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ECORFAN Journal Republic of Guatemala

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The works must be unpublished and refer to topics of Biological and Health Sciences, Medical Mycology, Dermatology, Immunology, Human Ecology, Parasitology, Pediatric Infectious Diseasesand other topics related to Medicine and Health Sciences.

Presentation of Content

In the first article we present, *Drug use in university students*, by LOZANO-GUTIÉRREZ, Jorge Luis, PACHECO-AMIGO, Beatriz Mabel and SOLÍS-RECÉNDEZ, Emma Perla, with adscription in the Universidad Autónoma de Zacatecas, as the following article we present, *Wax obtained from the insect Dactylopius coccus Costa, study for its application in natural cosmetic products*, by ARROYO FIGUEROA, Gabriela, MEDINA SAAVEDRA, Tarsicio, HERRERA MENDEZ, Carlos Hernán, DZUL CAUICH Jorge Gustavo, with adscription in the Universidad de Guanajuato, as the following article we present, *Differences between handgrip strength and anthropometric measurements with respect to the index of biological maturation in schoolchildren*, by LÓPEZ-GARCÍA, Ricardo, ESTRADA-SÁNCHEZ, Ivonne Azeret, NUÑEZ-ROCHA, Georgina Mayela and LAGUNES-CARRASCO, José Omar, with adscription in Universidad Autónoma de Nuevo León, as the following article we present, *Multidrug-resistant Klebsiella sp. one of the main etiological agents of urinary and respiratory tract infections in infants at southeastern Mexico*, by FARRERA-ULLOA, Isaura, FELICIANO-GUZMÁN, José Manuel, LÓPEZ-SÁNTIZ, José Raúl and GUTIÉRREZ-JIMÉNEZ, Javier, with adscription in the Universidad de Ciencias y Artes de Chiapas, Tuxtla Gutiérrez.

Content

Article **ECORFAN Journal-Republic of Guatemala**
June 2023, Vol.9 No.16 1-6

Drug use in university students

Consumo de drogas en estudiantes universitarios

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Abstract

Objectives. The general objective is to identify drug use in university students. The specific objective is to generate specific knowledge for the prevention of drug use at its various levels.

Methodology. The research is descriptive, non-experimental, cross-sectional. The participants are students of the subject "Risk behavior in educational contexts" at the Academic Unit of Psychology of the Autonomous University of Zacatecas. The Drug consumption Questionnaire (2009), prepared by the Social Security Institute of the State of Mexico and Municipalities, is used, the treatment of the data is through percentages.

Contribution. Obtained data, that lead to the knowledge of drug use in university students, will allow to base the intervention through programs aimed at eliminating drug use through prevention.

Drug addiction, Risk, Students

Resumen

Objetivos. El objetivo general es identificar el consumo de drogas en estudiantes universitarios. El objetivo específico es generar conocimientos específicos para la prevención del consumo de drogas en sus diversos niveles.

Metodología. La investigación es de tipo descriptivo, no experimental, transversal. Los participantes son alumnos de la materia "Conductas de riesgo en contextos educativos" de la Unidad Académica de Psicología de la Universidad Autónoma de Zacatecas. Se utiliza el Cuestionario de Consumo de drogas (2009), elaborado por el Instituto de Seguridad Social del Estado de México y Municipios, el tratamiento de los datos es a través de porcentajes.

Contribución. Se obtienen datos que llevan al conocimiento del consumo de drogas en alumnos universitarios, lo que permitirá fundamentar la intervención por medio de programas dirigidos a eliminar el consumo de drogas a través de la prevención.

Drogadicción, Riesgo, Estudiantes

Citation: LOZANO-GUTIÉRREZ, Jorge Luis, PACHECO-AMIGO, Beatriz Mabel and SOLÍS-RECÉNDEZ, Emma Perla. Drug use in university students. ECORFAN Journal-Republic of Guatemala. 2023. 9-16:1-6.

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Introduction

Drug use today is a problem involving public health. Every time different groups of people of different ages are involved, from minors to older adults with high consumption and lethality. University students are no stranger to the development of addictions with risky behaviors that endanger the lives of users.

One way to start drug use is through bullying, which over time implies problems to be solved, according to Lozano, et al, bullying can leave various consequences both at the personal level of the participants and their possible social and legal consequences (2020). This harassment can be through coercion.

The importance of identifying the different groups of people who have risk behaviors and who can be identified to carry out intervention programs in various forms of prevention.

Drugs when consumed affect the nervous system, therefore, that impacts the different areas of development such as physical, mental, psychological and social. Likewise, it can prevent from achieving goals such as labor and social incorporation in an adapted way since, in the future, it can be truncated, in addition to having potential risk factors for losing one's life.

The present work was carried out through the application of a questionnaire on drug use, the subjects of the sample are university students. It yields results with significant relevance.

Among them, it stands out that a low percentage of participants have the belief that they can stop using drugs at any time, whether they consume or not.

From the foregoing, the importance of establishing drug use prevention policies can be deduced.

Carrying out preventive actions in drug consumption will allow avoiding harm to non-consumers; on the other hand, working with individuals and groups that are more vulnerable to risk due to their context and those individuals and/or social groups that have consumed addictive substances. Remaining in treatment control groups (Pacheco, 2019).

Therefore, the problem to be addressed is drug use and its identification in university students, based on the hypothesis that if drug use is identified, better prevention can be carried out at its different levels.

What is a drug?

According to the World Health Organization (WHO), cited by Centros de Integración Juvenil A. C. (2023), a drug is a substance that, introduced into the body by any route of administration, produces some natural alteration in the functioning of the body central nervous system, in addition, to be able to create dependency in the psychological, physical areas or both.

Drugs as a psychoactive substance modify important aspects of the user´s nervous system, affecting thinking, feelings, perceptions and behavior. In turn, they alter personality, based on the fact that this is what identifies people and distinguishes them from others. For Morris (2011) personality is the unique pattern of thoughts, feelings and behaviors of an individual that persists over time and between situations, which affects the various areas of life.

Drugs, when incorporated into the body, have the ability to alter the psychomotor, affective and perceptual functioning. Although they can be used under medical prescription, a large number of people do so by their “decision” due to various causes, such as recreational consumption whose main objective is pleasure by exercising self-administration, therefore, they do not have a medical prescription, without health care purposes.

Drugs and their effects

The effects of drugs on the nervous system are generally divided into three: stimulants, depressants and hallucinogens. And on the other hand, the consequences of those in terms of thinking and executive functions, they deteriorate together, altering the cognitive part. Therefore the reasoning and planning capacity decreases, making it difficult to solve problems by presenting thinking difficulties.

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Regarding drugs and their relationship with emotions, it has a double effect, directed towards the consumer himself, which in the long term decreases the ability to feel and express emotions as there is an effective flattening, excluding the moment of consumption. Drugs hide the development of emotions since their consumption leads to altered emotional states; as well as, regarding the relationship between perception and the use of in a serious way, it can present hallucinations because the senses capture unreal aspects that are attributed to the environment and not to real subjective conditions of the person.

Likewise, they can have visions, skin sensations, olfactory, gustatory among others. The relationship between emotions and perception in drug use is that it does not allow an adequate decoding of the emotions of other people, leading to problems of interpretation of situations of social interrelation, which in serious cases can present delusions, that is, thought disorder.

The impact of drug use is manifested mainly in behavior, either by increasing actions or by decreasing the ability to act. Behavioral changes in behavior occur, being able to present violence and legal problems, accidents, variation in appetite, modification of sleep habits, sudden changes in mood and hyperactivity.

With regard to physiological signs, dilation and irritation of the eyes, strange odors, poor language coordination, change in the body weight, and physical detriment to their body shape are presented. In the area of social relations, involvement in illegal activities, the need and search to financially solve drug use are combined; therefore, it is of great importance to locate friendship relationships, recreational activities, changes in activity schedules and vigilance in situations of school failure.

The use of addictive substances can cause various psychological disorders that include the areas mentioned above, thought, emotions, perception and behavior (Villatoro, et al. 2015).

Some disorders will require intervention at the level of treatment from drug use; for this reason, it is important to clarify that the intervention must be at its three levels: universal, selective and indicated. Due to the foregoing, knowledge about drug use allows such timely interventions to be carried out for each type of consumption diagnosis.

According to Martínez and Osorio (2021) the levels of prevention are structured to prevent iatrogenesis, which implies misinformation and its untimely exposure, as well as the selection of strategies of greater relevance for the historical moment of the community, its members and type- proof of consumption.

Situation that is taken as a basis to implement some level of prevention, as the situation requires. Universal prevention is identified as the one that is aimed at the whole of society, regardless of the level of risk, no prior diagnosis in needed, unlike selective prevention, which is for those social groups that through a diagnosis are identified in conditions of vulnerability, whether due to economic aspects, geographic community location, educational situation, personal psychological characteristics, peer group and their relationship, etc.

The indicated prevention applies to people who already consume drugs and have been detected, where the risk is greater because they can present problems or increase them.

According to the results from the Drug Consumption Questionnaire in the face of prevention, the main objective is to reach total abstinence by pretending that people do not try drugs once.

Some facts about drug use

According to Villatoro Velázquez, et al (2016), the consumption trends and the consumption pattern by type of drugs show the influence of exposure to the opportunity of ist use, that is, to the ease of disposition of type of drug. In the Survey of Drug Consumption in High School and Secondary Students oy the year 2014 (ENCODE) in the state of Zacatecas, 13.4 percent of students have used some drug, for the aforementioned data, the State is significantly below the national average, which stands at 17.2 percent.

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Regarding drug use in Young university students, according to the data issued by Dr. María Elena Medina Mora, director of the Faculty of Psychology, she stated that from 2011 to 2017, marijuana use increased from 1.9 to 3.5 percent, while cocaine use increased from 0.8 to 1.5 percent. Hermida (2021).

Methodology

This research is of type quantitative, non-experimental, descriptive, random cut, cross-sectional for students of the subject "Risk behaviors in educational contexts". The instrument used is The Drug consumption Questionnaire (2009), elaborated by the Social Security Institute of the State of Mexico and Municipalities, specifically by the Health Services Coordination, (2009). This questionnaire is used as screening, for identifying use of addictive substances. The questionnaire has 20 questions in a dichotomous scale, where the answer is yes or not. The score has the following values: one for the answer yes and zero for the answer no. The rating is as follows:

0 points = does not report abuse.

From 1 to 5 points = low level of abuse.

From 6 to 10 points = intermediate level of abuse.

From 11 to 15 = substantial abuse.

From 16 to 20 = severe abuse.

The statistical reliability is obtained through the formula 20 (KR-20) de Kuder-Richardson.

$$KR20 = (K/(K-1))(1-(\sum p.q)/Vt)$$

The results of the survey were processed through percentages obtained from the answers that the participants expressed at the time of answering it.

Results

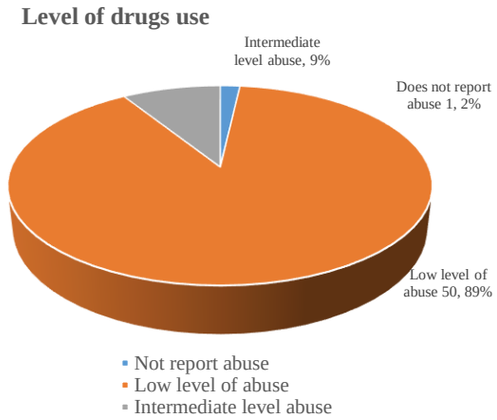
The level of drug use of the university students surveyed is the following:

a) Does not report abuse, one participant, equals 2 percent.

b) Low level of abuse, 50 people, equivalent to 89 percent.

c) Intermediate level of abuse, 5 people, representing nine percent.

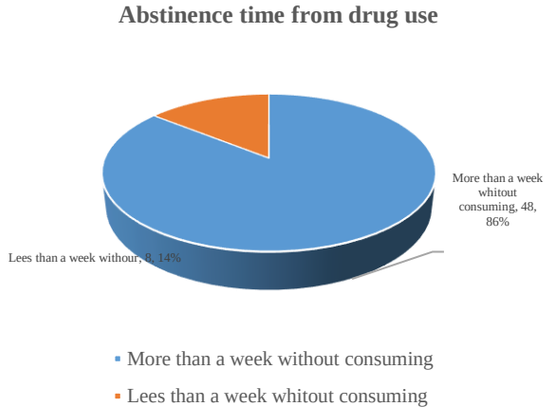
d) The levels of substantial and severe consumption did not exist.



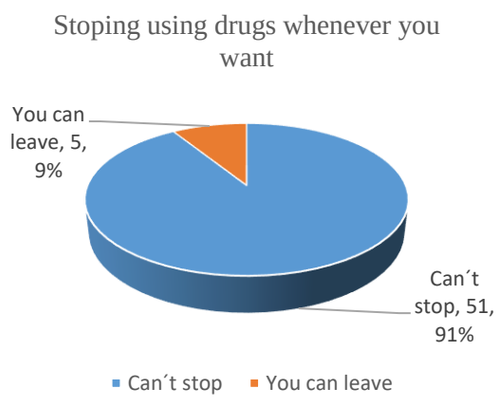
Graphic 1 Level of drug use
Source: Own elaboration

Regarding the specific questions and their response rates, it was found that in question four, which consists of having not used drugs for more than a week, 86 percent answered affirmatively, while 14 percent have used drugs within a week.

In question number five, which consists of being able to stop using drugs whenever you want, the lowest percentages in denial were presented, with ninety-one percent, while only nine percent affirmed the ability to stop using drugs whenever they wanted.



Graphic 2 Abstinence time from drug use
Source: Own elaboration



Graphic 3 Stopping using drugs whenever you want
Source: Own elaboration

Regarding the reliability of the Drug Consumption Questionnaire, it reached a 6.1, which represents weak reliability.

Financing

The sources of financing were the researchers' own resources. We thank the authorities and students of the academic Unit of Psychology of the Autonomous University of Zacatecas for their availability.

Conclusions

The objective is met, since risk behaviors due to the use of drugs in university students were identified, they were located in a low consumption with 89%, and only 2% do not report drug abuse (do not consume) and 9% presents an intermediate level of abuse, clarifying that the legal consumption of medicines is included. It should be noted that there is no substantial or severe consumption of drugs, however, all those who have low-level consumption may be potential subjects of greater types of consumption and various substances, so it is essential to carry out intervention proposals such as, it is pointed out in the authors cited in the development of the research as it is the selective and indicated type of prevention.

With regard to drug use and quitting when desired, only few participants consider that they can do so, which represents risky behavior, since drugs, used or not, put them at risk by not perceiving the danger of consumption and acquisition of addictions. Within the last week, drug use was identified.

Regarding the instrument, it has a weak reliability, but it fulfills the screening function, by identifying drug use behaviors. Therefore, it is stated that prevention programs should be carried out at various levels among university students.

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Article **ECORFAN Journal Republic of Guatemala**
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Wax obtained from the insect *Dactylopius coccus* Costa, study for its application in natural cosmetic products

Cera obtenida del insecto *Dactylopius coccus* Costa, estudio para su aplicación en productos cosméticos naturales

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Abstract

The insect *Dactylopius coccus* Costa produces a white wax that serves to protect itself from the environment, at the time of harvesting the insect, the wax is separated by sifting, in intensive production of the insect a large amount of wax is discarded. Therefore, the objective of this work was to carry out a physicochemical analysis of three samples from different producers obtained by the same method, to determine if it meets the characteristics to be used in any natural product. The methodology consisted of determining the organoleptic characteristics, as well as the color by means of a colorimeter, determination of pH, melting point, and percentage of humidity. The results obtained were compared with a synthetic (microcrystalline) wax used in a cosmetic product, to see if it could be substituted by the analyzed wax. It was found that it was possible to substitute the synthetic wax for the natural wax due to its conflicting characteristics. Therefore, it is concluded that this wax can be used in the elaboration of natural products. Although it would be necessary to carry out a series of tests of the final product obtained with and without the wax. To determine if the substitution is favorable or not.

Wax, Insect, Cosmetics

Resumen

El insecto *Dactylopius coccus* Costa, produce una cera blanca que sirve para protegerse del medio ambiente, al momento de realizar la cosecha del insecto se separada la cera mediante el cernido, en producciones intensivas del insecto se desecha una gran cantidad de la cera. Por lo que el objetivo de este trabajo fue realizar un análisis fisicoquímico de tres muestras de productores diferentes obtenida por el mismo método, con la finalidad de determinar si cumple con las características para ser usada en algún producto natural. La metodología consistió en determinar las características organolépticas, así como el color mediante un colorímetro, determinación de pH, punto de fusión, y porcentaje de humedad. Los resultados obtenidos fueron comparados con una cera sintética (microcristalina) usada en un producto cosmético, para ver si podía sustituirse mediante la cera analizada. Se encontró que era posible sustituir la cera sintética por la cera natural debido a sus características encontradas. Por lo que se concluye que esta cera puede ser usada en la elaboración de productos naturales. Aunque sería preciso realizar una serie de pruebas del producto final obtenido con y sin la cera. Para determinar si es favorable o no la sustitución.

Cera, Insecto, Cosméticos

Citation: ARROYO-FIGUEROA, Gabriela, MEDINA-SAAVEDRA, Tarsicio, HERRERA-MENDEZ, Carlos Hernán and DZUL-CAUICH, Jorge Gustavo. Wax obtained from the insect *Dactylopius coccus* Costa, study for its application in natural cosmetic products. ECORFAN Journal-Republic of Guatemala. 2023. 9-16:7-11.

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Introduction

The insect (*Dactylopius coccus* Costa), also known as grana cochineal, lodges in the cactus and an active compound is obtained, which is carminic acid, used as a natural colouring agent in various areas (textiles, cosmetics, food, etc.) (Renita et al., 2023). In the development of this insect during its production, once fixed, the nymphs secrete wax in the form of filaments or a white powder (coccicerin), which covers them (nymph I fixed), (Fig., 1) (Hernández-Hernández et al., 2005).

Figure 1 Wax secreted by the grana cochineal insect in its Nymph I stage

Once they reach their adult stage, the males have wings in their adult instar, are mobile and smaller; while the females are apterous, immobile and larger, oval in shape and covered with a talc-like wax (coccicerin), which is easily detached when blown (López Soto, 2005) (Fig., 2).

Figure 2 Wax secreted by the grana cochineal insect in its adult stage (female in the process of oviposition)

In post-harvest handling, when the females are removed from the cactus, the insect is sifted in order to clean the insect and take it to drying. At this stage, the wax is removed (Rosenblueth et al., 2018). This wax in intensive insect productions is discarded in large quantities, so producers seek to give an application to this waxy product, so this work represents a great contribution to the producers of the insect, since they would have another source of income. The objective of this work was to carry out a physicochemical analysis of three samples of wax from different producers obtained by the same method, in order to determine whether it meets the characteristics to be used in a natural cosmetic product.

Methodology to be developed

Preparation of the wax obtained from the insect by means of an extraction method. Some research has used various methods of extraction or cleaning of the insect to obtain the wax, mainly ketones and alcohols (Aldama Aguilera et al., 2005; Vera Ponce et al., 2016). The extraction method proposed for this project consisted of: a) Separate the wax containing the grana cochineal through a sieve. b) Place the wax in a beaker with approximately 350ml of reagent grade acetone (≥99.5%), per 250g of wax. c) Decant, discard the solid (wax impurities) and store the acetone with the resulting dissolved wax under refrigeration for 24 hours. Once the acetone is separated from the wax (evaporation), it can be used for the next step. It should be noted that physicochemical analysis was carried out on three samples from different grana cochineal producers (M1, M2 and M3).

Physicochemical analysis of the wax

The physicochemical tests were carried out using the methodology provided in some published articles (Arroyo Figueroa et al., 2011; Arroyo Figueroa et al., 2016; and Rodríguez et al, 2017, based on the aforementioned regulations, the tests carried out are: organoleptic (physical appearance, odour), colour (using the CR-400 colourimeter, Minolta, considering the CieLab* coordinates), pH (in 10% solution in ethyl alcohol, using a potentiometer), melting point analysed using the melting point Fisher apparatus (NMX-K-492-1980), % moisture using a thermobalance for its analysis (NMX-F-211-SCFl-2006).

Comparison of tests with waxes used in cosmetics

Having the results of the physicochemical analysis of the natural wax obtained from the grana cochineal insect, a comparison was made with a synthetic wax used in the production of a lip balm (microcrystalline wax). In order to determine if it meets the similar characteristics to be used in the formulation of a lip balm in the future, a comparison was made with a synthetic wax used in the formulation of a lip balm.

Results

Melting point comparison

Table 1 shows the comparison of the melting points between the synthetic wax used in the production of the lip balm and the analysed samples of the natural wax obtained from the cochineal insect grana cochinilla. The first value corresponds to the beginning of the melting process and the second value to the end of the melting process, i.e. complete melting. It can be seen that the melting points of the samples analysed (M1, M2 and M3) have a higher value. This would be an alternative application for solid cosmetic products, especially in warmer places.

Sample	Melting point (°C)
Synthetic wax	71-98
Wax samples obtained from the insect	
M1	82.33-113.67
M2	82.33-110.67
M3	86.00-115.67

Table 1 Comparison of the melting point between the synthetic wax and the natural wax samples obtained from the insect

It can be seen that the melting point values reach a higher value in the natural wax, for example, for samples M1, M2 and M3, the maximum values are 113.67°C, 110.67 °C and 115.67°C, respectively. The microcrystalline wax has a range of 71 to 98°C. This indicates that the coccicerin sample can be used in the production of the lip balm, obtaining higher values in the melting point of the final product.

Comparison with colour coordinates

It was observed that the synthetic wax is whiter than the other natural wax samples, since the values of the coordinates a* (-0.40±0.23) and b*(-1.53±0.44) are close to zero.

The wax of sample number two (M2) is observed with the same trend in the coordinate values (a*, -1.31±0.03 and b*, 0.44±0.01). However, for the M1 and M3 samples, higher values are observed in the a* and b* coordinates, in the case of the a* coordinate, the higher the value, the redder the colouration, and for the b* coordinate, the higher the value, the yellower the colouration. It is considered that as the lip bullet is made with the by-product of cochineal (cochineal carmine or carmine lacquer), it does not affect the colouring obtained in each of the samples. However, it would be necessary to process the lip bullets and check the above.

Sample	Average and standard deviation of colour coordinates		
	L*	a*	b*
Synthetic wax	60.74±0.11	-0.40±0.23	-1.53±0.44
Wax samples obtained from the insect			
M1	77.20±0.27	13.12±0.17	2.56±0.05
M2	100.00±0.00	-1.31±0.03	0.44±0.01
M3	82.08±0.76	5.71±0.17	2.43±0.07

Table 2 Comparison of colour coordinates between synthetic wax and natural wax samples obtained from the insect

Comparison of pH and moisture content

The results regarding the pH of each of the samples and the synthetic wax, as well as the percentage of humidity can be seen in table 3. There is not much difference in the pH value, with a range of 6.0 to 6.5, all the samples including the synthetic wax fall in the mentioned range. However, for the moisture percentage, in the case of samples M1, M2 and M3, a range of 2.66 to 5.62% is observed, and the synthetic wax presents a very low moisture percentage of 0.13%. This could have an impact on the final product, however, the formulations should be tested to determine whether this parameter is decisive in obtaining the final lip balm, as it would be the only parameter that could affect the final product.

Sample	pH	% humidity
Synthetic wax	6.53	0.13%
Wax samples obtained from the insect		
M1	6.43	6.09%
M2	5.98	2.66%
M3	6.45	5.62%

Tabla 3 Comparison of pH and moisture content between the synthetic wax and the natural wax samples obtained from the insect

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Conclusions

It was possible to conclude that the wax from the insect can be used in the elaboration of the lip bullet, substituting the synthetic wax (microcrystalline), as it fulfils the characteristics. In order to obtain a completely natural product. It is necessary to verify the above by carrying out formulation tests by substituting the microcrystalline wax in different percentages with coccicerine wax, and to compare the results of the final product.

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Differences between handgrip strength and anthropometric measurements with respect to the index of biological maturation in schoolchildren

Diferencias entre la fuerza de prensión manual y mediciones antropométricas con respecto al índice de maduración biológica en escolares

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Abstract

The aim of this study was to identify the differences in handgrip strength values and anthropometric measurements with respect to the index of biological maturation (IBM) in schoolchildren. A descriptive study was conducted with a total of 256 schoolchildren (78 boys and 178 girls) aged 10 to 14 years. Body weight, height and sitting height (trunk and leg length) were measured using the ISAK protocol; also, manual grip strength was evaluated with a digital dynamometer and a formula of Mirwald et al. (2002) was used to determine the peak growth velocity (PGV) through the IMB. Subsequently, the sample was categorized into 7 groups according to their BMI (-1.5, -1.0, -0.5, 0, 0.5, 0.5, 1.0 and 1.5 years). Significant differences were found in schoolchildren in the 0.5, 1.0- and 1.5-years group with respect to the -0.5, -1.0- and -1.5-years groups in body weight, height, trunk and leg length, and grip strength ($p \leq 0.05$). We conclude that the higher the biological maturation index there is a tendency for the anthropometry and grip strength values in schoolchildren to be higher with respect to those with a lower IMB.

Biological maturation index, Anthropometry, Strength

Resumen

El objetivo de este estudio fue identificar las diferencias de los valores de fuerza de prensión manual y mediciones antropométricas con respecto al índice de maduración biológica (IMB) en escolares. Se realizó un estudio descriptivo con un total de 256 escolares (78 niños y 178 niñas) de 10 a 14 años. Se les midió peso corporal, estatura y talla sentado (longitud de tronco y pierna) empleando el protocolo de ISAK, también, se evaluó la fuerza de prensión manual con un dinamómetro digital y se utilizó una fórmula de Mirwald et al. (2002), para determinar el pico de velocidad de crecimiento (PVC) a través del IMB. Posteriormente, la muestra se categorizó en 7 grupos de acuerdo con su IMB (-1.5, -1.0, -0.5, 0, 0.5, 1.0 y 1.5 años). Se encontraron diferencias significativas en los escolares del grupo de 0.5, 1.0 y1.5 años respecto a los grupos de -0.5, -1.0 y -1.5 años en peso corporal, estatura, longitud de tronco y piernas, y fuerza de prensión ($p \leq 0.05$). Concluimos que entre mayor sea el índice de maduración biológica existe la tendencia a que los valores en la antropometría y la fuerza de prensión en los escolares sean mayores respecto a aquellos que presentan un IMB más bajo.

Índice de maduración biológica, Antropometría, Fuerza

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Introduction

Biological maturation is defined as the set of phenomena of cellular growth and differentiation that contribute to the appearance of certain functions in the organism, which involves genetically programmed changes, which occur naturally over time, where each individual is born with its own biological clock that regulates its progression towards the state of maturity (Machado & Barbanti, 2007), highlighting that this process generates as a result an increase in the functional performance of various organs and systems of the human body, producing an increase in motor indicators in the sense of a potential increase in the development of physical abilities in children and adolescents (Malina et al. , 2003; Tanner & Tanner, 1990). In addition, maturation is a useful tool, which prevents the development of chronic degenerative diseases such as osteoporosis and cardiovascular diseases (Gotthelf & Fonseca, 2012; Izquierdo & Ibañez, 2017). Assessing morphological status at the age of puberty is of utmost importance, due to the significant changes that occur during the passage of biological maturation (Lidor et al., 2005; Matthys et al., 2012; Ziv & Lidor, 2009), in which the increase in body weight due to muscle development can become a transcendent factor that affects physical aptitudes and therefore physical performance.

There are now recent studies that show that, following the guidelines, children and adolescents can increase their muscle strength without impairing their growth and development (Gómez-Campos et al., 2013), which is why many scientific organisations such as the American College of Sports Medicine (ACSM), the American Academy of Pediatrics (AAP) and the National Strength and Conditioning Association (NSCA) have advanced strength training in this age group. Therefore, it is essential that the coach who works with children and youth categories knows the processes of maturation and growth of children and adolescents (Izquierdo & Ibañez, 2017), as there are coaches who choose their athletes from an early age, demanding high levels of professionalism, increasing training loads in time and intensity, which can often cause negative effects, affecting their development in sport in future stages (Lloyd & Oliver, 2019; Verdugo, 2015).

Otherwise, defining the limits of a healthy physical exercise range could improve the permanence of the child in sport up to an international level (García Vega, 2023; McKeag, 1991).

It has been concluded, that by selecting children with accelerated biological development they later lose the advantage and drop out, therefore, more success tends to be achieved by children with normal or delayed development (Catley & Tomkinson, 2013; Manonelles Marqueta et al., 2003; Stratton et al., 2004). Young people aged 16 and 17 years show a sharp increase in physical abilities, where they reach international sport mastery, but only 20% have accelerated development, with athletes with delayed development often being the highest achievers (Villamarin Menza et al., 2021).

In recent decades, attempts have been made to study and obtain evidence on the important role of the assessment of biological maturation in children and adolescents with physical skills, and some studies have analysed anthropometric variables and physical performance such as power and muscle strength with biological maturity (Chancolla Mamani, 2023; Enriquez-del-Castillo et al., 2022; Luna-Villouta et al., 2021). Other studies expose the importance of biological maturation with respect to their physical sport performance in order to identify the importance of biological maturation and experience in performance in order to observe possible differences with respect to anthropometry (body weight and height), years of practice and performance (Barnett et al., 2013; Itoh & Hirose 2020), studies have also been conducted to estimate maturation and implement training load around the PVC in physical development and thus avoid the risk of injury (Toselli et al., 2021; Towlson et al., 2021).

Having literature that exposes the importance of the assessment of biological maturation in physical fitness and sport (Fernandes et al., 2021), and noting that in our community this is not considered as a starting point to initiate a physical activity, health and training model in schools and sports clubs (Caiza, 2023). The aim of this study was to identify the differences in handgrip strength values and anthropometric measurements with respect to the biological maturation index in schoolchildren.

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Methodology

The present study was observational, descriptive and cross-sectional. A total of 256 schoolchildren (78 boys and 178 girls) aged between 10 and 14 years participated in the study. The schoolchildren belonged to public primary and secondary schools. The exclusion criterion for the study was the presence of chronic diseases or the inability to engage in physical activity. The directors, parents and participants were informed of the objective of the research, in which the parents signed the informed consent form and the schoolchildren signed their informed consent to participate in the study, in accordance with the deontological standards recognised by the Declaration of Helsinki.

Biological maturation

Biological maturation was determined by the anthropometric equation proposed by Mirwald (Mirwald et al, 2002) allowing the calculation of Peak Growth Velocity (PVC). This procedure involved the interaction of the anthropometric variables in which they were determined by personnel certified by the International Society for the Advancement of Kineanthropometry (ISAK), following the established protocol (Esparza Ros et al., 2019). The anthropometric measurements assessed were body weight in kilograms (kg) with the Tanita TBF-410 electronic floor scale (0 - 200 kg ± 0.01 kg), height in centimetres (cm) with the Seca 225 stadiometer (20 - 205 cm ± 5 mm), and sitting height (cm) with an anthropometric bench, the latter giving the length of the trunk and legs.

Subsequently, the Mirwald formula (Mirwald et al, 2002) was used to capture body weight, height, sitting height, date of assessment and date of birth (chronological age), and sex. Then categorised into 7 groups according to the BMI (-1.5, -1.0, -0.5, 0, 0.5, 0.5, 1.0 and 1.5). Negative values mean the years that the subject is missing in giving the PVC (-1.5, -1.0 and -0.5), positive values are the years that have passed when they gave the PVC (0.5, 1.0, 1.5), and the value zero (0) means the moment in which the PVC is presented.

Strength fitness

Grip strength was determined with a GRIP-D (Grip Strength Dynamometer T.K.K.5401 Texas Scientific Instruments, Nigata, Japan) digital hand-held adaptive grip dynamometer with an accuracy of 0.5 kg, which determines the isometric strength of the upper body. The protocol indicated to evaluate both limbs (right and left) following the instructions recommended by (Cruz-Jentoft et al., 2010). Three attempts were recorded for each arm (right and left), then the best result obtained was selected in order to interpret the muscle strength.

Statistical analysis

The statistical package SPSS (version 25) was used, analysing the normality of the data distribution with the Shapiro-Wilk test. The mean and standard deviation of the biological maturation index (BMI), anthropometric variables (body weight, height, trunk and leg length) and strength were calculated. Analysis of variance (ANOVA) was used to compare by BMI group, followed by Tukey's post hoc test. The significance level was considered to be $p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$ for all statistical analyses.

Results

In the data obtained, we observed that schoolchildren who have not reached their PVC (BMI: -1.5, -1.0 and -0.5) tend to have an age in years between 11.75 and 13.30 in boys and 10.20 and 11.08 in girls, while those who have passed their PVC (BMI: 0.5, 1.0 and 1.5) tend to have an age in years between 13.70 and 14.64 in boys and 11.51 and 13.64 in girls (Table 1 and 2).

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In the anthropometric measurements (Table 1 and 2), schoolchildren with a higher BMI (0, 0.5, 1.0 and 1.5) had higher values than those with a lower BMI (-1.5, -1.0 and -0.5), with significant differences ($p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$) in body weight measurements in girls ([-0.5 > -1.5], [0 > -1.5], [0.5 > -1.5, -1.0 and -0.5], [1 > -1.5] and [1.5 > -1.5, -1.0, -0. 5 and 0]), in height in boys ([-0.5 > -1.5], [0 > -1.5], [0 > -1.5 and -1.0], [1.0 > -1.5 and -1.0] and [1.5 > -1.5 and -1.0]) and girls ([-1.0 > -1.5], [-0. 5 > -1.5], [0 > -1.5, -1.0 and -0.5], [0.5 > -1.5, -1.0 and -0.5], [1.0 > -1.5 and -1.0] and [1.5 > -1.5, -1.0 and -0.5]), in trunk length in boys ([-0. 5 > -1.5 and -1.0], [0 > -1.5 and -1.0], [0.5 > -1.5 and -1.0], [1> -1.5 and -1.0] and [1.5 > -1.5 and -1.0]) and girls ([-1.0 > -1. 5], [-0.5 > -1.5 and -1.0], [0 > -1.5, -1.0 and -0.5], [0.5 > -1.5, -1.0 and -0.5], [1.0 > -1.5, -1.0 and -0.5] and [1.5 > -1.5, -1.0 and -0. 5]), in leg length in boys ([-0.5 > -1.5], [0.5 > -1.5] and [1.0 > -1.5]), and girls ([0 > -1.5], [0.5 > -1.5 and -1.0] and [1.5 > -1.5]).

In the physical fitness of manual grip strength (Table 1 and 2), those with a higher BMI showed greater strength than those with a lower BMI, with significant differences ($p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$) found in both boys (0.5 > -1.5 and -1.0) and girls (0.5 > -1.5 and -1.0) ([0 > -1.5], [0.5 > -1.5], [1.0 > -1.5] y [1.5 > -1.5, -1.0 y -0.5]).

	Biological maturation index						
	- 1.5 (*n* = 26)	- 1.0 (*n* = 21)	- 0.5 (*n* = 14)	0 (*n* = 5)	0.5 (*n* = 8)	1.0 (*n* = 2)	1.5 (*n* = 2)
Age (years)	11.75 ± 0.82	12.11 ± 1.18	13.30 ± 0.64	13.70 ± 0.76	14.30 ± 0.41	14.64 ± 0.01	14.41 ± 0.46
PVC (years)	13.17 ± 0.68	13.11 ± 1.07	13.64 ± 0.67	13.65 ± 0.80	13.84 ± 0.33	13.79 ± 0.06	12.84 ± 0.55
IMC (kg/m²)	23.58 ± 5.62	22.67 ± 5.52	21.78 ± 4.38	22.46 ± 3.80	21.92 ± 3.48	19.36 ± 0.49	23.28 ± 4.51
Anthropometry							
Weight (kg)	54.72 ± 13.6	55.14 ± 14.6	56.84 ± 13.22	58.52 ± 10.66	59.16 ± 9.96	56.60 ± .014	68.15 ± 17.7
Height (cm)	152.2 ± 5.32	155.7 ± 7.44	161.1 ± 5.86 a***	161.2 ± 2.40 a*	164.2 ± 3.40 a*** b**	171.0 ± 1.97 a*** b**	169.2 ± 7.63 a*** b*
Trunk length (cm)	79.94 ± 2.88	81.00 ± 2.94	83.85 ± 2.99 a*** b*	85.38 ± 2.65 a*** b*	86.26 ± 1.14 a*** b***	88.55 ± 0.35 a*** b**	89.15 ± 2.61 a*** b***
Leg length (cm)	72.31 ± 3.30	74.73 ± 5.00	77.27 ± 3.32 a**	75.90 ± 1.55	77.95 ± 3.80 a*	82.45 ± 2.33 a*	78.55 ± 7.14
Physical fitness Strength (kg)	20.36 ±7.46	20.82 ± 6.22	24.62 ± 6.87	26.44 ± 6.52	30.82 ± 6.61 a*** b***	28.50 ± 1.27	30.05 ± 2.33

Note. n: number; PVC: peak growth velocity; BMI: body mass index; kg/m2: kilograms over metres squared; cm: centimetres; kg: kilograms; a: significantly greater than (-1.5); b: significantly greater than (-1.0); c: significantly greater than (-0.5); d: significantly greater than (0); e: significantly greater than (0.5); f: significantly greater than (1.0); g: significantly greater than (1.5). Significance value: $p \leq 0.05$ (∗), $p \leq 0.01$ (∗∗) y $p \leq 0.001$ (∗∗∗)

Table 1 Differences in anthropometric characteristics and hand pressure strength with respect to the biological maturation index of male schoolchildren

	Biological maturation index						
	- 1.5 (n = 38)	- 1.0 (n = 45)	- 0.5 (n = 39)	0 (n = 28)	0.5 (n = 17)	1.0 (n = 5)	1.5 (n = 6)
Age (years)	10.28 ± 0.65	10.57 ± 0.52	11.08 ± 0.50	11.51 ± 0.63	12.01 ± 0.44	13.32 ± 0.69	13.64 ± 0.64
PVC (years)	11.74 ± 0.59	11.52 ± 0.55	11.56 ± 0.48	11.51 ± 0.60	11.51 ± 0.39	12.19 ± 0.64	12.11 ± 0.63
IMC (kg/m²)	18.57 ± 3.16	20.23 ± 4.59	20.85 ± 4.55	21.06 ± 4.76	22.91 ± 4.21	22.95 ± 3.42	25.24 ± 4.50
Anthropometry							
Weight (kg)	38.35 ± 6.89	42.81 ± 10.0	46.03± 8.71 a**	49.51±10.94 a***	55.70 ± 9.83 a*** b*** c**	55.40 ± 9.50 a**	63.53±13.14 a*** b*** c*** d*
Height (cm)	142.8 ± 4.55	146.8 ± 5.77 a**	149.4 ± 3.75 a***	153.4 ± 3.45 a*** b*** c*	156.0 ± 3.17 a*** b*** c***	155.3 ± 5.58 a*** b**	158.2 ± 2.98 a*** b*** c***
Trunk length (cm)	74.78 ± 2.76	77.13± 3.50 a**	79.04 ± 2.07 a*** b*	81.35 ± 2.25 a*** b*** c*	83.10 ± 1.76 a*** b*** c***	83.28 ± 1.64 a*** b*** c*	84.45 ± 2.37 a*** b*** c***
Leg length (cm)	68.27 ± 3.08	69.48 ± 4.88	70.55 ± 3.21	72.12 ± 2.53 a***	72.92 ± 3.24 a*** b*	72.02 ± 4.31	73.80 ± 1.04 a*
Physical fitness Strength (kg)	13.93 ± 2.68	16.10 ±3.32	16.18 ±3.13	18.24 ±3.76 a***	18.81 ±3.79 a**	19.74 ±4.63 a***	21.35 ±3.97 a*** b** c**

Note. n: number; PVC: peak growth velocity; BMI: body mass index; kg/m2: kilograms over metres squared; cm: centimetres; kg: kilograms; a: significantly greater than (-1.5); b: significantly greater than (-1.0); c: significantly greater than (-0.5); d: significantly greater than (0); e: significantly greater than (0.5); f: significantly greater than (1.0); g: significantly greater than (1.5). Significance value: $p \leq 0.05$ (∗), $p \leq 0.01$ (∗∗) y $p \leq 0.001$ (∗∗∗).

Table 2 Differences in anthropometric characteristics and hand pressure strength with respect to the biological maturation index of female schoolchildren

Discussion

Body growth such as proportionality or muscle mass, and physical skills such as some conditional abilities during puberty take a very drastic change (Malina et al., 2004), remembering that after this stage minimal growth and developmental changes are usually shown. That is why the present study had the general purpose of identifying the differences in handgrip strength values and anthropometric measurements with respect to the biological maturation index in schoolchildren. From the results obtained, we were able to observe significant differences between the biological maturation indices in anthropometric and strength measurements ($p \leq 0.05$, $p \leq 0.01$ and $p \leq 0.001$). In which schoolchildren with a higher BMI showed higher body weight, height and trunk and leg length than schoolchildren with a BMI of -1.5, -1.0 and -0.5.

During the PVC, a number of changes in body composition usually occur, the main change being muscle mass, which is an indicator of body weight (Barnett et al., 2013), if we look at our schoolchildren, only girls showed significant results of body weight of those of a high IMB than those of a low IMB, this may be because women usually give increase in body weight (muscle and fat) at early ages such as 12 and 13 years, while and boys a little later which are at 14 and 15 years of age, although at the end of growth, boys are almost 30% increase muscle mass and therefore body weight (Malina et al., 2004).

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In relation to bone length such as height, trunk and legs, we found significant results in men and women, since at the time of giving the PVC consisting of IMB of -0.5 to 0.5, a height increase of 20 to 25 cm is usually achieved (Malina et al., 2004), which also involves the longitudinal growth of the trunk and legs. Subsequently after passing the PVC, the increase in height, leg and trunk length is not very significant, as shown by the work of Hammami et al. (2019) and Matthys et al. (2013) with youth handball players.

In terms of handgrip strength, our schoolchildren with a higher IMB showed better performance than those with a lower IMB, these findings are in agreement with the work of Enriquez-del-Castillo et al. (2022), where higher results in dominant handgrip strength were observed in girls and a positive correlation between PVC and dominant handgrip strength in all children. According to other studies, biological maturation increases physical abilities in schoolchildren, as well as biological maturation levels have been shown to influence anaerobic and athletic performance (Almeida-Neto et al., 2022).

Likewise, other studies such as Hammami et al. (2019), Matthys et al. (2013), Navarro (2008) and Romero-García et al. (2022), where with children and young athletes, observed that strength is affected by development and biological maturation, recommending its inclusion in biomedical assessments for the planning and dosage of training. Although the number of years of training has been shown to contribute to the overall physical and technical performance levels of players, in these findings, individuals who reached full maturity at a younger age were larger, weighed more and possessed higher levels of strength and other physical abilities (Guimarães et al., 2019).

The sex difference in strength increases by 10% to 40% after puberty (Catley & Tomkinson, 2013; Stratton et al., 2004). Some studies in boys and girls have determined differences in physical tests such as strength (Catley & Tomkinson, 2013), observing that boys achieve better results than girls, but it is chronological age that makes the increase in strength.

In our results, those with a higher IMB were found to have higher strength values than those with a lower IMB, with girls at younger ages (11 years) and boys slightly later (14 years) where these findings were found. These data are similar to the work of Albaladejo-Saura et al. (2021) where they examined the impact of chronological age and biological maturation on variations in anthropometric and fitness profiles in athletes of both genders, showing that age and biological maturity have a clear impact on the discrepancies found between both genders.

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Conclusions

The results obtained in this study indicate that the higher the BMI, the greater the tendency for the anthropometric and grip strength values of schoolchildren to be higher than those with a lower BMI. These findings suggest that biological maturation is a starting point for establishing physical work groups in schools and in sports, and thus generate training guidelines on the degree of maturation and the peak growth rate, which could serve as a talent detection process, to reach the physical enhancement to reach the highest levels of sporting competition.

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Multidrug-resistant *Klebsiella* sp. one of the main etiological agents of urinary and respiratory tract infections in infants at southeastern Mexico

Klebsiella sp. multidrogorresistente, uno de los agentes etiológicos principales de infecciones de los tractos urinario y respiratorio en infantes del sureste de México

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Abstract

Goals. The purpose of the work was to determine the *Klebsiella* species affecting hospitalized infants at southeastern Mexico, their antimicrobial susceptibility profile, the resistance phenotype, and the presence of ESBL enzymes. Methodology. From 2015 to 2020, a total of 794 records of bacteriological cultures positive to *Klebsiella* spp. were included. The frequencies of bacterial species, the biological material from which they were isolated, the age groups affected, the antimicrobial susceptibility profiles, the resistance phenotype, and the detection of ESBL enzymes were obtained. Data were analyzed using descriptive statistics and bivariate analysis, with a significance level of $p \leq 0.05$. Contribution. *K. pneumoniae subsp. pneumoniae* was the most frequent bacteria isolated from urine, blood and bronchial aspirate samples. Most of them were resistant to beta-lactams and cephalosporins, in addition to exhibiting the MDR phenotype associated with the presence of ESBL enzymes. The susceptibility of the strains to meropenem and ertapenem indicates that carbapenems are the treatment alternative to combat these nosocomial infections in infants at southeastern Mexico.

***Klebsiella*, Nosocomial, Susceptibility, Southeastern**

Resumen

Objetivos. Determinar las especies de *Klebsiella* que afectan a infantes que acuden a un hospital del sureste mexicano, su perfil de susceptibilidad a los antimicrobianos, el fenotipo de resistencia y la presencia de enzimas BLEE. Metodología. Del 2015 al 2020, se compilaron los resultados de 794 cultivos bacteriológicos positivos a *Klebsiella* sp.. Se obtuvieron las frecuencias de especies bacterianas, el material biológico del que se recuperaron, los grupos de edad afectados, los perfiles de susceptibilidad antimicrobiana, el fenotipo de resistencia y la detección de las enzimas BLEE. Los datos se analizaron con estadística descriptiva y análisis bivariado, con un nivel de significancia de $p \leq 0.05$. Contribución. Se determinó que *K. pneumoniae subsp. pneumoniae* fue la más frecuente aislada en muestras de orina, sangre y aspirado bronquial. La mayor parte de los aislados fueron resistentes a los beta lactámicos y cefalosporinas, además de exhibir el fenotipo MDR asociado a la presencia de enzimas BLEE. La susceptibilidad de las cepas a meropenem y ertapenem indica que los carbapenémicos son la alternativa de tratamiento para combatir estas infecciones nosocomiales en infantes del sureste mexicano.

***Klebsiella*, Nosocomial, Susceptibilidad, Sureste**

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Introduction

Antimicrobial drugs are one of the vital tools in therapy, however, their uncontrolled use favours the emergence of bacteria resistant to them, or such prokaryotes acquire this phenotype by genetic mechanisms (Nercelles et al., 2000). The group of recognised nosocomial bacteria with high antimicrobial resistance are Enterococcus faecium, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumanni*, *Pseudomonas aeruginosa* and *Enterobacter*, which make up the group known as ESKAPE (acronym formed by the first letter of each genus) (Rice, 2008). Of these, *K. pneumoniae* is the main reservoir of infections at the hospital level, favoured by its ability to exhibit antimicrobial resistance to at least three different categories of antibiotics (multidrug-resistant or MDR) (Navon-Venezia et al., 2017). The Mexican drug resistance research and surveillance group (INFIVAR) has identified Acinetobacter sp. Klebsiella sp. and E. coli as the most frequent MDR bacteria; in addition, K. pneumoniae and E. coli strains exhibit a high presence of genes encoding for beta-lactamases, mainly CTX-M-15 (Garza-González et al., 2019, 2021).

This paper shows the resistance profile of Klebsiella sp. strains isolated from infants in a hospital in Chiapas, the state with the highest poverty in Mexico (Consejo Nacional de Evaluación de La Política de Desarrollo Social (CONEVAL). Measuring Poverty 2008-2016, 2017). These data provide information on this nosocomial bacterium that affects this vulnerable population, which contributes to the therapeutic approach that can be used to combat this aetiological agent in paediatric infections.

Material and methods

The study was descriptive and retrospective, based on records from 2015 to 2020 captured in the WHONET© platform, of Klebsiella genus isolates from outpatients and inpatients treated at the Hospital de Especialidades Pediátricas de Tuxtla Gutiérrez, Chiapas. Antimicrobial susceptibility testing and BLEE enzyme detection were processed in the Vitek® 2 Compact kit, following the manufacturer's instructions.

The continuous variable was the age of the patients, while the categorical variables were age groups, sex, hospital area, type of biological sample, date of collection, *Klebsiella* species isolated, antimicrobial susceptibility profile according to the established cut-off values (CLSI, 2021), resistance phenotype (multidrug-resistant -MDR-, extensively drug-resistant -XDR- and pandrug-resistant -PDR- (Magiorakos et al, 2012) and the presence of BLEE enzymes. Detection of these enzymes was corroborated by the double diffusion test with discs on Müeller Hinton agar, placing a disc of cefotaxime (CTX, 30 µg) in the centre with that of the beta-lactamase inhibitor clavulanic acid (CLA, 10 µg) and at 25 mm the discs of the monobactam Azteronam (ATM, 30 µg) and the cephalosporins ceftazidime (CAZ, 30 µg), ceftriaxone (CRO, 30 µg) and cefepime (FEP, 30 µg) were placed; the occurrence of synergy between the inhibitor with the cephalosporins (fishtail or egg effect) constitutes a positive BLEE test, while a negative test is recorded with the occurrence of inhibition halos with CLA >=18 mm, ATM >=21 mm, CAZ >=21 mm, CRO >=23 mm and FEP >=25 mm (CLSI, 2021). Descriptive statistical analyses and Pearson's correlation between the proportion of Klebsiella strains and year of isolation were performed; categorical variables were examined with Fisher's exact test, with a significance level of $p \leq 0.05$; SigmaPlot software (version 12.0) was used for the analyses.

Results

In the five-year period, a total of 794 patients were registered, of which the majority were male (57.9%) and the rest female (42.1%). *K. pneumoniae* subsp. *pneumoniae* was the most frequent species (89.9%), followed by *K. pneumoniae*, *K. oxytoca* and *K. pneumoniae* ozaenae (5.7, 3.7 and 0.8%, respectively). Most species were recovered from urine, blood and bronchial aspirate (30.1, 23.6 and 16.9%, respectively), while, of the fomites, the majority were recovered from catheter tips (11.2%) (Table 1).

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Source of insulation	Species of *Klebsiella*			
	K. pneumoniae subsp. pneumoniae	*K. pneumoniae*	*K. oxytoca*	*K. pneumoniae subsp. ozaenae*
Urine N(%)	215 (30.1)	17 (37.8)	6 (20.7)	0 (0.0)
Blood N (%)	167 (23.4)	7 (15.6)	11 (37.9)	2 (33.3)
Bronchial aspirate N (%)	124 (17.4)	6 (13.3)	2 (6.9)	2 (33.3)
Wound N (%)	81 (11.3)	5 (11.1)	6 (20.7)	1 (16.7)
Faeces	9 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
Abscess	8 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)
Vaginal/vulvar exudate	6 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)
Sputum	4 (0.6)	1 (2.2)	0 (0.0)	0 (0.0)
Water	4 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)
Bronchoalveolar lavage	3 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)
Pleural dialysis fluid	3 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)
Pleural fluid	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Tissues	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Otic secretion	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Anal swab	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Catheter tip	76 (10.6)	8 (17.58)	4 (13.8)	1 (16.7)
Catheter exit site	7 (1.0)	1 (2.2)	0 (0.0)	0 (0.0)
Penrose	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)

Table 1 Distribution of *Klebsiella* sp. species by source of isolation in Chiapas, Mexico

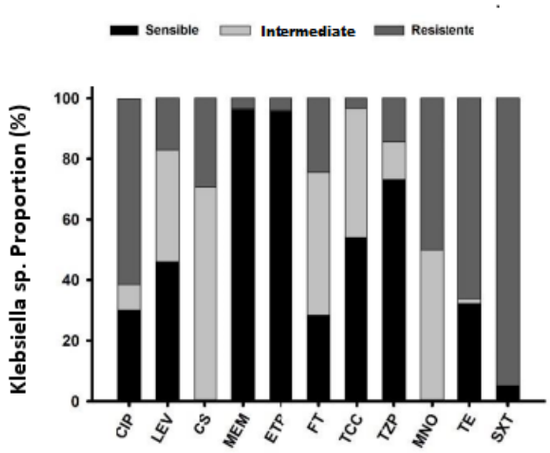
Similarly, a study in hospitals in North America and Europe showed that of the enterobacteria isolated from patients with urinary tract infection (UTI), *E. coli* was the most frequent (61.5%), followed by *Klebsiella* sp and *P. mirabilis* (19.5 and 6.6%, respectively) (Hoban et al., 2012). Boys, compared to girls, were more affected by *Klebsiella* species (57.9 vs. 42.1%, respectively), however, there were no significant differences (p=0.96). Significantly, almost half of the children under 5 years of age were more affected compared to the other age groups (Table 2); this could be due to the underdeveloped immune system in this group of infants.

	Age groups (years)			
Species of *Klebsiella*	<5 N (%)	5-9 N (%)	10-19 N (%)	P
K. pnuemoniae sp. pneumoniae	341 (47.8)	195 (27.3)	178 (24.9)	<0.001
K. pneumoniae	5 (11.1)	26 (57.8)	14 (31.1)	
K. oxytoca	9 (31.0)	13 (44.8)	7 (24.1)	
K. pneumoniae ozaenae	4 (66.7)	0 (0.0)	2 (33.3)	

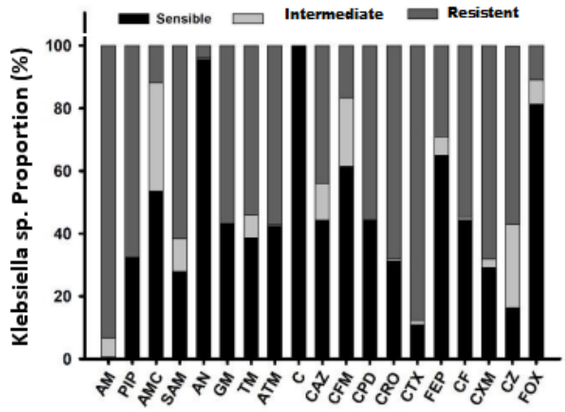
Table 2 *Klebsiella* sp. species by age group in Chiapas, Mexico

Similarly, a study in hospitalised Chinese infants revealed a higher proportion of K. *pneumoniae* strains isolated in the neonatal ward (29%) compared to the paediatric care unit (9%) (Hou et al., 2022).

No association between species isolated and year of isolation was observed (R2=0.03; p=0.73). The antimicrobial resistance profile of Klebsiella sp. revealed that most were resistant to sulfamethoxazole (94.9%), followed by ampicillin and cefotaxime (93.3 and 87.7%, respectively; figs. 1A and 1B).



Graph 1A Antimicrobial susceptibility profile of Klebsiella sp. strains isolated in Chiapas, Mexico. Fluoroquinolones (ciprofloxacin -CIP- and levofloxacin -LEV), polymyxins (colistin -CS-), carbapenemics (meropenem -MEM- and ertapenem -ETP-), nitrofurans (nitrofurantoin -FT-), extended-spectrum penicillins (ticarcillin/clavulanic acid -TCC- and piperacillin/tazobactam -TZP-), tetracyclines (minocycline -MNO- and tetracycline -TE-) and folate inhibitors (sulphamethoxazole -SXT-).



Graph 1B. Antimicrobial susceptibility profile of Klebsiella sp. strains isolated in Chiapas, Mexico. beta-lactams (ampicillin -AM-, piperacillin -PIP-, amoxicillin/clavulanic acid -AMC- and ampicillin/sulbactam -SAM-), aminoglycosides (amikacin -AN-, gentamicin -GM- and tobramycin -TM-), monobactams (aztreonam -ATM-), phenicols (chloramphenicol -C-), 3rd and 4th generation cephalosporins (ceftazidime -CAZ-, cefixime -CFM-, cefpodoxime -CPD-, ceftriaxone -CRO-, cefotaxime -CTX-, cefepime -FEP-) and 1st and 2nd generation cephalosporins (cephalothin -CF-, cefuroxime -CXM-, cefazolin -CZ- and cefoxitin -FOX-).

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The high resistance to cefotaxime reported here may be due to the fact that the majority of *K. pneumoniae* isolates in Mexico (91.9%) possess the blaCTX-M gene, which encodes a class A beta-lactamase capable of hydrolysing that 3rd generation cephalosporin (Garza-González et al., 2021). Similar to what is shown here, other studies have revealed that more than half of *K. pneumoniae* strains isolated from the urinary and respiratory tract are resistant to cephalosporins (Haeili et al., 2013; Iqra et al., 2014). According to the antimicrobial resistance profiles, most strains were of the multidrug-resistant (MDR) phenotype (70.4%); no XDR or PDR phenotypes were detected. The majority of MDR strains exhibited the BLEE enzyme (Fig. 1), thus both characteristics were significantly associated (Table 3).

	Enzyme BLEE N (%)		
Antimicrobial resistance phenotype of *Klebsiella* sp.	Positive	Negative	P
MDR	479 (85.7)	80 (14.3)	<0.001
No MDR	50 (21.3)	185 (78.7)	

Table 3 Relationship between BLEE enzyme and antibacterial resistance phenotype in Klebsiella spp. from Chiapas, Mexico

This trend was similar in patients with UTI in a hospital in Monterrey, Mexico, where it was revealed that more than half of *K. pneumoniae* and *E. coli* isolates (59.6 and 59.4%, respectively) exhibited BLEE (Villalobos-Ayala et al., 2017). In contrast, all isolates in this study were susceptible to chloramphenicol, followed by meropenem (96.1%), amikacin (95.8%) and ertapenem (95.6%). To combat extended-spectrum beta-lactamase-producing enterobacteria, carbapenem antibiotics have represented a treatment option because of their stability against attack by these bacterial enzymes. (DeRyke et al., 2007).

Figure 1 Detection of BLEE in *Klebsiella* sp. by double diffusion test. Left: Positive BLEE test in a *Klebsiella* sp. strain with MDR phenotype, showing synergy between the CTX/CLA disc and cephalosporin discs (egg effect); right, Negative BLEE test in a non-MDR strain, exhibiting sensitivity to all discs.

Conclusions

The present study revealed that K. pneumoniae subsp. pneumoniae was the most frequent bacterium in urine samples, followed by blood and bronchial aspirate, with infants under five years of age being the most susceptible to these nosocomial infections. Most isolates were resistant to beta lactams and cephalosporins, with 70% of them having an MDR phenotype, and this characteristic was associated with the presence of BLEE enzymes. The susceptibility of most strains to meropenem and ertapenem indicates that treatment of infants with these carbapenemics should be the alternative to combat these nosocomial infections in southeastern Mexico.

Annexes

The database is available in the Mendeley repository (GUTIERREZ-JIMENEZ, JAVIER; Farrera-Ulloa, Isaura; Feliciano-Guzmán, José Manuel; López- Sántiz, José Raúl (2023), "Multidrug-resistant Klebsiella sp. is the main etiological agent of urinary and respiratory tracts infections in infants at southeastern Mexico", Mendeley Data, V1, doi: 10.17632/zjtbmgb6h4.1).

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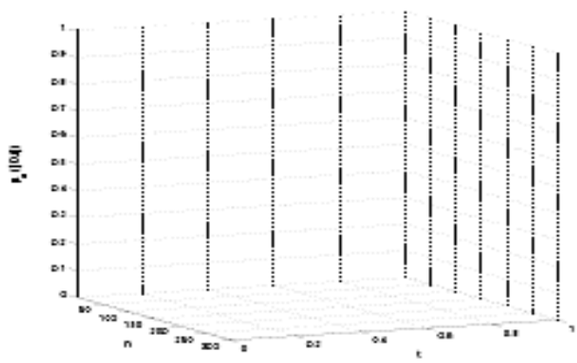

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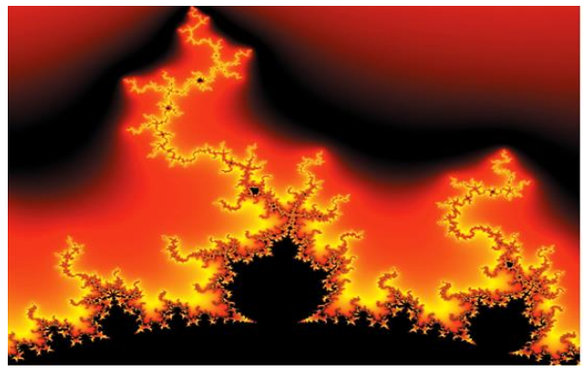

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