The prevalence of Temporomandibular Joint Dysfunction in group 2 is 52.4% (Graphic 2). A statistically significant difference was observed between the temporomandibular dysfunction presented in both groups, chi2 = 6.24, p = .01.

It is observed that 85.8% of men in group 1 have temporomandibular dysfunction and 14.27% of women present it, with a statistically significant association. RM = 4.6, p = .04 (Graphic 3). The dysfunction of the temporomandibular joint and sex in group 2 reported that 64% of women and 36% of men present it. There was a statistically significant association. RM = 1.8 (Graphic 4).

The components that determine Temporomandibular dysfunction in group 1 presented the following values: myofacial pain 7.3%, myofascial pain with limited opening 29.3%, disc displacement with reduction 4.2%, disc displacement without reduction 5.8%, arthritis and osteoarthritis 11% , osteoarthrosis 1%, combination of myofacial pain and disc displacement with reduction 4.2%, combination of myofacial pain and osteoarthritis 6.8%.

The components that determine Temporomandibular dysfunction in group 2 presented the following values: myofacial pain 10.8%, disc displacement with reduction 17.2%, disc displacement without reduction 5.2%, arthritis and osteoarthritis 7.2%, osteoarthrosis 9.2%, combination of pain myofacial and disc displacement with reduction .8%, combination of myofacial pain and disc displacement without reduction 2%.

The molar ratio of group 1 was explored, with class I molar in 57.6%, class II in 2.1% and class III .5%. The molar ratio of group 2 was explored, with class I molar in 88%, class II in 11.3% and class III 8.5%. In group 1 in dental wear were found 5.2% of subjects without wear, 69.1% with wear in enamel, 23.6% wear in dentin, 1.6% wear in the middle of the crown and 1 subject (.5%) more than 2 / 3 parts of worn crown.

In group 2 in dental wear, 52.8% of subjects were found to be without wear, 35.6% with enamel wear, 16.4% wear in dentin, 1.2% wear in the middle of the crown. Regarding the area of pain in group 1, it was found that 70.2% did not present pain, 11% presented joint pain, 14.1% had muscle pain and 4.7% presented both joint and muscle pain. Regarding the area of pain in group 2, it was found that 81.6% did not present pain, 5.6% presented joint pain, 8.8% muscle pain and 4% presented both joint and muscle pain.

Deviation of the midline was studied, obtaining the following results: in group 1, 77.8% deviation to the left and 22.2% to the right; in group 2, 33.9% presented deviation to the left, 25% deviation to the right and 41.1% did not show deviation. In group 1, the mean number of missing teeth was 3.98, SD = 3.07, Range from 0 to 15. A positive correlation was observed between absent teeth and age r = .39, p = .000.

In group 2, the mean number of missing teeth was .71, DS = 1.3, Range from 0 to 7. A positive correlation was observed between absent teeth and age r = .38, p = .000.

In group 1, the average of restorations in the mouth was 4.53, DS = 3.02, Range from 0 to 28. In group 2, the average of restorations in the mouth was 1.9, DS = 2.6, Range from 0 to 16.

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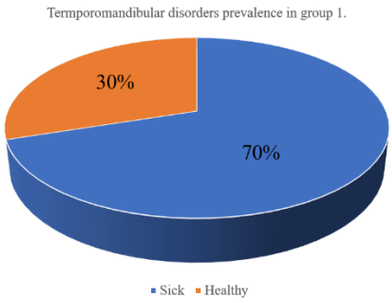
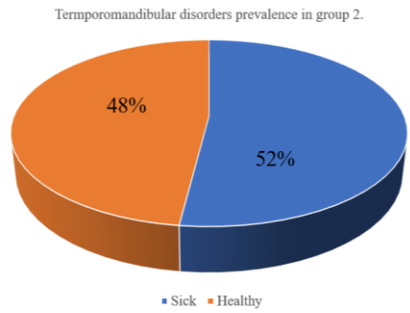
In group 1, the unassisted opening mean without pain was 36.62, DS = 5.8, Range 17 to 48. In group 2, the unassisted opening mean without pain was 41, DS = 7.3, Range from 21 to 46. In group 1, the mean maximum unobserved openness was 43.7, DS = 4.9, Range from 30 to 57 In group 2, the mean maximum unobserved openness was 47.9, DS = 7.4, Range 25 to 58. In group 1, the mean maximum assisted opening was 49.2, DS = 4.8, Range from 35 to 63. In group 2, the mean maximum assisted opening was 50.4, DS = 6.7, Range 32 to 65.



Direct source

Graphic1 Prevalence of temporomandibular disorder (TMD) (healthy and sick) study population: group 1 = Interns of Cereso



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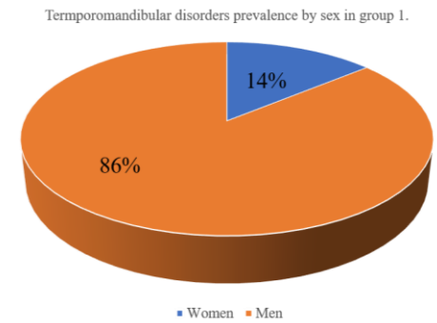
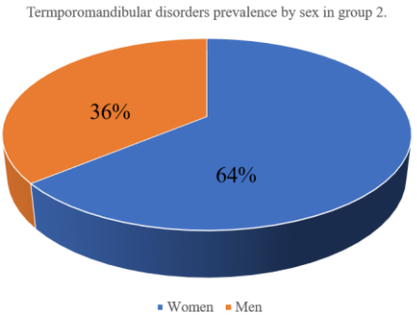
Grafica 2 Prevalence of temporomandibular disorder (TMD) study population: group 2 = university patients



Direct source

Gráfia3 Prevalence of temporomandibular disorder (TMD) related to sex group 1 = study population inmates of Cereso



Direct source

Graphic 4 Prevalence of temporomandibular disorder related to sex (TTM) group 2 = university patients

6 Conclusion

This study shows that the internal population of the Social Readaptation Center was more affected than the university population. In the population made up of students, teachers and university administrators, women were more affected and men were more affected in the inmates.

I emphasize that in the group of university students the condition that predominated was disc displacement with reduction and in the population of inmates it was myofacial pain with limited openness. Dental loss is a common condition in Mexicans and this study confirms it when presenting a relationship between it and dysfunction in both populations studied.

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Proprioceptive training a method adopted to prevent injuries in players of 13 years

Entrenamiento propioceptivo un método adoptado para prevenir lesiones en futbolistas de 13 años

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Abstract

Objetives: To know the efficacy, the benefit, and the importance of proprioceptive training in children 13 years of age. As well as the application of an injury prevention program designed according to the age of the players analyzed. The proprioception previously was used for the recovery of injuries, nowadays it has been implemented in daily training of different disciplines. One of the first works for the prevention of injuries was the FIFA 11+ which mentions that the injuries can be reduced from 30% to 50%. Methodology: The investigation was Longitudinal, Experimental, Prospective and Quantitative. Contribution: The collection of information resulted in a high benefit of prevention of sports injuries with propioceptive exercises in the sport of soccer. It was possible to reduce a 67% injury rate

Propioception, Injury, Therapeutic Training, Skeletal Muscle, Prevention

Resumen

Objetivos: Conocer la eficacia, el beneficio, y la importancia del entrenamiento propioceptivo en los niños futbolistas de 13 años de edad. Asi como la aplicación de un programa de prevención de lesiones diseñado de acuerdo a la edad de los futbolistas analizados. La propiocepción anteriormente se utilizaba para la recuperación de lesiones , hoy en día se a implementado en los entrenamientos a diario de diferentes disciplinas. Uno de los primeros trabajos para la prevención de lesiones fue los FIFA 11+ el cual menciona que las lesiones se pueden disminuir de un 30% a un 50%. Metodología: La investigación fue de tipo Longitudinal, Experimental, Prospectiva y Cuantitativa. Contribución: La recopilación de información arrojo como resultado un beneficio alto de prevención de lesiones deportivas con los ejercicios propioceptivos en el deporte del futbol. Se logro reducir un porcentaje lesional del 67%.

Propiocepción, Lesión, Entrenamiento Terapéutico, Musculo Esquelético, Prevención

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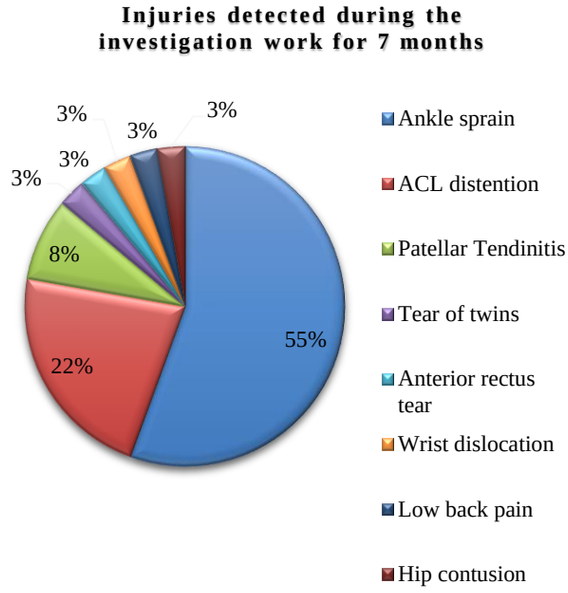
Introduction

Proprioception refers to the ability of the body to detect the movement and position of the joints. It is important in the common movements that are made daily, especially in sports movements that require a greater level of coordination (Saavedra, 2003; Lephart, 2003; Griffin, 2003) This has as an important role to maintain joint stability under dynamic conditions, providing control of the desired movement and joint stability. The proper coordination of muscle coactivation (agonists - antagonists) attenuates the loads on the articular cartilage (Ibid.). There are multiple programs that facilitate the training of the conditional and athletic physical capacities necessary for the demands of football [10].

The programs that already exist complement the sports training programs in each club and help prevent injuries to athletes. They include stability exercises, agility, neuromuscular control and proprioception. Some others mix coordination activities, facilitating the improvement of the static and dynamic balance. Such is the case of the exercise program called The 11 FIFA®, developed with the support of the International Federation of Associated Football (FIFA) ® and published in the renowned British Medical Journal in 2008., which focuses on the prevention of injuries and it consisted of a complete heating divided into 3 stages.

Lephart in 2003 mentioned that the best sensory source to provide the necessary information to mediate neuromuscular control and improve functional joint stability is proprioception.

During 7 months in the year of 2017, from June to December an investigation was made which consisted in detecting the type and number of injuries in soccer children of 13 years of age, 36 injuries were found, 27 of them were presented during the first 3 months leaving the other 9 for the 4 months in which the proprioceptive training work was implemented.



Graphic 1 Prevalence in percentage of injuries during the 7 months of investigation
Source: Self Made

The ankle sprain is the most frequent covering 55% of the total injuries, the incidence of distention of ACL has 22% of the total, this injury was frequent due to extrinsic causes since it was trained in an irregular terrain, as well as in a synthetic court which had edges and produced a bad footprint to the player, 8% corresponds to patellar tendinitis, and 15% is divided into twin tear, anterior rectus tear, wrist dislocation, lumbago and hip contusion.

It was demonstrated that when performing a proprioceptive training during the work week, in different unstable bases and with different degrees of difficulty in the applied exercises, a 67% injury rate is decreased based on our injuries obetenidas.

1 Influence of other stimuli on proprioception

Frequently the human being receives sensory stimuli that are multiple of stimuli of the environment that influence our senses and our body. The concept of doing proprioceptive exercises to restore neuromuscular control was initially introduced in rehabilitation programs. It was thought because the ligaments contain mechanoreceptors, and an injury to a ligament would alter afferent information, so in training, after an injury, it would be necessary to restore this altered neurological function.

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The afferent pathways synapse in the dorsal horn of the spinal cord and from there they pass directly, or through the interneurons to the alpha and gamma neurons, which control the information coming from the periphery. Proprioception will depend on sensory stimuli such as: visual, auditory, vestibular, skin, joint and muscle receptors.

Proprioceptive system

It is the one that provides us with information about the harmonic functioning of muscles, tendons and joints: it participates by regulating the direction and ranges of movement; allows reactions and automatic responses important for survival; intervenes in the development of the body schema and the relationship with space and sustains the planned motor action.

Vestibular system

It responds to the movements of the body through space and the changes of position of the head, together with the proprioceptive system maintains muscle tone, automatically coordinates the movement of the eyes, head and body, maintaining a stable visual field and is fundamental in the persepcion of space and in the orientation of the body in relates this.

When these three sensorial systems work correctly, a regulated, organized and skilled person can be observed, being able to develop responses adapted to the demand of the environment.

Touch system

It is responsible for recording external information related to temperature, pain, touch, cold, heat; in this way it allows us to discriminate both the stimuli of the medium and react when they are threatening.

Sensory branch of the oculomotor nerve

The sensitive branch of the oculomotor nerve is composed of afferent axons that send information from the receptors to the central nervous system and that come from proprioceptors of the extrinsic muscles of the eye. These axons report proprioception, non-visual perception of movements and body position.

Hearing receptors

It acts as an acoustic analyzer that registers the sound waves and provides information of different situations: it indicates the orientation, technical and tactical measures. In the ear are the senses of hearing and balance these senses are captured through mechanoreceptors located in the human ear, the phonoreceptors are mechanoreceptors sensitive to sound stimuli, waves, produced by vibration and transmitted by a gaseous, liquid or liquid medium solid. They capture acoustic stimuli and their equilibriuminformation about changes in the position of the body in space.

Receptors of the skin

They provide information on muscle tonic state and on movement, contributing to the sense of position and movement, especially of the extremities, where they are very numerous.

Skin receptors

The cutaneous mechanoreceptors that surround the joint exclusively provide information on external events (exteroceptors) that affect the joint system. Cutaneous receptors on the plantar surface play an important role in postural control by signaling the distribution of weight and location of the center of gravity (Childs, 2003; Buz, 2004). In general, the skin receptors constitute sensations, that is, the superficial sensitivity of the body.

Some authors also claim that not only lesions diminished, but in no case could the work of proprioception be harmful (Owen, J.L. and Cols, 2006).

Receptors of the joint capsule and articular ligaments

They are sensitive mechanoreceptors located in the soft structures of the joint. (joint capsule and ligaments). The load that these structures support in relation to the muscular tension exerted, also activates a series of mechanoreceptors capable of detecting the movement of the involved joint. These are important proprioceptors when the structures are damaged.

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Ruffini capsule corpuscles:

These receptors are located mainly on the anterior and posterior sides of the joint capsule and are sensitive to the movements of flexion and extension of the joints.

Golgi joint terminations:

They are located in the articular ligaments and are more sensitive to abduction, adduction and rotation movements of the joint.

Modified organs of Vater-Pacini:

Are found in the periarticular tissues, that is around the joint, and are sensitive to any rapid movement of the joint and also to the pressures exerted on it.

Muscular spindle

It gives us information about changes in muscle length and participates in the stretch reflex. It sends information to the central nervous system where information is used to coordinate movement, the spindle muscles help us control movement, there are more muscle spindles where finer movements are made, such as fingers, it also helps to maintain stability of a joint.

Tendinous spine (Golgi tendon organ)

These are in the union of muscle and tendon, these respond to increases and decreases in muscle tension, they protect the tendons and muscles from damage caused by excessive tension. This is because the articular receptors contribute sensory information at the end of the joint movement available.

Myotatic reflex

It is a reflection of protection against a sudden or excessive stretching, the most common example is the patellar tendon strike to combrobar if we have normal reflexes (patellar reflex).

2. Relationship of the joints with proprioception and mechanoreceptors

The joints are characterized mainly by their proprioceptors and articular mechanoreceptors (Ruffini, Pacini corpuscles, free nerve endings, Golgi tendon organs) (Saavedra, 2003).

Research has shown that mechanoreceptors play an important role in joint stabilization. Afferent information is also processed and modulated in the cerebellum and cortex. Working completely subconsciously, the cerebellum has a role in planning and modifying motor activities.

The cerebellum is divided into three functional areas:

Vestibulo-cerebellum	Controls primary axial muscles responsible for postural balance
Cerebro-cerebellum	Plan and initiate movements of precision, speed and dexterity
Hawthorn cerebellum	Receives somatosensory, visual and vestibular afferent information. Adjusts movements and regulates muscle tone.

Table 1 Cerebellum Divisions
Source: Evidence of proprioceptive work used in the prevention of sports injuries

Proprioception occurs by a complex integration of somatosensory impulses (conscious and unconscious) which are transmitted by means of mechanoreceptors, allowing neuromuscular control on the part of the athlete. (Childs, 2003; Buz, 2004)

Childs in 2003 and Buz in 2004 mentioned that there are three types of mechanoreceptors: joint, muscle and skin which have a joint role for maintaining good joint stability.

3. Injury

The WHO considers "injury" to any damage, intentional or unintentional, to the body due to acute exposure to thermal, mechanical, electrical or chemical energy; or due to the absence of heat or oxygen that leads to temporary or permanent bodily or psychic damage and that may or may not be fatal. Dvorak and Junke in the year 2000 for the supplement of the FIFA of the AMSM defined the injury as to that circumstance that occurred during the practice of football that caused the athlete the absence to training and / or matches followed by the need for a diagnosis of some damaged tissue and its corresponding treatment.

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4. The proprioceptive training

The work of proprioception over the years has worked effectively as a method of recovery and integration after an injury in sports, in recent years has been adopted as a method of injury prevention obtaining positive results, it is about a series of focused exercises. On this occasion we took on the task of conducting research on the effectiveness of this same proprioceptive work for the prevention and reduction of injuries in children 13-year-old soccer players.

Many authors recommend the proprioceptive work of the knee and ankle joint after the injuries, for the strengthening of these joint groups, but there is scientific evidence that the work of proprioception of these joints without these having any previous injury reduces the risk of suffering some injury (Jerosch . J. y Cols , 1996).

Nowadays, several studies have shown that the improvement of proprioception can reduce the risk of sports injuries, both in adolescent and adult children.

We must bear in mind that proprioception is of great importance and has always been present in our daily lives to carry out our activities of daily life, both at home, school, recreational and sports activities as said by Safran, M.R. And Cols in the year of 1999.

The work of proprioception, strength, coordination, are relegated many times only for the recovery of athletes and injured and are not used as a means to prevent the occurrence of injuries. Training techniques should be designed to develop individualized neuromuscular compensatory responses for potentially destabilizing charges that may occur during various sports activities and daily life. The application of these charges must be in a controlled manner. (Childs, 2003).

Thacker et al, 2003 mentioned that proprioceptive and neuromuscular work had better prevention results than the use of orthotics and some orthopedic shoes. More recently, neuromuscular conditioning techniques have been used for the prevention of injuries (Griffin, 2003).

Kim and associates, showed that the stimulation of the collateral ligaments of the knee produces a contraction of the surrounding muscles. There is evidence that Proprioceptive training not only reduces potential biomechanical risk factors for joint injuries, but also decreases knee and anterior cruciate ligament injuries, especially in female athletes.

It is not yet clear which of the components (strength, balance, plyometrics, etc.) of such training is the one that induces the protection or if it is a combined benefit of these. Future research should evaluate the relative efficacy of each of these interventions alone or in combination, in order to achieve an optimal effect in preventing injuries (Hewett, 2005a).

The mechanism of anticipation or anterograde (feedforward) plans movement programs and activates the musculature based on the experiences lived previously, also plays an important role in the maintenance of joint stability. This mechanism is characterized by the use of proprioceptive information in preparation for anticipated charges or activities that can be performed.

According to Álvarez Medina and Adalid-Leiva, the prevention programs focused on proprioception applied in sports such as skiing, basketball and football showed a global reduction of serious injuries at the level of the anterior cruciate ligament from 15.2% to 89%. %, that is to say, that the incidence of lesions at the level of the anterior cruciate ligament, and in general of the lesions in the lower limb, can be reduced through general methods of neuromuscular formation.

A recent study by Cancela and Ramos (2014), in which they reviewed the scientific articles related to epidemiology and the risk factors for lower limb injuries in football, highlighted that injuries in the lower limb represent more than 80% of the totals recorded in football, that women and younger age groups have lower injury incidence, but have a higher risk of specific injuries such as ACL tears and developmental injuries and that apparently, the factors of Risk with more weight in the injuries of soccer players are the history of previous injuries and muscle imbalances. Solla and Martínez (2010) citing several authors conclude that most of the injuries suffered by elite players that affect the lower extremities reach 77 to 93%.

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The breaks and contractures constitute 10-42% and are located in the area of the quadriceps, hamstrings and abductors musculature. The majority of the injuries of the thigh are breaks or contractures and constitute between 20-22% in elite players. Of these injuries, those that affect the anterior part of the thigh are associated with the anterior rectus and the mechanisms of the ball or sprint, while those that affect the back do so to the biceps femoris, biarticular muscle and sprint mechanisms.

The next step, according to Van Mechelen, (1992) would be to analyze and identify the risk factors and mechanisms of injury that appear in our athlete and our sport. Proprioceptive training with balance tables has been effective in preventing ankle injuries without the aforementioned drawbacks (Verhagen et al., 2004). We begin by identifying the main injuries to analyze the incorporation of measures that from the field of physical preparation have shown evidence of effectiveness in the preventive task, such as: strength training, flexibility and proprioception.

For this, we use the proposal of Van Mechelen (1992) where the first step to follow is the definition of the problem. In order to develop a good analysis of the injury situation of our team, according to Solla and Martínez (2010), a good knowledge of the sport's injury profile must be carried out in the first step and a good knowledge of the epidemiology of the team must be maintained, based on the history injury registered in the club and finally, a knowledge of the player's injury profile and be aware of its pre-disposed characteristics.

5. FIFA 11+ Program

The FIFA 11+ injury prevention program was developed by an international group of experts from the FIFA Medical Evaluation and Research Center (F-MARC), the Oslo Injury Research Center and the Orthopedic Medicine Research Foundation and Deportiva de Santa Mónica with the support of the International Federation of Associated Football (FIFA) ® and published in the renowned British Medical Journal in 2008., which focuses on the prevention of injuries and consisted of a complete heating divided into 3 stages based on their practical experience with different injury prevention programs for players over 14 years of age.

The FIFA 11+ program consists of three parts with a total of 15 exercises that should be performed at the beginning of each training session in the order specified, this has a duration of 20 minutes.

1st Part. Duration 8 min.	Career exercises	
1. Run in a straight line.	2. Run with hip out.	3. Run with hip inwards.
4. Run in circles.	5. Run contact with the shoulder.	6. Run forward and backward.

Table 2 First part of the FIFA 11+ program
Source: FIFA 11+ Manual

The FIFA 11+ program mentions that not all football injuries can be prevented, but especially knee injuries, ankle sprains and problems of excessive use can be significantly reduced by performing preventive exercises on a regular basis.

Figure 1 FIFA 11+ program
Source: FIFA 11+ Manual

2nd Part Force. Duration 10 min	Plyometrics	Balance.
7. Forearm support Static front	7. Support in forearms alternating legs.	7. Forearm support and lift one leg
8. Support in static lateral forearm	8. Support in lateral forearm raise and lower the hip	8. Support in lateral forearm lifting one leg
9. Trainer's beginner	9. Intermediate scissors	9. Advanced Ischiotibial
10. One-leg balance holding the ball	10. One-leg balance throwing the ball	10. Balance in one leg and unbalance the partner
11.Genuflexions to the tip of the feet	11. Stroubling strokes	11.Genuflexions in one leg
12. Vertical jumps	12.Saltos laterales	12. Alternate jumps

Table 3 Second part of the FIFA 11+ program
Source: FIFA 11+ Manual

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3ª Parte. 2 Ejercicios de cadera minutos.		
13. Run in all the terrain.	14. Run high jumps.	15. Running change of address.

Table 4 Third part of the FIFA 11+ program
Source: FIFA 11+ Manual

Teams that practiced the FIFA11 + program regularly at least twice a week had 37% fewer injuries during training and 29% fewer injuries in games. Serious injuries were reduced by almost 50%.

Process

A proprioceptive training plan was made in the sub 13 category of the Atlas Bella Airosa Soccer School in the City of Pachuca, Hidalgo. Work was done during 7 months in 2017, of which 3 were observed in June, July, August, the following months September, October, November, and December 2017, proprioceptive training was implemented with the objective of reducing the rate of injuries in the category worked. Based on what Cerulli. G. and Cols proposed in the year 2001 where they say that each player has to have some kind of individual or specific proprioceptive work, they looked for exercises in different difficulties but with the same objective, prevention of injuries with the help of proprioception work and we put them in practice with athletes.

Proprioceptive training for category 2004.

According to the age, a training was designed which could be done by the players of this category, demanding them but without going beyond the load requirements that a boy of this age can bear.

During 35 minutes every third day the exercises were performed 5 minutes per season, based on balance exercises, on different surfaces, instability platforms, etc., with a minimum frequency of 3 times a week for 4 months which would be sufficient for find results in reducing the incidence of injuries.

Different exercises were carried out between sessions to ensure that all the joints received the benefit of the program, which was to prevent. The exercises were developed based on the principle of individualization and the systematic graduation of the load previously observed in each of the players.

It was worked taking as background the scientific evidences about the general preventive programs of inferior train, which affirm that the preventive programs that obtain the best results, as much for the lower extremity, as for the muscular-tendinous structure and for the joint, are those that present a multifactorial format, which include the combination of different training media.

Proprioceptive training for Monday

1) Jogging trot.

Figure 2 The player performs a jog on a bouncy bridge for 40 seconds for 20 seconds of rest
Source: self made. 2448 × 3264 pixels

2) Touch tip on unstable base

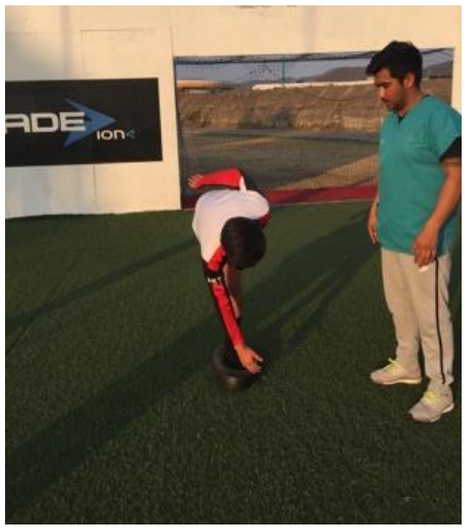

Figure 3 Touch the tip of the toe with the opposite hand performing the most amount of repetitions for 2 min, 1 minute of rest and change of leg and hand for 2 min
Source: Self Made. 2448 × 3264 Pixels

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3) TRX lizard.

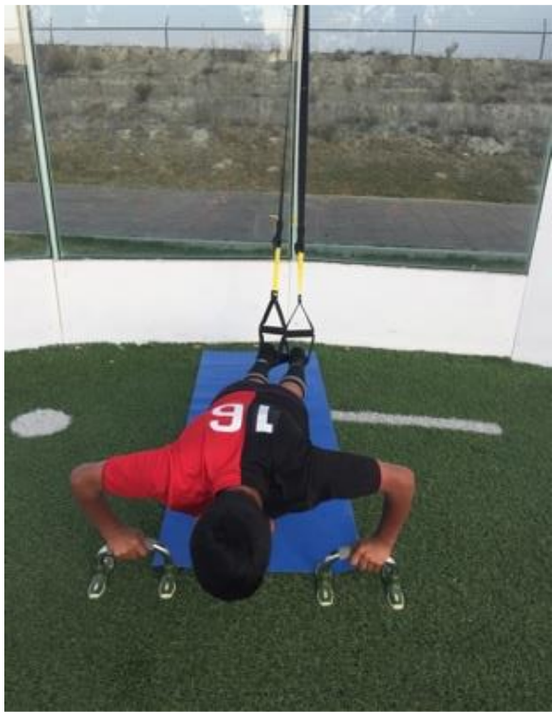

Figure 4 Perform a lizard with handles while your feet are in TRX, take out as many repetitions for 30 seconds and 30 seconds and rest until completing 5 minutes
Source: Self Made. 2448 × 3264 Pixels

4) Stability of 10 to 30 seconds with the foot in bosu.

Figure 5 Maintain the balance from 10 to 30 seconds in one with 10 seconds of rest until you reach 5 minutes
Source: Self Made. 2448 × 3264 Pixels

5) 2 feet on rocker front-back.

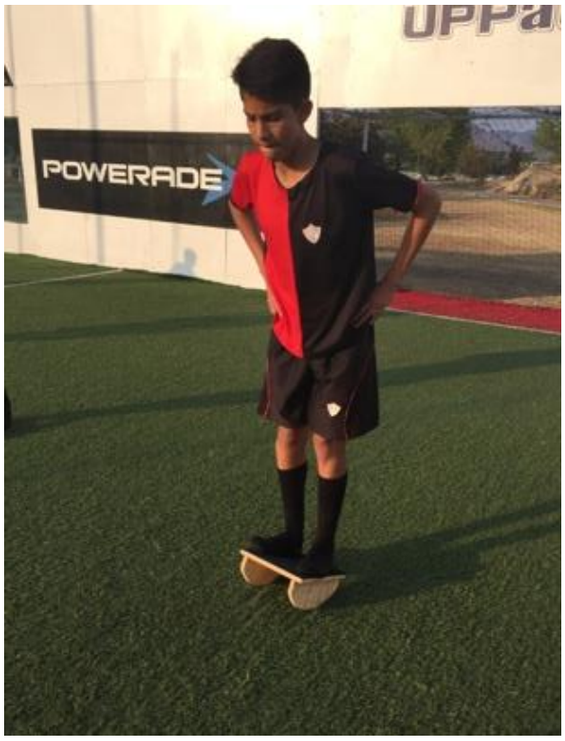

Figure 6 Swing in front and back in times of 40 seconds for 20 seconds of rest until you reach 5 minutes
Source: Self Made. 2448 × 3264 Pixels

6) Unstable base one foot with ball.

Figure 7 While the balance is maintained on an unstable base, one foot is placed around it to the side and back. For a time of 5 min
Source: Self Made. 2448 × 3264 Pixels

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7) Touch cones to order

Figure 8 Player keeps trotting in the middle and a color is indicated, he must touch it and keep trotting. 35 sec. Time for 25 sec. Of rest until completing 5 min
Source: Self Made. 2448 × 3264 Pixels

Proprioceptive training for wednesday

1) Bosu left-right with garter

Figure 9 Lateral squat with league goes up and down from bosu right to left and vice versa for times of 40 sec and 20 rest for 5 min
Source: Self Made 2448 × 3264 Pixels

2) Trot with a ball.

Figure 10 Player trots and hits internal part with right, then trots and hits with left inner part in time of 40 seconds and 20 of rest for 5 minutes.
Source: Self Made. 2448 × 3264 Pixels

3) Jumper with 1 foot: 2x2 brincos.

Figure 11 You jump with one foot in two turns with right and two turns with left for 40 seconds, 20 seconds of rest for 5 minutes
Source: Self Made. 2448 × 3264 Pixels

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4) TRX with unstable base and turn.

Figure 12 Semisquat in unstable base with one leg, the other leg in TRX, this turns to one side and the other with weight in hands for 1 minute and 30 seconds of rest, then change leg, to complete min
Source: Self Made. 2448 × 3264 Pixels

5) Unstable base and arrow with weight.

Figure 13 Player on an unstable base leans forward maintaining balance in 15 seconds, changes leg to complete 5 min
Source: Self Made. 2448 × 3264 Pixels

6) Rocker with 1 foot in front- back.

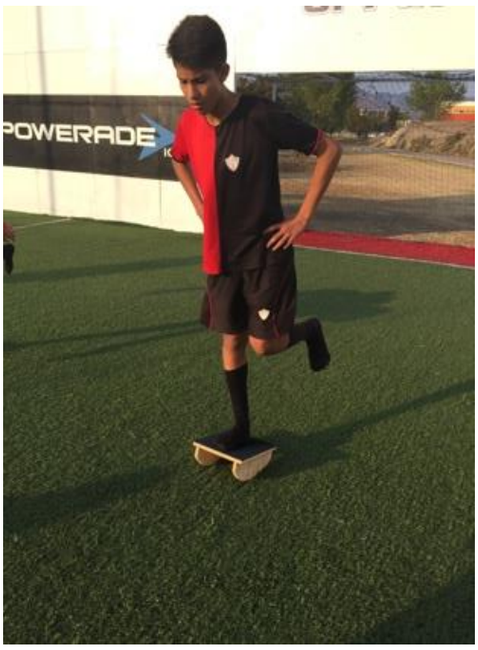

Figure 14 Maintain balance with one foot balancing in front - back during times of 40 sec times by 20 sec rest until you reach 5 min
Source: Self Made. 2448 × 3264 Pixels

7) Skip squat cones.

Figure 15 Semisquat with lateral jump, front and back
Source: self made. 2448 × 3264 pixels

Proprioceptive training for Friday

1) Jumper and header.

Figure 16 Player performs fast trot with headbutton to the indication for 40 sec, 20 sec of rest for 5 min
Source: Self Made. 2448 × 3264 Pixels

2) Bosu and hip mobility bows with voodoo floss

Figure 17 Maintain balance while performing ligament flexion, extension and hip abduction. You must repeat it 10 times to rest and change your leg, rest 20 sec and start again, this will be done in a time of 5 min
Source: Self Made. 2448 × 3264 Pixels

3) TRX performing inclined rowing.

Figure 18 Player holds the TRX and performs rowing pull to dorsals, perform more repetitions for 35 seconds to rest 25 seconds and perform it for 5 minutes
Source: Self Made. 2448 × 3264 Pixels

4) TRX in position lizard simulating running

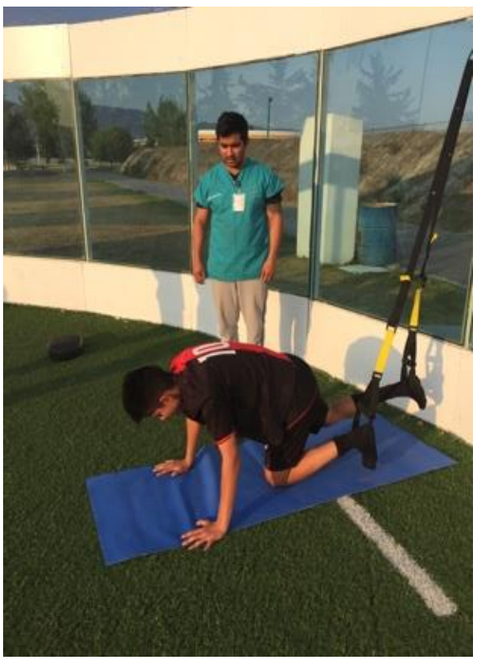

Figure 19 Player in position of lizard is placed TRX with help in feet and simulates running this at higher speed and for 35 sec, rest 25 and will do so for 5 min
Source: self made. 2448 × 3264 pixels

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5) Bosu skipping with head

Figure 20 Player performs skipping in Bosu and is asked to head straight, this for 35 seconds, 25 seconds of rest and is performed for 5 minutes
Source: Self Made. 2448 × 3264 Pixels

6) Left-right rocker with squat

Figure 21 Semisquat with swinging right to left - left right for 5 min
Source: Self Made. 2448 × 3264 Pixels

7) TRX squat with bosu

Figure 22 Player performs squat in Bosu holding TRX by getting up and down this he must do it for 35 sec. Achieve the highest number of repetitions and rest 25 sec for 5 min.
Source: Self Made. 2448 × 3264 Pixels

A proprioceptive training plan was made in the sub 13 category of the Atlas Bella Airosa Soccer School in the City of Pachuca, Hidalgo. Work was done during 7 months in 2017, of which 3 were observed in June, July, August, the following months September, October, November, and December 2017, proprioceptive training was implemented with the objective of reducing the rate of injuries in the category worked

Based on what Cerulli. G. and Cols proposed in the year 2001 where they say that each player has to have some kind of individual or specific proprioceptive work, they looked for exercises in different difficulties but with the same objective, prevention of injuries with the help of proprioception work and we put them in practice with athletes.

During the 7 months 36 lesions were found, 27 of them were presented during the first 3 months leaving the other 9 for the 4 months in which the proprioceptive training work was implemented.

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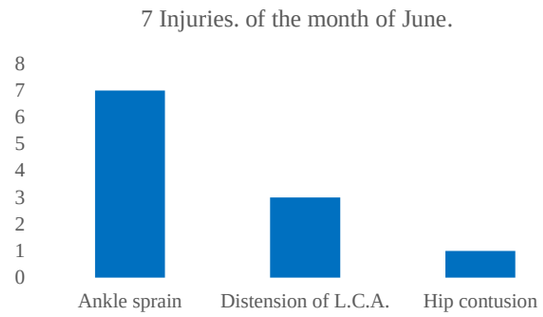
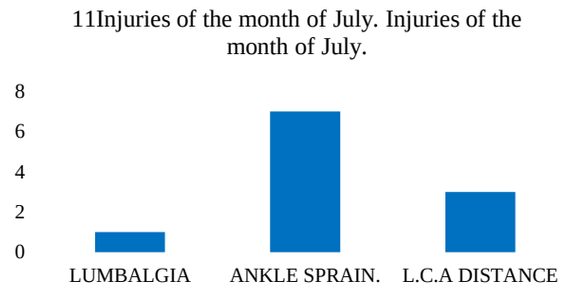
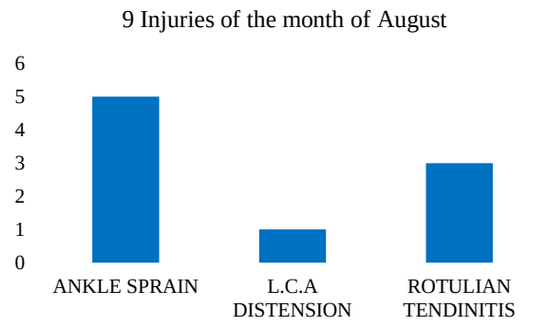
Inclusion of graphics and tables



Graphic 2 In June there were 7 injuries, 4 ankle sprains, 3 with distension of L.C.A and 1 hip contusion
Source: Self Made



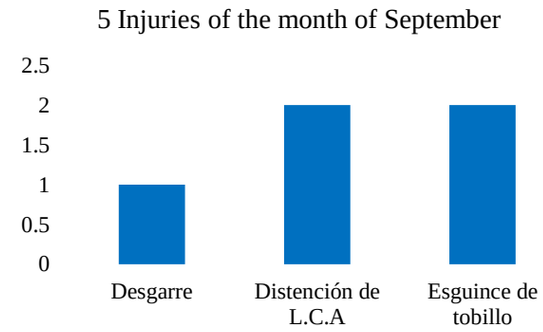
Graphic 3 Injuries in July: 11 injuries 1 of low back pain, 7 with ankle sprains and 3 distension of L.C.A
Source: Self Made



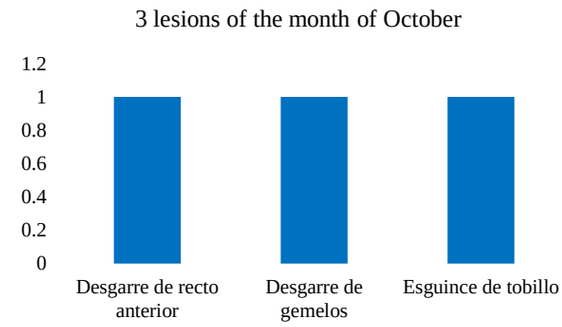
Graphic 4 In August: 9, of which were, 5 ankle sprains, 1 distension of L.C.A and 3 patellar tendonitis
Source: Self Made

27 injuries in the first 3 months.	18 injuries avoided.	9 injuries in the last 4 months.
100%	67%	33%

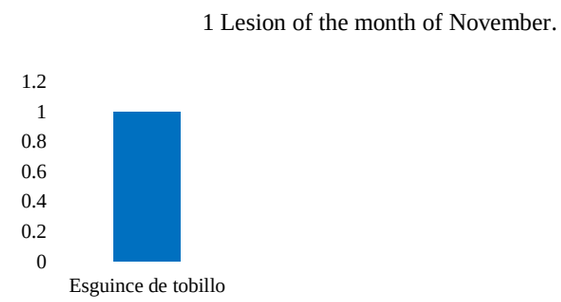
Table 5 Decrease in lesions from the first 3 to the last 4 months
Source: Self Made



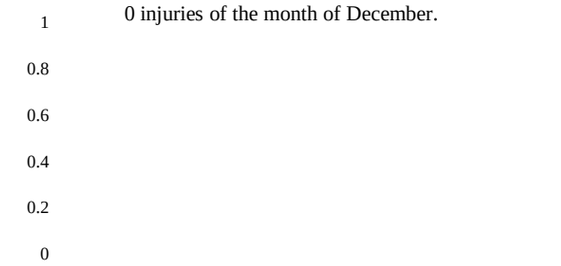
Graphic 5 In the month of September lesions decreased in the previous months, there was only one tear of hamstrings, 2 ankle sprains and 2 distensions of L.C.A
Source: Self Made



Graphic 6 In October, 3 lesions were recorded, 2 of them were tears in one in twins and one in the anterior rectum. The third lesion was a first-degree ankle sprain
Source: Self Made



Graphic 7 At the end of the season in November a sprained ankle was registered due to a strong entry in the last game of the regular season. *Source: Self Made*

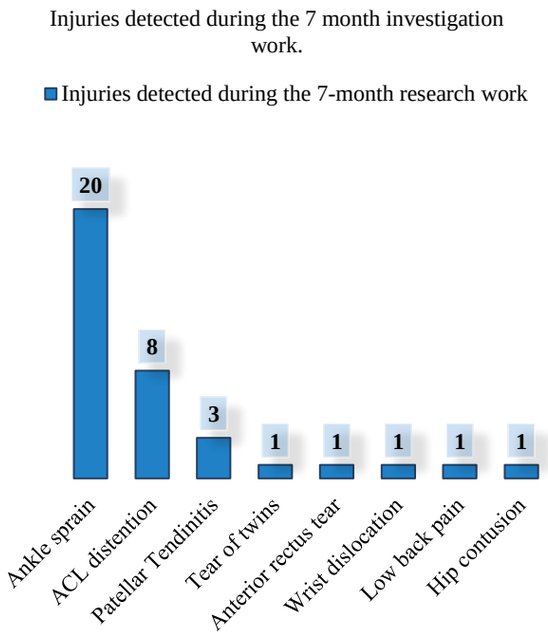


Graphic 8 No injuries in December
Source: Self Made

A lo largo de los primeros 3 meses se registraron 27 lesiones un índice lesional elevado para la edad de 13 años con los que contaban los deportistas, en base a esto ,se tomo como población a los 22 futbolistas de la edad de 13 años de la categoría 2004.Los 22 deportistas realizaron el trabajo de prevención de lesiones.

Figure 23 Ultimo día de aplicación del entrenamiento propioceptivo
Source: Self Made. 2448 × 3264 Pixeles

El esguince de tobillo es el mas frecuente abarcando el 55% del total de lesiones, la incidencia de la distención de LCA tiene el 22% del total, esta lesión fue frecuente debido a causas extrínsecas ya que se entrenaba en un terreno irregular , asi como en una cancha sintética la cual tenia bordes y producía una mala pisada al jugador, el 8% corresponde a la tendinitis rotuliana , y 15% esta dividido en desgarre de gemelos, desgarre de recto anterior , luxación de muñeca , lumbalgia y contusión de cadera.



Graphic 9 Total injuries that occurred during 7 months of investigation
Source: Self Made

Methodology

The investigation was Longitudinal, Experimental, Prospective and Quantitative. A proprioceptive training plan was made in the sub 13 category of the Atlas Bella Airosa Soccer School in the city of Pachuca, Hidalgo, where it was worked for 7 months in 2017, of which 3 were for observation June, July, August, the following months September, October, November, and December 2017, the proprioceptive training was implemented with the objective of reducing the rate of injuries in the category worked.

The investigation consisted in detecting the type and number of injuries in 13-year-old soccer players based on a group of 22 soccer players of 13 years of age where we related the extrinsic factors such as a bad court, inadequate footwear, weather, bad entries by opponents or partners etc; and the intrinsic-biomechanical factors such as postural defects which were scoliosis, flat feet, shortening and muscular weaknesses which produced knee or ankles in varus and valgus etc; all of them were related together to result in a high injury rate.

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Inclusion criteria:

– Have the age established for the prevention program
– Accept informed consent for such research

Exclusion criteria:

– Players with a link less than a month of the football sports club.
– Not counting the corresponding age.

Elimination criteria:

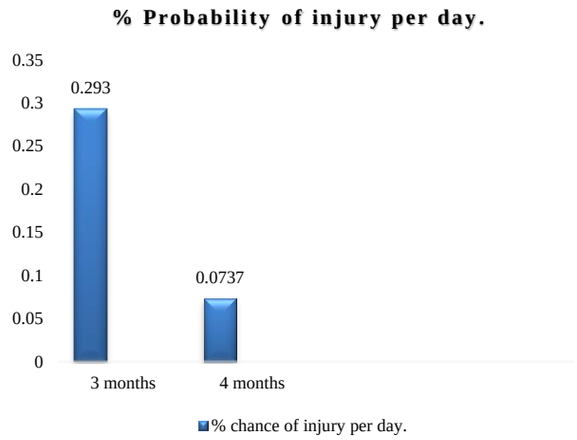
– Missing trainings on Monday-Wednesday and Friday, which are the days where the investigation is carried out.

Results

The index of low injuries in the last 4 months in which the proprioception work was implemented, of 27 injuries that occurred and that corresponds to 100% of the total injuries found during the first 3 months of observation, we were able to go down to the number of 9 injuries occurred in 4 months, which corresponds to 33%, so it was possible to reduce a 67% injury probability based on what happened in the first months.

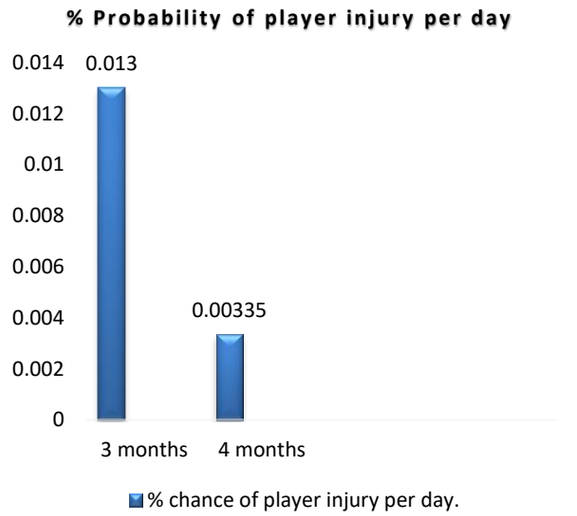
During the first trimester 27 lesions were detected which we took as our 100% of injuries detected in the period, these injuries occurred during 92 days so the probability of injury per day was of .293%, which I manage to lower in the second period that lasted 4 months at .0737% chance of injury per day in 122 days in which they could cause an injury.

Figure 24 Group of some players who underwent proprioceptive training during the months of work
Source: Self Made. 2448 × 3264 Pixels



Graphic 10 Probability of injuries per day
Source: Self Made

Based on the previous results, the probability of injuries per athlete per day was calculated, which was .013% per day per player in the first 3-month period, and in the period in which the proprioceptive training was performed. 00335% chance of injury per player per day.



Graphic 11 Probability of injuries per player per day
Source: Self Made

Acknowledgement

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Conclusions

Proprioceptive training is a very important support for the prevention of injuries, because it aims to avoid injuries rather than rehabilitate them. We must achieve optimal functioning in all areas covered by proprioception and auditory, visual, joint, muscle receptors to achieve an almost perfect benefit in the athlete.

The work done by FIFA 11+ has inspired the development of different types of training that have been implemented to the physical preparation of football players in recent times. By applying the proprioceptive training program we confirm the effectiveness of an injury prevention training.

According to the results, the injury prevention training conducted in a period of 4 months, 3 times a week focused on proprioception, helped significantly to prevent injuries in soccer players of 13 years of the Atlas Bella Airosa Soccer School since it decreased 67% of injuries.

After the effectiveness of proprioceptive training was proven, it is our job to convince coaches, coaches and athletes of the importance of preventing injuries to maintain good performance.

It is suggested the application of a protocol or training of injury prevention in different categories, as well as in the feminine category.

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Characterization of ambient air dust particulates deposited on *Ficus* leaves in the Metropolitan Area of Guadalajara, México

Caracterización de partículas de polvo ambiental depositados sobre hojas de *Ficus* en la zona metropolitana de Guadalajara, México

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Abstract

Leaves of Ficus were collected in 11 points. The particles was mainly under the age of 10 µm with a spherical shape and oval, and agglomerates of particles. The elemental analysis showed mainly C, Yes, OR, Ca and K with different concentrations of elements such as Zn, Pb, Cd and Ni in addition to W, Fe and Ti. *Objectives, methodology*: Identify morphology and elemental composition of particles present. The sampling sites were established according to the urban trace, land use and types of roadways. MEB was applied x-ray spectroscopy Using atomic absorption measured the concentrations of trace metals (Cu, Zn, Co, Ni, Cd, Cr and Pb) the ambient dust deposited on the surface of the sheet. *Contribution*: On the site with industrial, commercial, services and housing identified greater presence of elements analyzed with high levels of heavy metals. We stress the importance of conducting further analysis that allows us to control cyclical fine particles in the air and the evolution of the same.

Quality of air, Ultra fine particles, Heavy metals, Geophysical observations

Resumen

Se colectaron hojas de *Ficus* en 11 puntos. Las partículas fue principalmente menores de 10 µm con forma esférica y ovalada, y aglomerados de partículas. El análisis elemental mostro principalmente C, Si, O, Ca y K con diferentes concentraciones de elementos como Zn, Pb, Cd y Ni además de W, Fe y Ti. *Objetivos, metodología:* Identificar morfología y composición elemental de partículas presentes. Los sitios de muestreo se establecieron según la traza urbana, uso de suelo y tipos de vialidades. Se aplicó MEB espectroscopia rayos X. Mediante absorción atómica se midieron las concentraciones de metales traza (Cu, Zn, Co, Ni, Cd, Cr y Pb) del polvo ambiental depositado en la superficie de la hoja. *Contribución*: En el sitio con actividades industriales, comerciales, de servicios y de vivienda se identificó mayor presencia de elementos analizados con elevados niveles de metales pesados. Subrayamos la importancia de realizar posteriores análisis cíclicos que nos permita controlar las partículas finas en el aire y la evolución del mismo.

Calidad del aire, Partículas ultra finas, Metales pesados, Observaciones geofísicas

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Introducción

Urban areas represent sources of continuous emission of polluting particles mainly due to traffic and industrial activities (Aguilar et al., 2011). The World Health Organization (WHO) has made several publications, which state that air pollution by metal particles is a major cause of mortality and morbidity worldwide, and in the future will be the leading cause of premature mortality. Therefore, it is the most important environmental risk is for health; affecting mainly the vulnerable groups (younger than five and older than 65 years, population in poverty and / or with health problems). At the Latin America level, Mexico is in the third place of countries with highest number of deaths attributable to air pollution, with the particles of an aerodynamic diameter less than 10 (PM_{10}) and 2.5 μm microns ($PM_{2.5}$) as the main air pollutants. Small particles are particularly harmful, because of their ability to penetrate deep into lungs, causing inflammation and aggravating heart or lung problems (Chen, Shah, Huggins, Huffman, & Dozier, 2005; OMS, 2014).

The particles are diverse in shape, they can be observed as spheres, ellipses, cubes, or aggregates. The chemical composition of particles is also very diverse and depends mainly on both the source station and the formation mechanism of the particles. In the case of coastal areas, their composition is predominantly sodium chloride; those with geological origin shall be composed of oxides of iron, calcium, silicon and aluminum.

For the particulate matter (PM) produced by combustion, they will be based on carbon and inorganic materials whose origin will be the mineral present in the fuel. Regarding most industrial processes, such as cement factories, where the main compounds are inorganic, they will frequently have a chemical composition similar to that of raw materials or products generated. As for PM produced by gasoline powered mobile vehicles, they will have a mixture of organic carbon, trace of metals and sulfate (Glynis C. Lough et al., 2004).

The PM can travel long distances (it depends on the size, smaller particles will travel longer distances) and subsequently is deposited in soil, water or vegetation. Therefore, it generates health effects, even at very low concentrations.

So, it is essential to reduce the levels of air pollution by particles, because this can reduce the burden of disease resulting from stroke, lung cancer, chronic and acute pulmonary diseases, including asthma.

In Mexico, cities considered as critical, due to the levels of environmental pollution from PM are Mexico City, Guadalajara Metropolitan Area (GMA) and Monterrey. According to the environmental monitoring network of Guadalajara, in the period 2000-2009 the main problems with the air quality in the GMA are related to high concentrations of ozone (O_3) and PM10 (Secretaría de Medio Ambiente y Recursos Naturales, 2011). Guadalajara is considered one of the most important industrial and economic cities in the country, with 11 industrial parks and one technological park; the latter do not support manufacturing or real estate activities (Instituto Tecnológico y de Estudios Superiores de Monterrey, 2011).

Economic activities taking place in the municipalities of the area under study are shown in Fig. 1, being the city of Guadalajara the one where the highest percentage of these are located, followed by Zapopan, etc., according to the National Statistics Directory of Economic Units (INEGI, 2014).

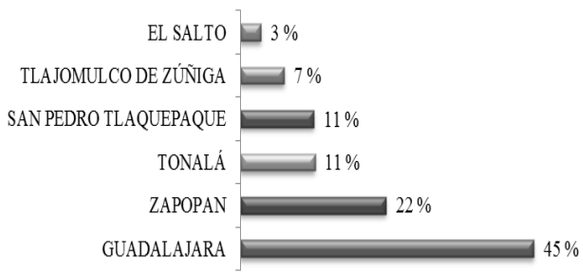

Figure 1 Distribution by municipality of economic activities

There are approximately 31,265 businesses, 45 % of which are engaged in trade, 27 % in manufacturing of various products, and the remaining 27 % are engaged in diverse activities. As for manufacturing activities, the main corresponds to blacksmithing products (20 %), furniture (13 %), bricks (9 %), wood products (4 %), pottery (4 %), footwear with cutting skin (3 %), stone-based products (2 %), plastic footwear (2 %), integrated kitchens (2 %), and office furniture and shelving (2 %); the rest (39 %) are engaged in the manufacture of various products.

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As for the distribution of these factories by city, Guadalajara, Zapopan and Tonala are the main (Fig. 2).

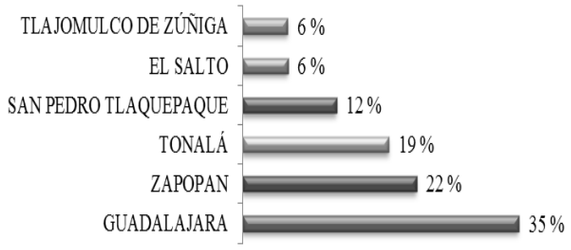

Figure 2 Manufacturing distribution by municipality (INEGI, 2014).

Moreover, previous studies have showed the metal trapping capacity of tree species for monitoring air in different parts of Mexico and the world (Aguilar et al., 2013; Padgett, Meadows, Eubanks, & Ryan, 2008). The technique of scanning electron microscopy (SEM) with energy dispersive X-ray spectroscopy (EDS) can be used to observe morphological details and the chemical composition of elements deposited in the cell structure of the leaves of the tree species (Aguilar et al., 2012). Additionally, the atomic absorption spectroscopy method has been used for the analysis the concentration of trace elements including heavy metals coming from air pollution (Bhattacharya, Chakraborty, Tuteja, & Patel, 2013).

The objective of this research was to use scanning electron microscopy equipped with an energy dispersive X-ray spectrometer and atomic absorption spectroscopy to characterize heavy metals deposited on leaves of *Ficus* collected in the metropolitan area of Guadalajara and thus assess air quality.

Experimental

Study area

Jalisco is one of the 32 states that comprise Mexico. It is located in the west of the country, between the mountain areas of the Sierra Madre Occidental, the Sierra Madre del Sur, the Mexican Volcanic Belt and the Central Plateau. Jalisco has an area of 78,588 km^2 (accounting for 4.0 % of the national total) (Gobierno del estado de Jalisco, 2015). The GMA is the country's second largest city, after the Mexico City. It is located in the center of the State of Jalisco.

Surrounding the GMA, at the NE is Sierra de San Esteban; At SE, Serranía de San Nicolas and mountain sets Cerro Escondido, San Martin and El Tapatío, La Reyna; At the S, Cerro del Cuatro, Gachupín and Santa Maria; At W, the Sierra La Primavera. These mountains are natural physical barriers to the movement of the winds. The slopes vary with an average of 3 % (Instituto Nacional de Ecología, 2007).

Regarding winds in the GMA, the prevailing winds are weak with the presence of thermal inversion phenomena about 300 days a year. Plus anticyclone systems generated in the Gulf of Mexico and the Pacific Ocean influence the area, causing atmospheric stability and preventing vertical air mixing (García et al., 2014).

The GMA consists of eight municipalities, San Pedro Tlaquepaque, Tonala, Zapopan, Tlajomulco de Zuniga, El Salto, Juanacatlán, Ixtlahuacán de los Membrillos and Guadalajara. The area covered is 2,734 km^2. According to the projections of the population of the municipalities that make up the metropolitan areas, 2010-2030, the total population of the eight municipalities of the GMA in 2014 is 4, 737,096 inhabitants (CONAPO, 2014), of which six (Guadalajara, Zapopan, Tlaquepaque, Tonala, Salto and Tlajomulco de Zuniga) represents our study area.

According to the INEGI in 2013, the vehicle fleet for these six municipalities was 1,878,270, Automobiles (67 %), cargo trucks and vans (25 %), motorcycles (7 %) and passenger buses (0.4 %). In 2009 55 % of the vehicle fleet was over 10 years old (Secretaría de Medio Ambiente y Recursos Naturales, 2011). This trend increased by 4 % to 2012 (59 %) (CONAPO, 2014).

Features of *Ficus* (Moraceae)

The *Ficus* are tree (up to 50 m in height and 1 m in diameter) and bushes (0.3 to 1 m high and diameter of 3-4 cm) species, more commonly from 3-15 m, with an appearance of lianas or vines. It is a representative species of tropical and subtropical forests for their evergreen foliage. The leaves are usually alternate, with a symmetrical or asymmetrical base, varied, simple, spiral, complete, toothed or lobed shapes. Young individuals have leaves larger than those from adults.

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These plants have latex in its leaves, which usually shows as milky white and rarely aqueous, yellow or even light green. In the GMA, *Ficus benjamina* L. (Moraceae) species are widely distributed. In the city, the individuals belonging to this gender can be observed in gardens, sidewalks, streets, medians, parks, roundabouts, among others (Cazimir, Sylvestre, & Carvajal, 2001). The *Ficus* tree leaves have been used for trapping heavy metal particles from atmospheric dust in urban areas due to the latex secretion and the morphological characteristics (stomata) of the leaves (Aguilar et al., 2012).

The stomata are groups of two or more specialized epidermal cells whose function is to regulate the gas exchange and transpiration. Each stoma is formed by two occlusive cells and between them there is an opening called ostiole (pore) (Botánica Morfológica, 2013). The stomata are found in the aerial parts of the plants, particularly in the leaves.

Sampling design

Cartographic and land use information of the Government of the State of Jalisco (Secretaría de Medio Ambiente y Desarrollo Territorial, 2016) were consulted to obtain the urban layout, land use and the roads. This was used to design the sampling in the GMA, making classification and grouping in seven land uses: 1. Low density housing (LDH), 2. High density housing (HDH), 3. Intraurban not developable (IND), 4. Urban corridor (UC), 5. Urban infrastructure (UI), 6. Industrial (I) and 7. Mixed (M). Similarly, they were classified by type of road, making an estimate of the traffic flow (high, medium, low and rural), and the dimensions of the road.

Obtaining four types of roads 1) primary, 2) secondary, 3) tertiary and 4) rural. A stratified sampling was designed relying on the satellite photo of the GMA (Fig. 3). For the cartographic design, we worked with free software for Digital Map of Mexico QGIS desktop version 6.0.1 and version 2.6.

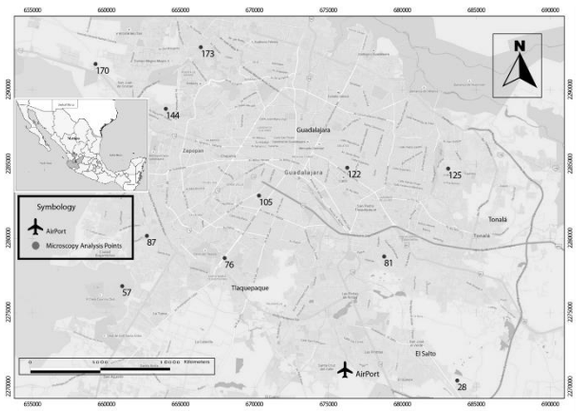

Figure 3 Location of the sampling sites in the Metropolitan Area of Guadalajara

Sampling

Sampling was performed on Saturday March 23, 2013. Eleven samples of *Ficus* leaves were collected. The sites were georeferenced in coordinates of Universal Transverse Mercator (UTM) and Datum WGS84. For the sampling, safety equipment (goggles, gloves and face masks) was used. The leaves were collected from a height of 1.5 to 2 meters. 30 large mature brown leaves were cut with pruning shears. The leaves were collected in re-sealable bags and a colored label was added with the sample number, time, name of the collector, and the coordinates of the site according to previously developed methodology (Aguilar et al., 2013; Bautista et al., 2011).

Preparation of sampled leaves *Ficus benjamina* (Moraceae)

Sampled leaves were taken to the drying room of the Institute of Botany, where they were placed individually on brown paper. They were accommodated in a press and put on a stove with convection heat system.

This process lasted 48 hours, during which they were checked periodically for re-accommodate them to ensure a homogeneous drying. Once dry, they were placed in re-sealable bags with the respective labels.

SEM and heavy metals analysis

The SEM measurements were performed with a microscope JEOL JSM 6610LV, operating at 10kV, with an EDS Oxford Xmax detector. The use of this technique allowed us to identify the size, morphology and elemental composition of the particles that are present in the leaves.

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SEM analysis was principally applied as a complementary tool due to its great specificity that bulk analytical methods. This technique has been used to obtain images of the surfaces of the leaves, as it enables dry analysis or with a thin conductive film that covers the sample and facilitates analysis (Barkay, Teller, Ganor, Levin, & Shapira, 2005; Walker, Allen, Bell, & Roberts, 2015). In this case, for SEM analysis, eleven samples were taken of those leaves with the most dust observable at the naked eye and that belonged to different areas of the GMA.

Using a scalpel blade, small fragments of leaves were cut and with a curved forceps, they were placed on the aluminum sample holder, which was previously prepared with a double sided conductive carbon tape to hold the samples still during the analysis process within the equipment. Because of the leaves were dry, it was not necessary to add any substance to stabilize them (Echlin, 2009). Each sample was taken through a general scanning at a small scale (250 or 100 µm), to know the chemical composition of the particles present in the leaves and, subsequently, in the areas of interest (for example, increased accumulation of particles). These particles were observed in greater detail (10, 2.5 µm and smaller). This procedure allowed making EDS elemental mapping and measurements of particles size and shape for comparisons of contamination between the different sampling areas.

On the other hand, trace metals (Cd, Co, Cr, Cu, Ni, Pb and Zn) were measured with a flame atomic absorption spectrometer model Varian AA240 FS equipped with cathode lamps as radiation source, a Czerny-Turner monochromador and an adjustable nebulizer system. The absorbance measurement was converted to concentrations using standard calibration curves. All samples were treated in duplicate.

Results and discussion

In general, particles of several shapes ranging from 0.5 to 10 µm not homogeneously distributed within the ostioles and surrounding areas were observed from SEM images of the leaves. For example, individual ultra fine particles of different sizes (< 1 µm) as well as individual big particles (from 5 to 10 µm) and aggregates deposited around the stoma openings, were observed in the sample 170 (Fig. 4a).

The sample 76 is mainly characterized by ultra fine and fine particles (~0.5-2.5 µm), ranging from sub-round to round shapes as well as some aggregates located outside stoma openings. Particles larger than 5 µm with sharp borders within the ostioles, typical of mineral soil, were also observed in this sample (Fig. 4 b). Small individual particles (< 2 µm) emitted by anthropogenic sources from combustion processes are characterized by their spherical shape and smooth surfaces, although agglomerates of these particles can also be observed on the leaf surfaces (Tomašević, Vukmirović, Rajšić, Tasić, & Stevanović, 2005). The presence of these particles around and over the stoma openings causes physiological disturbance (decreasing of the stomatal conductance and gas exchange), which may further influence the water regime and photosynthesis (Tomašević et al., 2005).

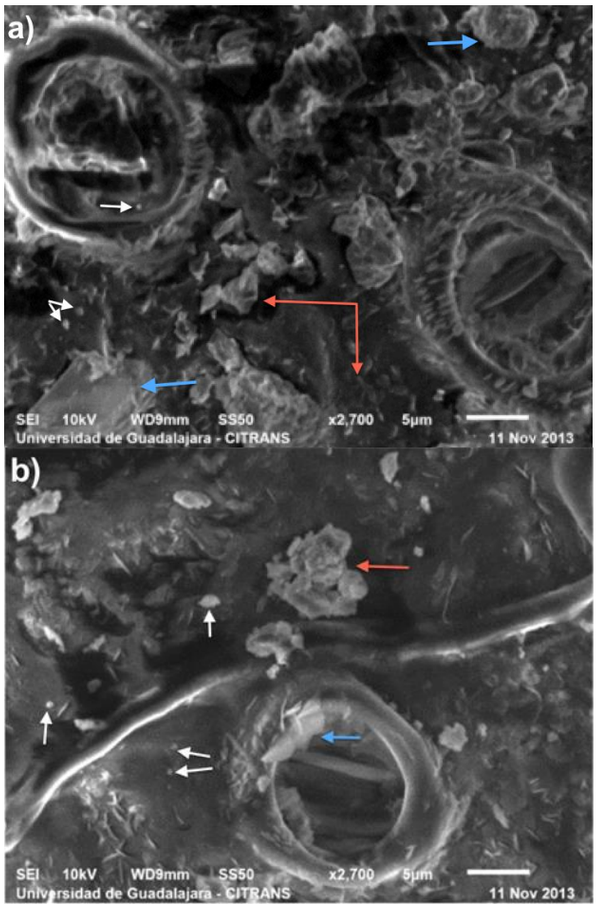

Figure 4 Abaxial face *Ficus* leaf SEM images for the samples (a) 170 and (b) 76. The variety of particles is indicated with arrows. Individual small particles (white), individual big particles (blue) and aggregates (red)

By using elemental mapping with EDS, it was possible to identify the presence and prevalence of elements present on the surface of the leaves.

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In almost all the samples appearing the main elements O, Ca, K, Si, and C. Some these elements are most likely to be of natural origin (coarse particles) but fine coal ash emitted from anthropogenic sources from combustion processes should not be ruled out due to the rounded shape of the particles and smaller size. The presence of heavy metals such as Pb, Cd, Co, Ni, Cu, Zn originated by industrial processes (Tomašević et al., 2005) was also abundant in many sites.

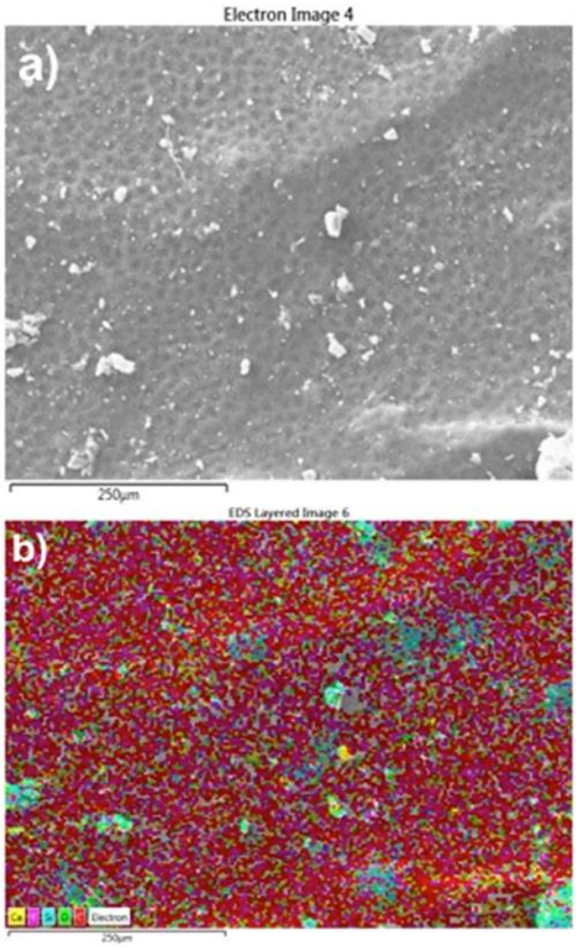
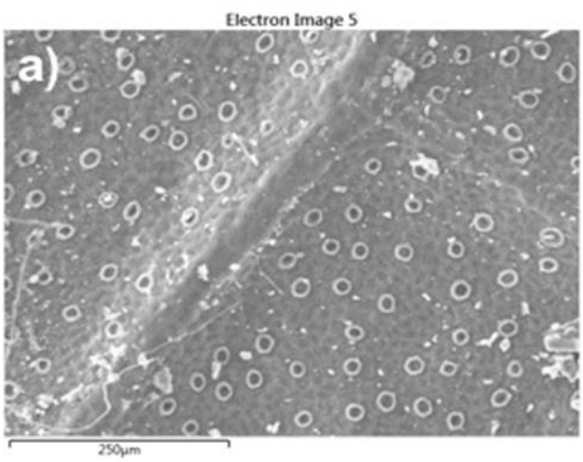


Figure 5 SEM image of a selected area (a) and EDS mapping (b) of the sample 170



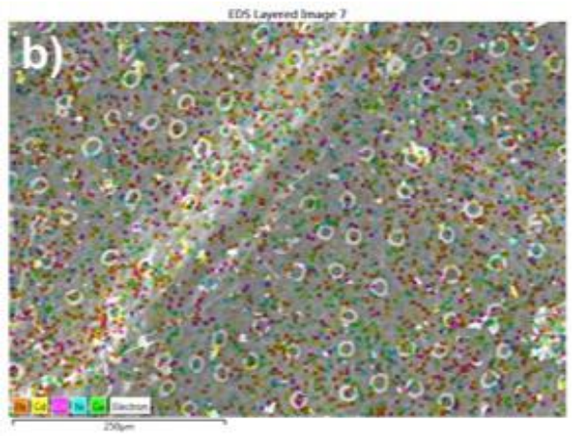
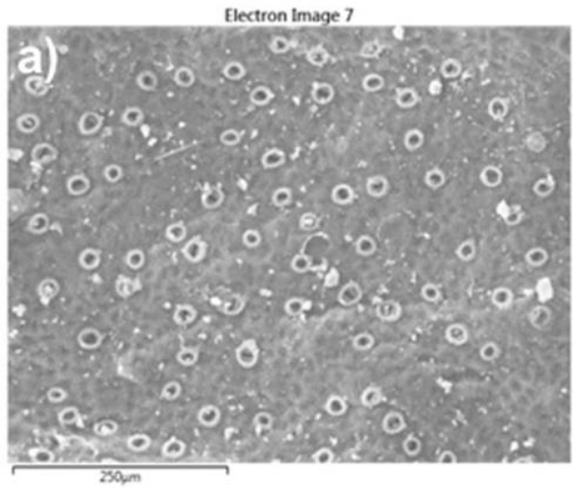


Figure 6 Abaxial face *Ficus* leaf SEM image (a) and EDS mapping (b) of the sample 170

For example, the SEM images and EDS elemental mapping of the sample 170 are shown in Figs. 5-6. The elements found were Ca, K, Si, O and C (Fig. 5) with varying concentrations of elements such as Pb, Cd, Co, Ni and Cu (Fig. 6). Similar results were found for single particles.

In another example, according to the EDS mapping on the abaxial side of the sample 125 among the main elements identified in the environment were Cr, Pb, Cd, Co and Ni (Fig. 7). The presence of similar heavy metals in many sites suggests a common anthropogenic source. For example, Ni has been identified in rural and urban areas and its principal source in street dust coming from the combustion of diesel fuel (Bhattacharya et al., 2013).



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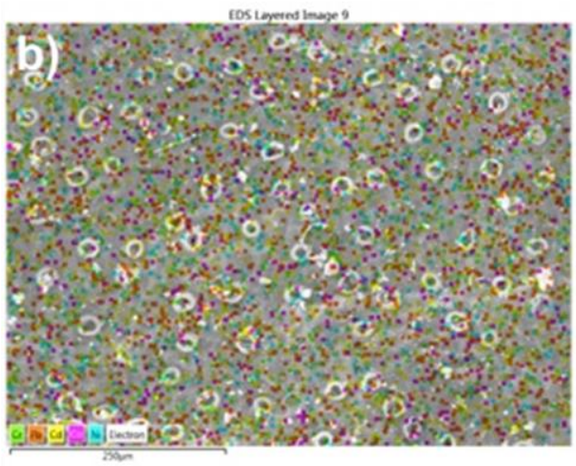

Figure 7 Abaxial face Ficus leaf SEM image (a) and EDS mapping (b) of the sample 125

In essence, it was feasible to determine by using the SEM technique the size and shape of the particles of dust deposited in both the abaxial side and adaxial faces of Ficus leaves, consistently observed in all samples, so it can be inferred that a significant amount of particulate matter floating in the atmosphere is retained in the tree leaves. The most representative elements of all sites were Si, Ca, K, O and C. However, it is important not to lose sight of the fact that the heavy metals Cd, Co, Cr, Cu, Ni, Zn, Pb in dust are predominant. Besides trace elements as W, Ti and Fe were also identified in some sites. In all cases, fine and ultrafine particles with spherical and oval shapes were abundant. These data correlate with those reported by Aguilar (Aguilar et al., 2011) for GMA, which refers to a magnetic carrier (Aguilar et al., 2011).

On the other hand, the atomic absorption spectroscopy method was used to measure the trace element concentrations such as Cu, Zn, Co, Ni, Cd, Cr and Pb in the *Ficus* leaves for the eleven monitoring sites (Fig. 8). The concentrations of Cu, Pb and Zn were substantially greater at sites 125, 105 and 122, with 38.7, 35.8 and 30.3 ppm, respectively. Specifically, the concentration of Cu was 3 times higher at site 125 (industrial area, tertiary road) than at site 170 (mixed area, rural road). Similarly, the concentration of Pb is 5 times higher at site 105 (mixed area, secondary road) than at site 87 (high density housing area, secondary road) and the concentration of Zn is 19 times higher at site 122 (mixed area, tertiary road) than at site 76 (mixed area, rural road).

The mixed area with secondary road (site 105) was the most contaminated with Cu (38.7 ppm), Co (8.7 ppm), Cd (8.4), Ni (11.4 ppm) and Pb (35.8 ppm). The most abundant element found in a mixed area with tertiary road (sample 122) was Zn with 30.3 ppm. Finally, the concentration greater of Cr (13.8 ppm) was found at site 173 (low density housing area, tertiary road). Consequently, at site 105 (industrial activities and relating to trade, services and housing) was the most contaminated with seven elements found, five of these have the highest concentration of all monitoring sites.

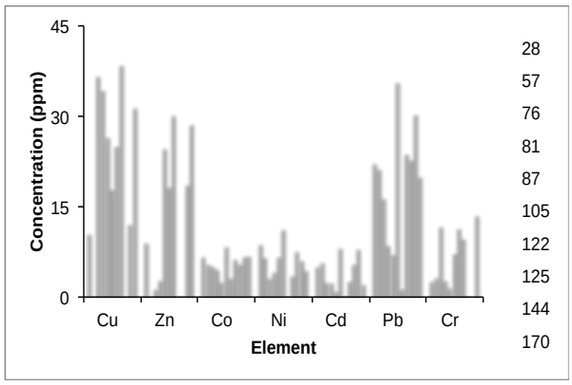

Figure 8 Distribution of heavy metals at eleven monitoring sites indicated with numbers to the right

In general, the presence of Cu, Zn, Co, Ni, Cd, Pb and Cr was identified for all the analyzed samples (except at sites 122, 170, 144 and 57). The characteristics of the sites and number of elements found are broken down in Table 1. As noted above, it can be seen that the sample 105 corresponding to a type of secondary road, and land use is Mixed is the one that presented a greater presence of the analyzed elements. In the following three sites 76 (mixed area, rural road), 87 (HDH, secondary road) and 81 (NUI, primary road), the presence of all heavy metals is a principal characteristic.

Land uses and types of roads are diverse in these sites. With respect to the sample 81, it is interesting to observe that it corresponds to a type of primary road and has strong presence of heavy elements. Similarly, at sites 28 (UI, tertiary road), 125 (industrial area, tertiary road) and 173 (LDH, tertiary road) were found all the analyzed heavy metals suggesting the strong impact of the urban infrastructure, industrial activities and housing on the air pollution.

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For the samples 57 (UC area), 122 (mixed area) and 144 (industrial area) were found less than seven heavy metals, is the type of tertiary roads, i.e. the vehicular movement is relatively low; however, land uses are urban equipment (facilities to accommodate the required functions to satisfy community needs), type I (comprising a wide range of manufacturing activities), and mixed. For the sample 170 land usage is mixed and the type of road is rural were found all heavy metals except Cr.

Sample	Elements	Land use	Type of road
105	7	M	Secondary
28	7	UI	Tertiary
125	7	I	Tertiary
122	6	M	Tertiary
170	6	M	Rural
173	7	LDH	Tertiary
57	5	UC	Tertiary
76	7	M	Rural
144	5	I	Tertiary
87	7	HDH	Secondary
81	7	NUI	Primary

Table 1 Land use for analyzed samples

Conclusions

Collecting leaves of *Ficus* located in several areas of the GMA allows knowing the specific air pollution of a short period of time (since these are renewed constantly) by using SEM/EDS and atomic absorption spectroscopy. All types of particles adhere to the leaves (not selective) by the latex they have on their surface. Dust samples collected in this way represent the air quality at the zone level that is breathed by people, so the type of suspended particles can be analyzed quantitatively and qualitatively. *Ficus* leaves are stored as historical material for further verification or interpretation with another methodology.

The costs of this study are low compared with the installation and operation of the few existing monitoring stations in the GMA. High concentration of metals found shows that environmental quality in the GMA is bad and it follows that there must be a correlation with the health of the population. It is important to stress that, since the diameter of the particles present in the leaves of Ficus is mainly less than 2.5 μm ($PM_{2.5}$), the health problems of the population of the GMA associated with fine and ultra fine particulate matter are expected to be significant. Similar studies are needed periodically to compare the evolution of the environmental air quality in the GMA.

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Bruxism and Cefaleas

Bruxismo y Cefaleas

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Abstract

Bruxism or teeth grinding is a pathology of not well defined etiology, which currently constitutes a serious problem of oral and mental health, so it involves both the dentist and the psychologist for treatment and care. The influence of a stressful situation on its appearance and development is not perfectly determined, however, there are characteristics that can be related to its presence. Some investigations report a twice higher incidence of headache (headache) in individuals with craniomandibular dysfunction than in subjects seeking routine dental care. It has been found that these headaches are of personal or subjective presentation, and that muscular hyperactivity is an important component in these patients. *Methodology.* An applied, observational, transversal and prospective study was carried out in students of the Faculty of Engineering of the Universidad Veracruzana. *Objective:* To compare levels of anxiety and stress among individuals with and without headaches. *Results:* The stress to which university students are currently subjected makes it necessary to delve into this subject, with the purpose of developing and establishing programs that allow the timely diagnosis and application of preventive measures, thus improving the quality of life of these students.

Bruxism, Teeth Grinding, Headaches

Resumen

El bruxismo o rechinar de dientes es una patología de etiología no bien definida, que en la actualidad constituye un serio problema de Salud Bucal y Mental, por lo que involucra tanto al odontólogo como al psicólogo para su tratamiento y atención. No está perfectamente determinada la influencia de una situación estresante en su aparición y desarrollo, sin embargo, existen características que pueden relacionarse con su presencia. Algunas investigaciones reportan dos veces mayor incidencia de cefalea (dolor de cabeza) en individuos con disfunción craneomandibular que en sujetos que buscan atención dental de rutina. Se ha encontrado que estas cefaleas son de presentación personal o subjetiva, y que la hiperactividad muscular es un componente importante en estos pacientes. *Metodología.* Se realizo un un estudio aplicado, observacional, transversal y prospectivo en estudiantes de la Facultad de Ingeniería de la Universidad Veracruzana. *Objetivo:* Comparar los niveles de ansiedad y de estrés entre individuos con y sin cefaleas. *Resultados*: El estrés al que actualmente están sometidos los estudiantes universitarios hace necesario ahondar sobre este tema, con la finalidad de desarrollar y establecer programas que permitan el diagnóstico oportuno y la aplicación de medidas preventivas, así mejorar la calidad de vida de estos estudiantes.

Bruxismo, Rechinar De Dientes, Cefaleas

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Introduction

Bruxism is a repetitive mandibular-muscular activity characterized by clenching and grinding of the teeth and / or fixation or mandibular thrust. Associated with several dental, musculoskeletal and headache clinical problems. Important factor in the unleashing and perpetuation of myofacial pain. The frequency of association between TMD and bruxism in adults is between 36 and 59 percent.

The occlusal splints are the therapeutic tool most used in the TTM. With a clinical success of 70-90 percent in the reduction of pain, especially the myofacial and although its effect is predictable, its mechanism of action has not been fully clarified. (Romero, 2015)

Because relaxation plates (occlusal guards) have been shown to reduce increased muscle action (muscle hyperactivity) and headache, especially in patients with four or more headaches per week, studies suggest its placement as a conservative, reversible treatment and non-invasive in patients with etiological factors that are difficult to identify and in the absence of tumors, bumps, arteriovenous malformations, lumbar punctures and other obvious organic causes (Kassian, 2001).

Tension headache is characterized by a long-lasting headache, months or years, which occurs in the morning on waking or evening, lasting several hours, intermittent and then continuous, whose distribution in the skull is indicated by the index finger or with the extended hand of hemicrania or bilateral localization with sensation of beginning in the neck or occipital region and irradiated towards the vertex and rarely to the forehead.

Others mention hypersensitivity to the touch in the cervical region, the heat relieves it and the cold aggravates it, neck movements exacerbate it, it can often be accompanied by bruxism and extend to the upper muscle fibers of the trapezius and shoulders, it can radiate towards the anterior or posterior part of the pinna of the ear. Its organic origin is verified by its partial or total relief with analgesics.

The localized headache usually comes from neck-base pathologies, temporomandibular joint, prolonged extension of the neck during intubation for surgeries, vicious positions during work hours, immobility and rigidity in elderly patients and those with onset of Parkinson's disease due to the rigidity characteristic of this condition.

It is usually linked to a sustained contraction of the muscles of the head and neck, producing an ischemia inside the contracted muscle. This muscle tension may be due to incorrect body posture, prolonged exposure to situations of social or psychological stress, or normal reactions of intense fatigue.

This type of headache is often associated with: sleep disorders, affective disorders, anxiety states, bruxism and others (Mosquera, 1998).

Bruxism plays a significant role in Temporomandibular Joint Disorders and craniofacial referred symptoms (Okeson, 1998), considers bruxism as a microtrauma product of dysfunctional tightening and grinding of teeth subconsciously that can exceed physiological tolerance and Structure of the muscles, teeth and joint Greene and Laskin (2000), have shown that at the origin of the Temporomandibular Joint Disorders one of the primary causes is psychological stress (Ramírez, 2005).

Migraine is a common and misdiagnosed disease. The etiology of headaches is not clear or well understood, even the study of headaches is still a subjective area. Intracranial and extracranial inflammatory origins must be ruled out, such as an intracranial tumor, Eagle's Syndrome, Carotid Artery Syndrome, among other etiologies..

Tension and vascular headaches in temporomandibular joint disorders are frequent and highly associated as they share common nociceptive pathways. Some researchers defend the hypothesis that tension headaches and migraines are two different presentations of the same physiopathological mechanism. The traditional explanation of migraine as a pulsatile hemicranial pain associated with prodrome, visual aura and vomiting is not a frequent form of this disorder. Muscle contraction that occurs in the muscles of the back and chewing occurs both in migraines and in tension headaches.

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Headache can affect all aspects of a child's functioning. It has been associated with psychiatric illnesses, such as anxiety and depression, as well as psychosocial problems (for example, school absenteeism, problematic social interactions).

Moskowitz (Ramírez, 2005) states that the trigeminal nerve provides the main afferent conduction in the pathophysiology and transmission of headache in humans. The ophthalmic and maxillary branches of the trigeminal nerve innervate the cerebral arteries in addition to the dura, pia mater in the anterior and middle fossa. Considering also that the cervical and cranial sensory nerves can project painful signals to the trigeminal nerve (caudal subnucleus), as in the meningeal arteries, the peripheral dysfunctional causal-muscular component of Temporomandibular Joint Disorders cannot be ignored.

The phenomenon of bruxism is well known by all stomatologists, who usually observe it in their patients, especially in communities of high intellectual level because of the tensions in which their activities unfold (Barrancos, Money, 1995). Bruxism was defined at the beginning of the last century and has received different names such as: traumatic neuralgia, bruxumanía, occlusal habit neurosis, parafunction.

The origin of this pattern of behavior is not fully clarified. It is considered to have a dual cause where on the one hand there would be the psychic and emotional overload given to the anxieties, fears, frustrations, stress, anxiety, etc. and on the other the association of some occlusal interference. The predominance of one of the factors seems not to be determinant, since very obvious interferences with little tension, or tensional states pronounced with very slight interference, are capable of engendering it, the important thing is that either of the two factors exceeds the resistance limit individual or the adaptive capacity of the individual.

Arnol states that there are three etiological factors, including: factors of dental origin (interference), those of muscular origin (increased tone) and psychological factors (tension, stress, anxiety) (Cairo, González, 2005).

Most people do not know that they suffer from the habit of bruxism, they are surprised by the fact that they are diagnosed and sometimes they feel ashamed to present this habit. It is important to note that it may take years to present this pathology, so that the first signs of alteration or damage due to bruxism become visible.

Methodology to be developed

An applied, observational, cross-sectional and prospective study was carried out. In the Faculty of Engineering of the Universidad Veracruzana, Veracruz region in the period between February and August 2008. The objective of this work was: To compare the levels of anxiety and stress between individuals with and without headaches. We worked with 250 students from the Faculty of Engineering. The instruments used were: Odontological Clinical History, Test of Attitudes that Provoke Stress (Batista, 2007) and Vivencial Self-Report (Batista, 2007) (Grau, 1985).

Results

Headaches, stress and anxiety

Statistically significant differences were found when comparing the level of stress presented by the individuals who reported having headaches and those who did not. As can be seen in Table 6, the fashion for the subjects who did present headaches was found in "moderate stress", while the fashion for the subjects who did not present headaches was found in "mild stress". This difference in fashion is reflected by comparing the percentages of individuals who have "moderate stress" and "mild stress": x2 = 9,029, gl = 3, p = .029, so it can be concluded that subjects with headaches present higher levels of stress.

			Stress level				Total
			High	Moderate	Mild	Low	
Headaches	Yes	Count	0	20	14	0	34
		% in headaches	.0%	58.8%	41.2%	.0%	100.0 %
		% within Stress level	.0%	22.2%	8.9%	.0%	13.6%
	No	Count	1	70	144	1	216
		% in headaches	.5%	32.4%	66.7%	.5%	100.0 %
		% within the Stress Level	100.0%	77.8%	91.1%	100.0%	86.4%

Table 1 Headaches and Stress Level. x^2 =9.02,gl=3, p = .029 s

These results coincide with what was found in the anxiety test. When analyzing the scores of this test, it was found that subjects with headaches had a significantly higher mean than those without headaches: 60.03 ± 9.7 and 55.60 ± 9.6 respectively (t = .2.47, gl = 248, p = .014) This finding can be seen in Figure 1.

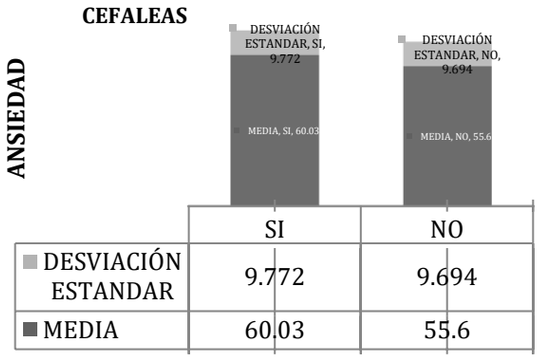

Figure 1 Mean and standard deviation of the anxiety score in individuals with headaches and in those who do not present them

Conclusions

A significant part of the studied population was diagnosed as bruxópatas, which is very young and this constitutes a relevant data for the health of the economically active population of the country in some years. It is important to note that when finding signs of wear or damage caused by bruxism in students, it is an indicator derived from two important observations: that students have a long time showing bruxism and the manifestations are already remarkable, or the habit is very strong and they are causing important health effects.

The presence of stress and anxiety in bruxist and non-bruxist patients did not represent a statistically significant finding, if it was found in the presence of headaches. This leads us to the theory of the multifactorial and not very specific etiology of this pathology, in which it is very clear how it indicates the presence of this habit in an indistinct way in the subjects that present or not emotional alterations, nevertheless it should be noted that Subjects who have high stress and anxiety will generally have greater affectations caused by bruxism.

Recommendations

As a result of this study it is important to establish programs that allow the timely diagnosis of bruxism in the university population, which affect an adequate treatment plan and the establishment of preventive measures or programs, to avoid disorders caused both in physical and emotional health of the student community, which impacts on their mental health.

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Microencapsulation and antioxidant activity of Betabel juice *(Beta vulgaris)*

Microencapsulación y actividad antioxidante del jugo de Betabel *(Beta vulgaris)*

MARTÍNEZ-AYALA, José Leonel, REYES-MUNGUÍA, Abigail, CARRILLO-INUNGARAY, Ma. Luisa and MARTINI-MORALES, Sasi Elibeth

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Abstract

The objective of this work was to perform the microencapsulation of beet juice (JB) (Beta vulgaris) by spray drying, using as gum arabic (GA) wall materials at a concentration of 30%. The antioxidant activity of JB and the microcapsules of JB during storage was evaluated. Antioxidant properties were determined: percentage of inhibition (DPPH method), redox potential, content of phenols, anthocyanins and flavonoids. In the JB a percentage of inhibition of 73.27 ± 0.77% was obtained suffering an oxidation of 15.57%, this percentage was similar to that obtained in the microcapsules (75.55 ± 1.00%). The redox potential of the JB was 239.25 mV, lower than the 298.2 mV obtained in the microcapsules, as regards the content of total phenols, the JB had 230.53 ± 0.28 mg EAG / L and the microcapsules 534.68 mg EAG / L. The content of flavonoids and anthocyanins obtained a higher content in the microcapsules compared to the JB, however, this had a higher betalaine content.

Microencapsulation, Betalains, Gum arabic, *Beta vulgaris*

Resumen

El objetivo de este trabajo fue realizar la microencapsulación el jugo de betabel (JB) (*Beta vulgaris*) mediante el secado por aspersión, utilizando como materiales de pared goma arábiga (GA) a una concentración del 30%. Se evaluó la actividad antioxidante del JB y de las microcápsulas del JB durante el almacenamiento. Se determinaron propiedades antioxidantes: porcentaje de inhibición (método de DPPH·), potencial redox, contenido de fenoles, antocianinas y flavonoides. En el JB se obtuvo un porcentaje de inhibición de 73.27 ± 0.77% sufriendo una oxidación del 15.57%, este porcentaje fue similar al obtenido en las microcápsulas (75.55 ± 1.00 %). El potencial redox del JB fue de 239.25 mV, menor al de 298.2 mV obtenido en las microcápsulas, en lo que respecta al contenido de fenoles totales, el JB tuvo 230.53 ± 0.28 mg EAG/L y las microcápsulas 534.68 mg EAG/L. El contenido de flavonoides y antocianinas obtuvo un mayor contenido en las microcápsulas en comparación con el JB, no obstante, este presentó mayor contenido de betalaínas.

Microencapsulación, Betalainas, Goma arábiga, betabel, *Beta vulgaris*

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Introduction

Beet (Beta vulgaris) or beet, is a plant little used in human nutrition (Waizel, 2006). This vegetable has healing properties against pain, it is recommended to stimulate the immune system, prevent cancer and reduce oxidative stress in people with obesity and diabetes (Azeredo, 2009). Some studies have focused on red varieties because they produce pigments called betalains, these are phytochemicals considered to be powerful antioxidants (Cai et al., 2003). For the best use and conservation of the active compounds present in the beet, the food industry has implemented innovation technological processes; such as microencapsulation, nanoencapsulation, the development of packaging and preservatives.

Microencapsulation can be defined as a technique by which liquid droplets, solid or gaseous particles, are covered with a porous polymer film containing an active substance (Araneda and Valenzuela, 2009), the applications of this technique have been increased frequently in the encapsulation of aromas, flavor, color and nutritional components, with the purpose of protecting the material from the base of the degradation (reduction or reactivity) with its external environment (heat, humidity, air and light), maintaining its stability and viability for the development of products that provide a health benefit, that present a flavor of freshness and that also have a prolonged shelf life. For the adequate preservation of nutraceutical compounds, biopolymers of natural origin and low cost have been used, such as maltodextrin and gum arabic (Pavón-García et al., 2011).

Methodology

Collection and preparation of the sample

Beets were selected in a state of commercial maturity, which was determined on the basis of color (homogeneous red), then peeled to remove the bark, cut into cubes and passed through a juice extractor, then filtered with Whatman N paper two.

Microencapsulation

The encapsulation with gum arabic was carried out according to what was described by Beristain C. I. et al. (2010). Through a material balance, the necessary amount was obtained to prepare an aqueous solution at 30% (w / w) with gum arabic and beet juice. It was protected from light and allowed to stand overnight at room temperature. The microcapsules were obtained by spray drying. The solution was fed to a spray dryer Mini Spray Dryer, model Büchi B-290. The microcapsules were stored in amber colored bags at room temperature.

Determination of antioxidant properties of juice (JB) and beet microcapsules (MB)

Quantification of total phenols: The content of total phenols was determined by the Folin-Ciocalteu method (Singleton, 1999), in which the phenolic compounds are oxidized by the Folin-Ciocalteu reagent. Absorbance readings were performed at 740 nm in a spectrophotometer (AquaMate Plus uv-vis). The results obtained were expressed in milligrams of Gallic Acid Equivalents (mg EAG / L).

Percentage of free radical inhibition: The antioxidant activity was determined according to the methodology described by Brand-Williams et al. (1995) through the inhibition of the stable radical DPPH • (1,1-diphenyl-2-picrylhydracil). The absorbance was recorded every minute until similar readings were obtained, which is considered the final point of the monitoring.

Redox potential: The measurements were made with an Ag / AgCl platinum electrode connected to a potentiometer (Thermo Scientific Orion Dual Star). The values of the redox potential in mV were recorded until reaching its stability (Manzocco et al., 1998).

Quantification of Betalains: The betalaine content was determined using the spectrophotometric method developed by Nilsson (1970) for red pigments (betacyanines) and yellow pigments (betaxanthines).

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Results

The average percentage of inhibition of free radicals in the microcapsules of beet juice with gum arabic was 68.28 ± 4.33% while the average values for total phenols were 509.37 ± 11.92 mg EAG / L. Floirendo et al. (2014) microencapsulated the cranberry anthocyanins with gum arabic and soy protein, obtaining in their research that gum arabic was the one that gave the greatest protection to the antioxidants of cranberry. With regard to the evaluation of the redox potential, the microcapsules of beet juice with gum arabic did not show significant changes during storage.

The microcapsules of beet juice with gum arabic during the first week had a redox potential of 291.2 mV, while in week 14 it had a reducing power of 280.3 mV. With this, a decrease of 3.74% (10.9 mV) during the weeks of storage was slightly observed. However, these redox potential values are similar compared to those obtained from beet juice (299.25 mV). The results obtained in the quantification of betalains (betacianinas and betaxanthines) present in the microcapsules of beet juice with arabica gum were of a content of 204.4 mg / Kg for betacyanins, while for betaxanthines the concentration was 151.2 mg / kg.

Conclusions

The beet juice does not last for a long time due to the oxidation process and the development of microorganisms, which is why it is not common to use the juice for the elaboration of products, however, the active compounds of the beet juice can be preserved by applying technologies such as microencapsulation. The evaluation of the microcapsules with gum arabic as an encapsulating agent, gave a greater protection and stability to the bioactive compounds, this was verified when making the comparison between the activity of the antioxidant compounds of the fresh beet juice with that of the juice microcapsules. beet using as gum arabic wall material, observing a higher percentage of inhibition, redox potential, betalains and total phenols during storage.

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Efficiency of the NBelyax nanoparticle as a disinfectant agent for a broad spectrum of surfaces in hospital environments. On-site studies in two Mexican hospitals "Hospital Tacuba" and "Dr. Fernando Quiróz General Hospital"

Eficiencia de la nanopartícula NBelyax como agente desinfectante para un amplio espectro de superficies en entornos hospitalarios. Estudios in situ en dos hospitales mexicanos "Hospital Tacuba" y "Dr. Fernando Quiróz General Hospital"

LEON-GUTIERREZ, Gabriela*†, ALBARRAN, Leon, LEON-GUTIERREZ, Sergio and ARTEAGA-LOPEZ, Paola R.

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Abstract

This study identified the presence of pathogenic microorganisms on inert surfaces of different areas intended for direct medical care in two general hospitals of the national public sector located in Mexico City. In these hospitals the effectiveness of the nanoparticle NBelyax as a broad spectrum disinfectant agent was determined using the microbial challenge process through the evaluation of the percentage reduction of Colony Forming Units (UFC). Obtaining results of 99.999% effectiveness for pathogenic microorganisms of E. coli and S. aureus.

Nanoparticle, NBelyax, Bacterial challenge, Hospital, E. coli, S. aureus

Resumen

En este estudio se identificó la presencia de microorganismos patógenos en superficies inertes de diferentes áreas destinadas a la atención médica directa en dos hospitales generales del sector público nacional ubicados en la Ciudad de México. En dichos nosocomios se determinó la efectividad de la nanoparticula NBelyax como agente desinfectante de amplio espectro, empleando el proceso de reto microbiano a través de la evaluación del porcentaje de reducción de Unidades Formadoras de Colonias (UFC, por sus siglas en inglés). Obteniendo resultados del 99.999% de efectividad para los microorganismos patógenos de E. Coli y S. aureus.

Nanoparticula, NBelyax, Reto Bacteriano, Hospitales, E. coli, S. aureus

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Introduction

Disinfection is a manual process that is traditionally done by friction and that uses physical and chemical methods to reduce to the maximum the different microbial agents, in particular those related to the genesis of nosocomial infections by direct, indirect and cross-contamination in particular. inert surfaces and surgical instruments without proper cleaning (1-5)

The set of activities of disinfection and sanitation for the control of pathogenic microorganisms to minimize the possibilities of microbial contamination during hygienic processes carried out in hospitals. (6-8). Optimal disinfection must reduce the UFC count by 99.999% after applying the procedure. (9)

Microbial flora of hospital units

In the years of 2009 to 2011, according to the Committee for the Prevention and Control of Nosocomial Infections (CODECIN), contamination by E. coli and S. aureus was identified, among other pathogenic microorganisms.

Criteria for the selection of antiseptics, germicides, sanitizers, disinfectants

For the selection of antiseptics the following characteristics should be taken into account:

- Broad spectrum of action against pathogenic microbiological agents.
- Activity of the antiseptic on contact with tissues.
- Cumulative or residual effect of the product on inert surfaces.
- safety and effectiveness of the product
- Practical, simple and without risk in the preparation, management and application of each germicide.
- New technologies

Justification

Given the lack of effectiveness of traditional products in the fight and containment of pathogenic microorganisms, the use of new technologies is necessary.

The nanoparticle NBelyax acts eliminating all types of bacteria, fungi and spores. It is designed to act on any type of surface, in a maximum of 5 minutes, with a protection of up to 72 hours.

Problem

The effectiveness of classical disinfectants against pathogenic organisms has diminished due to the resistance that the latter have towards this type of products. It is necessary, then, the use of disruptive technologies that allow effective combat against these threats to health.

Hypothesis

The use of products with new technologies, will reduce by up to 99.999% the UFC of pathogenic organisms found in inert surfaces of hospital environments.

Objectives

Overall objective

To identify the presence of pathogenic microorganisms of inert surfaces in different areas destined to the direct medical attention in two general hospitals of the Western Regional Delegation and to determine the antimicrobial effectiveness of the nanoparticulate active NBelyax, by applying the process called microbiological challenge and the percentage of reduction of bacterial UFC.

Specific objectives

- Identify the bacterial flora of the inert surfaces of different areas and hospital services prior to the use of the NBelyax nanoparticulate active.
- Determine the quantitative value of germs subsequent to the use of the nanoparticulate active NBelyax.
- Determine the percentage variation of the bacterial flora after the use of the nanoparticle.
- Determine the effectiveness of the product.

Materials and methods

Observational, longitudinal and prospective type study, to determine the prevalence of microorganisms in inert surfaces and the modification of this after the use of the NBelyax nanoparticle.

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The microbiological challenge methodology was used according to the NMX-BB-040-SCFI-1999 standard for in vitro studies. For on-site studies, the methodology of taking samples directly from the inert surfaces of different strategic sites of both hospitals was used. Mesophilic bacteria and total coliforms were determined in CFU / 100cm2, before and after the use of the nanoparticle. The statistical analysis of results was performed with measures of central tendency, ratios and proportions.

Results

The results obtained in the study show the importance of complying with the stages recommended in the NMX-BB-040-SCFI-1999 standard. The following results were obtained:
E. Coli reduced a 99.999%
S. Aureus reduced a 99.999%.

The previous results show that the NBelyax nanoparticle presents antimicrobial activity.

Results Tacuba Hospital

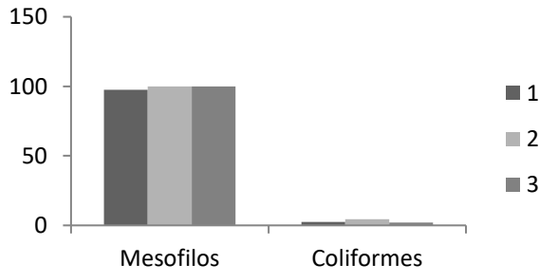

Figure 1 shows the results of the Tacuba General Hospital, noting that sample 1 (UCI cure cart), presented a 97.24% reduction of CFU for mesophyllics, in the sample (medicine preparation table for medicine). internal), the reduction of CFU was 100% and for sample 3 (operating room table) a reduction of 100% was also observed. The same is observed for the case of coliforms.

Results General Hospital Dr. Fernando Quiróz

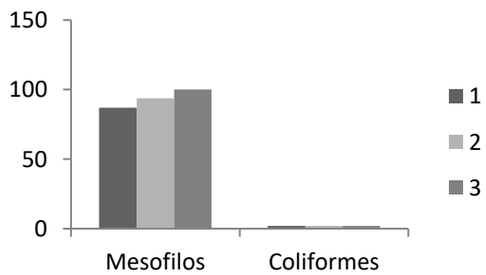

Figure 2 shows the results of the Dr. Fernando Quiróz General Hospital, in terms of the reduction of microorganisms after the use of the product. Maintaining a reduction above 87% for sample 1 (surgical plate), 93.75% in sample 2 (pediatric tray) and 100% reduction of CFU in sample 3 (inert surface taken in the Intensive Care Unit). In the case of coliforms, zero CFU values were obtained before and after the application of the nanoparticle.

Discussion and Conclusion

The results obtained in this study, through the microbiological challenge tests, give evidence of the bactericidal effect of the nanoparticle. The results of the sampling in two hospitals, show the reduction of CFU of both aerobic and mesophilic bacteria; as well as total coliforms, which corroborates the bactericidal effectiveness of the NBelyax nanoparticle.

It is concluded that the study objectives were fulfilled and the bactericidal effect of the NBelyax nanoparticle is based on the results of the microbiological challenge carried out. The study invites to develop later ones to broaden the microbiological spectrum of action.

New techno-scientific evidences were obtained as novel disinfection tools for the use in medical units in general, particularly in the hospital units that help in the procedures aimed at the prevention, control and epidemiological surveillance of nosocomial infections.

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Objectives
Methodology
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Introduction

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What is your added value with respect to other techniques?

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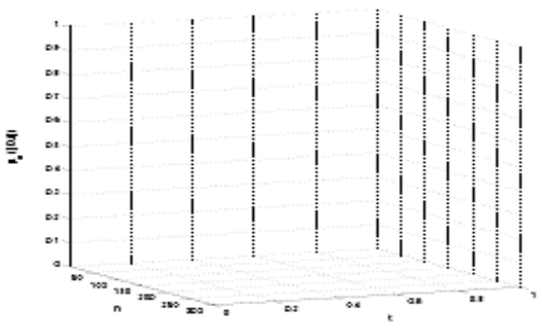

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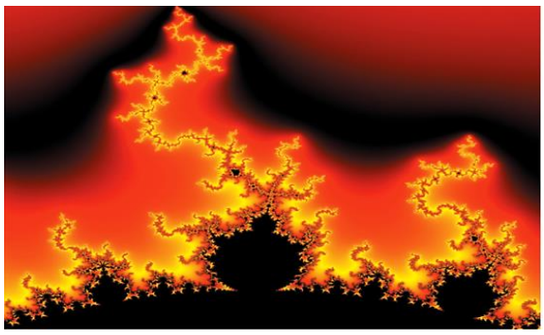

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Results

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Annexes

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Conclusions

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