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Presentation of Content

In the first article we present, *National State Survey to identify the presence of intestinal parasitic infections of mixed randomized patients as prevention who attended the IMSS laboratory*, by GONZÁLEZ-GARCÍA, Arcelia, HERNÁNDEZ-SALAS, Claudia, MARTÍNEZ-ORTIZ, Rosa Maria and GONZÁLEZ-MARTÍNEZ, Lilia, as following article we present, *Perceptions and practices of mothers and caregivers on common diseases in children under five years of age in a Mayan community in Yucatan, Mexico*, by RODRÍGUEZ-ANGULO, Elsa, AGUILAR-FRANCO, Laura, OJEDA-RODRÍGUEZ, Ricardo and ANDUEZA-PECH, Guadalupe, with ascription in the Centro de Investigaciones Regionales “Dr. Hideyo Noguchi”, Universidad Autónoma de Yucatán, as following article We present, *Identification of bacteria and parasites with medical importance present in common fly (Musca domestica), captured in a highly marginated community*, by CAAMAL-LEY Angel D., PUC-FRANCO Miguel A., REYES Guadalupe, MACHAÍN-WILLIAMS, Carlos, LINDO-PÉREZ David A. and VARGAS-GONZÁLEZ, Alberto, with ascription in the Universidad Autónoma de Yucatán. Centro de Investigaciones Regionales “Dr. Hideyo Noguchi”, as the last article we present, *Relationship between electrostatic powder coating thickness measurements at different points on uneven surfaces*, by LUÉVANO-Cabrales, Olga Lidia, SALAS-PÉREZ, Francisco Guillermo, JUÁREZ-DEL TORO, Raymundo, MORALES-VILLA, Julio César.

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National State Survey to identify the presence of intestinal parasitic infections of mixed randomized patients as prevention who attended the IMSS laboratory

Encuesta Nacional Estatal de identificar la presencia de infecciones parasitarias intestinales de pacientes aleatorios mixtos como prevención que acudieron al laboratorio del IMSS

GONZÁLEZ-GARCÍA, Arcelia†, HERNÁNDEZ-SALAS, Claudia, MARTÍNEZ-ORTIZ, Rosa Maria and GONZÁLEZ-MARTÍNEZ, Lilia

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Abstract

Introduction: Nowadays in our state, intestinal parasitic diseases are still endemic, with a greater frequency in rural and mountainous urban areas. After the years have elapsed since the last national survey, it was necessary to carry out a new survey to know the prevalence rates of intestinal parasitosis and to compare the results obtained between both studies. Such knowledge would be of great value in developing health strategies and designing intestinal parasitic infection control programs. Objective: to determine the current prevalence rates of intestinal parasites, to compare the results with those of the survey obtained. Methods: a random cross-sectional descriptive study was carried out during the months of December 2018 to March 2019 in a random sample of both sexes from the population of urban communities and the province of Zacatecas, Zac. Each one had a stool sample collected that was analyzed by the direct examination method, the Willis concentration technique, and the Kato-Katz examination; A questionnaire was also applied to them. Results: when comparing the results of the national and state surveys of intestinal parasitic infections carried out in 2009 and 2018, it was found that, in general, infections by parasites decreased, both helminths and pathogenic protozoa, although those infected with commensals increased their frequency in that of 2019. There was also a decrease in the frequency of infections by all species of soil-transmitted helminths, *Trichuris trichiura*, *Ascaris lumbricoides*, ancylostomídeos, and *Strongyloides stercoralis*, as well as by the pathogenic protozoa *Giardia lamblia* and *Entamoeba histolitica*. Conclusions: when comparing the results of national and state surveys of intestinal parasite infections carried out in 2018 and 2019, it was found that in general the frequencies of infections with intestinal parasites decreased. The finding in both studies of a higher frequency of infection with parasites or commensals in the group aged 5 to 14 years (school age), supports the recommendation to place emphasis on control programs for intestinal parasites in this age group.

National state survey, Prevalence, Intestinal parasitism, Intestinal parasitic infections

Resumen

Introducción: Hoy en día en nuestro estado, se encuentran enfermedades con parasitosis intestinales continúan siendo endémicas, con una mayor frecuencia en zonas urbanas rurales y montañosas. Después de haber transcurrido de los años desde la última encuesta nacional, se hizo necesario hacer una nueva encuesta para conocer los índices de prevalencia de las parasitosis intestinales y comparar los resultados obtenidos entre ambos estudios. Tal conocimiento resultaría de gran valor para elaborar estrategias de salud y el diseño de programas de control de las infecciones parasitarias intestinales. Objetivo: determinar los índices actuales de prevalencia de las parasitosis intestinales, comparar los resultados con los de la encuesta, obtenidas. Métodos: se realizó un estudio descriptivo de corte transversal aleatorio durante los meses de diciembre 2018 a marzo del 2019 en una muestra aleatoria de ambos sexos a la población comunidades urbanas y provincia de Zacatecas, Zac. cada uno se le recogió una muestra de heces que fue analizada por el método de examen directo, la técnica de concentración de Willis y el examen de Kato-Katz; también se les aplico un cuestionario. Resultados: al comparar los resultados de las encuestas nacionales y estatales de infecciones parasitarias intestinales realizadas en 2009 y 2018, se encontró que en general disminuyeron las infecciones por parásitos, tanto los helmintos como los protozoos patógenos, aunque los infectados con comensales aumentaron su frecuencia en la de 2019. También se produjo una disminución de las frecuencias de infecciones por todas las especies de geohelminths, *Trichuris trichiura*, *Ascaris lumbricoides*, ancylostomídeos, y *Strongyloides stercoralis*, así como por los protozoos patógenos *Giardia lamblia* y *Entamoeba histolitica*. Conclusiones: al comparar los resultados de las encuestas nacionales, y estatales de infecciones parasitarias intestinales realizadas en 2018 y 2019, se encontró que en general disminuyeron las frecuencias de infecciones con parásitos intestinales. El hallazgo en ambos estudios de una frecuencia mayor de infección con parásitos o comensales en el grupo de 5 a 14 años (edad escolar), respalda la recomendación de poner énfasis en los programas de control para las parasitosis intestinales en este grupo de edad.

Encuesta estatal nacional, Prevalencia, Parasitismo intestinal, Infecciones parasitarias intestinales

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Introduction

Intestinal parasite infections continue to constitute an important health problem due to their high prevalence rates and wide worldwide distribution, especially in tropical and subtropical regions. The child population continues to be the most affected, something that has not changed much in recent decades, despite the fact that effective therapeutic resources have increased and many countries have established control programs for intestinal parasites.^{1,2} Although the Mortality from these infections is low, each year, to name a few examples, up to 100,000 deaths due to amoebiasis and hundreds of thousands from helminthiasis occur worldwide [1-4].

In parts of the province, there is government concern to improve the quality of life of the population, through the implementation of multiple strategies and through the Public Health Institution, so the country has managed to significantly improve the existing health indicators.

In 1975, a survey of intestinal parasitism was carried out, considered by some to be national, although only helminths were reported, with a prevalence of 18.4% for *Trichuris trichiura*.⁸ Subsequently, in 1983 it was decided to carry out a new national survey, which was representative of the Zacatecan population and that in addition to helminths, protozoa were included, for which it was considered as the First National Survey of Intestinal Parasitism, which at its end in 2009, revealed that 54.6% of the population was infected with a parasite or diner, or more; 33% were infected with medically important parasites, and the age group most affected was between 5 and 14 years of age.⁹ More recent research has suggested that intestinal parasitism may be highly endemic in some rural areas and mountainous provinces.

Taking into account these antecedents, and the fact that several years have passed since the last national survey was carried out, it was necessary to know how the prevalence rates of intestinal parasitosis are currently behaving, and to compare the results obtained between both surveys when after this period.

Such knowledge would be of great value to develop health strategies and the design of intestinal parasitic infection control programs in different provinces of the state of Zacatecas, so it was decided in 2009 to carry out the second state survey of intestinal parasitism, of which it is offered in the present work some of its main results.

Methods

A sample of 90% was carried out, the study was descriptive, longitudinal, transversal, observational, random during the months of December 2018 to March 2019, the sample was random for both sexes who voluntarily attended the IMSS Institute laboratory.

Sample

A study was designed that had a national, state scope because all the individuals were cared for. IMSS had the opportunity to be included. The estimated size of the sample was around 90% subjects, the sample was polymetallic and the levels of selection of the sample were randomly, both sexes who came from urban communities, as voluntarily as preventive health, from urban communities, Municipalities, provinces Guadalupe Zacatecas health areas, IMSS clinic random people who came to the laboratory.

Collection and processing of parasitological samples and quality control.

The stool samples were analyzed by spontaneous defecation to each person, they voluntarily attended the IMSS, they were collected in clean and dry bottles, and they were immediately transferred to the laboratory for processing. The diagnostic techniques used were the direct examination method with eosin and Lugol, the Willis concentration technique, and the quantitative Kato-Katz examination.

For the quality control of the diagnosis, all the urban communities of the province of Zacatecas that voluntarily attended the Laboratory of the IMSS Institute of Zacatecas. 5% of the fecal samples positive for helminths and protozoa, 2% negative, as well as 5% of the positive slides by the Kato Katz technique for *Trichuris trichiura* and *Ascaris lumbricoides*, and 2% of the slides negative for helminths.

Procedures for collecting information

A questionnaire model was designed, which was submitted to the opinion of experts for possible modifications. The survey was actively filled out by individual, in Provincial Hygiene Epidemiology and Microbiology.

Treatment schemes

Most of the individuals who were found to be infected with pathogenic parasites were treated with their respective ones, who came voluntarily as a preventive health, subjects according to therapeutic schemes established in the medical literature.

Inclusion and exclusion criteria

The inclusion criterion was availability of the exclusion criteria were: refusal to participate, accepting that they were taking an antiparasitic drug, undergoing radiotherapy or chemotherapy treatments, or presenting limiting mental or physical illnesses.

Pilot study

A pilot test was carried out, in which they went to the (IMSS) laboratory, in the municipality of the rural community and Zacatecas province under conditions like those set for the research, to determine in practice the operation of the methodology proposed for the survey. Once this pilot test was completed, the difficulties for its implementation were identified.

Ethical aspects

The criteria of randomized patients, which were determined in the laboratory clinic of the (IMSS), as well as the Committees that review biomedical research, were met. The known benefits and risks or inconveniences involved, the confidentiality of the information is kept, above all.

Data analysis

They were stored and tabulated with the Microsoft Access suite of programs. Percentages were calculated as summary measure for qualitative variables; Comparisons were made of the results of the distribution of intestinal parasites between the surveys carried out in different years from December 2018 to March 2019.

Results

The general results that allow the comparison between the national state surveys of intestinal parasitic infections carried out in various years 2018 and 2019. In general, a decrease in infections by parasites was found, both in helminths and pathogenic protozoa, in the groupings that include these with the diners; However, when the percentage of random samples of both sexes infected with commensals is analyzed separately, an increase in the frequency was observed in the survey carried out, The frequency of infections due to parasitic and commensal species in urban communities and provinces de Guadalupe zacatecas and decreased throughout these years, it was observed that there was a decrease in the frequencies of infections by all species of soil-transmitted helminths, *Trichuris trichiura*, *Ascaris lumbricoides*, ancylostomidae and *Strongyloides stercoralis*. This same decrease in the frequency of infections in 2009 was found with the pathogenic protozoa *Giardia lamblia* and *Entamoeba histolytica / E. dispar*, and the diners: *Endolimax nana* and *Entamoeba coli*.

Conclusions

Several studies have been carried out to know the prevalence of intestinal parasitism. Except that one of the surveys in 1984 considered as the first national survey of intestinal parasitism, the rest of the investigations were not representative of the country, because they considered for their analysis, accumulated results of parasitological examinations obtained in patients who attended voluntarily. wing of the IMSS Institution.

Annexed

On the slope of a study of gastrointestinal diseases, with frequency of parasitosis, in random patients, of both sexes, from the IMSS institution in Zacatecas

1.- How old are you?

- a) 1 month to five years
- b) 5 to 20 years
- c) 20 to 60 years

2.- Who do you live with?

- a) with your parents
- b) alone
- c) Others?

3.- What place are you from?

a) Foreign, b) State of Zacatecas c). Others

4.- What gender do you have?

a) Woman b) Man C) other

5.- How many live in your house?

a) 1 to 3 b) 3rd 6 c) 6 to 10

6.- You live in your parents' houses

a) Rented c) Own c) Loaned d) other

7.- How many times do you get sick to your stomach in a year.

a) 1 month b) frequent c) Never c) other d) other

8.- How many times do you brush your mouth a day?

a) once a day b) twice a day c) three times a day d) other

9.- What snacks like to eat a lot of fried foods

a) Churros b) potatoes c) d) Seeds c) peanuts d) others

10.- How often do you eat fried foods

a) once a week b) three days a week c) everyday d) other.

11.- Every time you do a preventive exam.

a) six months b) one year c) three years d) never

12.- You have the services in your home.

3. Molina N, Pezzani B, Ciarmela M, Orden A, Rosa D, Apezteguía M, Basualdo J, Minvielle M. Intestinal parasites and genotypes of *Giardia intestinalis* in school children from Berisso, Argentina. *J Infect Dev Ctries.* 2011; 5:527-34.

4. Navone GT, Gamboa MI, Oyhenart EE, Orden A B. Intestinal parasitosis in Mbya-Guarani populations from Misiones Province, Argentina: epidemiological and nutritional aspects. *Cad Saude Publica.* 2006; 22:1089-100.

5. Quiroz R.H. 1984. *Parasitología y enfermedades parasitarias en animales domésticos.* México, Limusa: 311-318.

6. Sánchez Vega JT, Tay Zabala J, Robert Guerrero L, Rome ro Cabello R, Ruíz Sánchez D, Rivas García C. Frecuencia de parasitosis intestinales en asentamientos humanos irregulares. *Rev Fac Med UNAM.* 2000; 43:80-3.

7. Schuster FL, Visvesvara GS. Free-living amoebae as opportunistic and non-opportunistic pathogens of humans and animals. *Int J Parasitol.* 2004; 34:1001-27.

References

1. Indelman P, Echenique, C, Bertorini G, Racca L, Gomez C, Luque A, Magaró H. Parasitosis intestinales en una población pediátrica de la ciudad de Rosario, Santa Fe, Argentina. *Acta Bioquím Clín Latinoam.* 2011; 45:329-34.
2. Marshall MM, Naumovitz D, Ortega Y, Sterling CR. Waterborne protozoan pathogens. *Clin Microbiol Rev.* 1997; 10:67-85.

Perceptions and practices of mothers and caregivers on common diseases in children under five years of age in a Mayan community in Yucatán, México

Percepciones y prácticas de madres y cuidadoras sobre enfermedades comunes en niños menores de cinco años en una comunidad maya de Yucatán, México

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Abstract

Community perceptions and practices towards the disease are mainly influenced by traditional medicine. The intercultural perspective in health allows building symmetrical relationships between medical and traditional knowledge. One of the most vulnerable group is under five years age. Exploring the perceptions and practices of mothers and caregivers on the disease and care of children can guide towards better health practices. Objective. Describe the perceptions and practices of mothers about the main health problems of their children during an emergency. Methodology. Quantitative-qualitative study, participatory action-research type with an intercultural perspective. Question guide was prepared for the exchange of knowledge with the focus group technique. Through inductive analysis of the transcripts, themes emerged. Results. Thirty-one mothers and caregivers attended the workshops. There were 48.6% emergencies due to diarrhea, fever and accidents. Home remedies, lack of hygiene in homes and lack of doctors on weekends were noted. Conclusions. Emergencies in children occurred in almost half of the morbidity cases in the community studied. A new regionalization is necessary to reduce health gaps for children under five years of age.

Perceptions, Emergency, Children

Resumen

Las percepciones y prácticas comunitarias hacia la enfermedad son influidas principalmente por la medicina tradicional. La perspectiva intercultural en salud, permite construir relaciones simétricas entre los saberes médico y tradicional. Uno de los grupos más vulnerables es el de menores de cinco años. Explorar las percepciones y prácticas de madres y cuidadoras sobre la enfermedad y atención de los niños, puede orientar hacia mejores prácticas de salud. Objetivo. Describir las percepciones y prácticas de las madres sobre los principales problemas de salud de sus hijos durante una emergencia. Metodología. Estudio cuanti-cualitativo, tipo investigación-acción participativa con perspectiva intercultural. Se elaboró guía de preguntas para intercambio de saberes con técnica de grupo focal. Mediante análisis inductivo de las transcripciones emergieron temáticas. Resultados. Asistieron a los talleres 31 madres y cuidadoras. Ocurrieron 48.6% emergencias por diarrea, fiebre y accidentes. Se percibieron remedios caseros, falta de higiene en los hogares y falta de médicos los fines de semana. Conclusiones. Las emergencias en los niños se presentaron casi en la mitad de los casos de morbilidad en la comunidad estudiada. Es necesaria una nueva regionalización para reducir brechas de salud de menores de cinco años.

Percepciones, Emergencia, Niños

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Introduction

Community perceptions and practices towards disease and access to health care are mainly influenced by traditional medicine, which in many regions of the world is the first contact of the population; In developing countries, it should be a link between rural communities and health services (Oliver, 2013). The strategy proposed by the World Health Organization on traditional medicine promotes its development and implementation in clinical practice in order to ensure access for all people to medical care (WHO, 2014-2023). However, in reality a scientific medicine is still perceived far from those practices and with little interest in knowing the cultural perceptions and practices towards the health-disease process, which increases the gap in access to health between communities and health services. The current physician follows a biomedical model of conventional medicine, which frequently underestimates the importance of social and cultural influence in the genesis of the disease; and that it does not favor the understanding between science and sociocultural knowledge.

In the last decade, perspectives aimed at strengthening a better understanding between the health services and the community population have been promoted in the field of health-disease, in response to the call of the indigenous population to respect their culture and rights (Salaverry, 2010). Through this perspective, communication and interaction between people and groups with specific cultural identities is possible, without the ideas and actions of one person or cultural group being above the other, favoring dialogue, agreement and, at all times, with this, integration and enriched coexistence between cultures (WHO, 2014-2023). The intercultural perspective in health aims to build symmetrical power relationships for interdisciplinary dialogue and between knowledge. It is precisely through the direct approach with the communities that experience health and disease from their cultural and ethnic vision, where it is possible to establish a dialogue to be able to communicate their knowledge and integrate it into scientific medical knowledge (Espinosa and Ysunza, 2009; Astaiza, Rodríguez, Guerrero and Portela, 2012).

In the communities, one of the most vulnerable groups that require study and that is part of the objectives of the new millennium is those under five years of age. According to WHO data, under-five mortality represents a fundamental indicator of the health and well-being of society. In 2016 it was reported that 5.6 million children died in the world before reaching the age of five, that is, 15,000 deaths of minors of that age group occurred per day. The greatest burden of mortality occurred in children in their first month of life, (approximately 44%), due to preterm births, asphyxia during delivery and infections. Safe delivery and effective neonatal care are essential to prevent these deaths. At the end of the neonatal period and up to five years of life, the leading causes of death are pneumonia, diarrhea, and malaria (WHO, 2018).

In Mexico, for the year 2019 it was estimated that the mortality rate in children under five years was 14.35 x 1000 live births (National Population Council, 2017); and the 5 main causes of mortality in children under one year were conditions originating in the perinatal period, respiratory distress of the newborn and other respiratory disorders, congenital malformations, influenza, pneumonia and accidents; and in the group aged 1 to 4 years, accidents, malignant tumors (mainly leukemias) and congenital malformations predominated (National Institute of Geography and Information Statistics, 2017).

During 2015 and 2016, 928 deaths of children under the age of five were reported in the State of Yucatán, with infant mortality rates of 13.6 and 13 per 1,000 live births, respectively. As antecedents of studies carried out in recent years in the State, perinatal conditions and congenital malformations were found as the first causes of death (Rodríguez, Marín, Andueza & Ojeda, 2017). Other findings were the barriers in access to health services in emergency situations, which delayed timely treatment (Rodríguez, Hernández, Palmisano, Ojeda, Hoil and Andueza, 2019).

In recent years, the concern to explore the perceptions and practices of mothers and caregivers when children fall ill has resurfaced; that provide guidance on barriers to access to care and allow proposing strategies aimed at preventing them. Some of them report the importance of promoting self-care with hygiene measures for the healthy growth of children (Usfar, Iswarawanti, Davelyna, Dillon, 2010; Chidziwisano, Slekiene, Mosler, Morse, 2020; Valencia, Thomson, Duncan and Andrew, 2016). However, in Mexico this type of study is scarce, especially in rural communities, where access to care is more difficult.

Similarly, there is little information on the specific morbidity of children at the local level and what are the practices that are being developed in the different health care settings at the community level, during the process of care in emergency cases. The foregoing will make it possible to contribute evidence that may be useful to the health system to undertake actions aimed at improving access to community health in this age group. The objective of the study is to describe the perceptions and practices of mothers about the main health problems of their children when an emergency occurs.

Methods

Study site

In Yucatán there are communities with a high degree of marginalization, as is the case of the Pustunich community, located in the municipality of Ticul, located in the south of the State of Yucatán, Mexico. Pustunich has a population of 2,480 inhabitants of which 203 (8.2%) are under five years of age. 93.63% of the population is Mayan and 55.73% of the inhabitants speak the Mayan language, the fertility rate is 2.3 children per woman, 6.98% of the population is illiterate, with women almost double for each man; The level of schooling is 7.71 years completed (7.93 for men and 7.51 for women) (Pueblos de América.com, 2020). The community has an open population health center with first level care services; In case of requiring a specialized consultation or the care of an emergency, the patient has to be transferred to a clinic or hospital outside his locality. It also has a private practice, midwives and traditional doctors who participate in the care.

Design and instrument

A quantitative-qualitative study of the participatory action-research type with an intercultural perspective was designed. Initially, the health center records on morbidity of children under five years of age were reviewed. With these reports, the clinical causes of consultation and the main emergencies in children could be identified. Taking this information as a frame of reference, a question guide was prepared for discussions in participatory workshops with mothers and caregivers. The guide consisted of 6 questions: 1. What do children get sick or suffer from the most? 2. How do you know that something is happening to your child?; 3. What are the warnings or signs that you see in the child that indicate that he is sick? 4. What do you do when you realize that something is happening to your child?; 5. What is the route that mothers take when they seek help for the care of their child ?; and 6. how is the child currently? The main purpose of the guide was the exchange of knowledge and knowledge about the perceptions and practices of mothers and caregivers about illnesses in children, their worldview in situations of illness that merited emergency care, as well as discussing experiences on the routes traveled to obtain access to medical care. The question guide was made in Spanish, these were validated by two medical specialists in social anthropology, who reviewed the content, construct, clarity and objective of the questions. This guide was applied to five moms prior to the workshops for clarity and understanding of the questions.

Focus Groups for Discussion and recruitment

Using a focus group discussion technique, participatory workshops were organized with mothers and caregivers of children under five years of age. The workshops were held from June to August 2019. The number and schedule of workshops were agreed with the participants and the recruitment was through an open invitation to the community through messages on social networks by the municipal commissioner, doctor of the center of the health center, the community kindergarten teacher and home visit to mothers of children under five years of age.

For the recruitment, it was taken into account that they were mothers or caregivers of children under five years of age who were responsible for the child's health or that they shared decision-making in the child's care.

Data collection

To collect the qualitative information with the question guide, the main researcher acted as a facilitator in all the workshops, with 4 research assistants observing, writing the responses of the participants and managing the recording devices, as well as time management. In the first workshop with a focus group, the dynamics to develop during the workshops were explained, the participants were asked if they all understood and spoke Spanish and were asked to provide their name and age. Subsequently, an icebreaker dynamic was carried out, in order to build a relationship of trust between the researchers and the participants, and emphasis was placed on how important the opinion of each would be, and the participants were encouraged to speak freely. Similarly, to guarantee the confidentiality of the participants, their voluntary consent was requested to record the workshop discussions. All discussions were digitally recorded using a voice recorder and lasted approximately 45-60 minutes. The size of the groups was 7 to 8 participants. In total there were 4 groups and 8 discussion sessions. The transcription of the recordings was made immediately after each workshop.

Data analysis

The transcripts and notes of the focus group workshops were subjected to an inductive analysis, following a sequence of related steps: reading, coding, presentation, reduction and interpretation according to the themes and central ideas collected and observed (Ulin, Robinson, Tolley, 2006). Two conditions were considered for the construction of knowledge: the rescue of community knowledge about the social reality of diseases in children; and practices and experiences in seeking help for emergency care. From the reading and rereading of the texts, different themes emerged that included general categories that shared the themes that emerged. At each step of the process, we try to identify the thoughts, expressions and behaviors of the participants; and in this way, the information was reduced to the essential, to answer each question asked.

Each speech was characterized and interpreted individually, to finally be interrelated and presented through the network of concepts that gave answers to the original questions. All information was verified by a qualitative analysis specialist researcher.

Ethical considerations

Protocol number CIRB-2017-0007. The protocol was approved by the ethics committee of the Regional Research Center "Dr. Hideyo Noguchi". Each study participant was asked for their verbal informed consent to record the discussions during the same.

Results

During the two years studied, 132 consultations were granted, of which 40 (30%) were for respiratory infections, 22 (17%) for diarrheal disease, 22 (17%) for dislocations and fractures and 48 (36%) for various Causes; 74 (56.0%) children needed to be referred to a second level hospital outside their locality; and of these, 36 (48.6%) were referred to emergency.

The workshops were attended by 31 mothers and caregivers of children under five years of age. The age range of the participants was from 18 to 67 years, with a mean of 34.6 ± 10.66 . Regarding the number of children, they cared for, 25 (80%) mentioned that they had one child under the age of five under their care and 6 (20%) had 2.

During the dialogue in the workshops and in response to the question of what the children of Pustunich get sick or suffer more, themes and categories common to them emerged, which are listed in Table 1.

Topics	Categories
Acute diarrheal diseases	Emergency referrals Risks that exist in the community Disease needs
Acute respiratory infections	
Accidents	
Access to health services	Emergency care routes

Table 1 Emerging topics on the main diseases and conditions of children

When asked if they had had to take their children to another clinic or hospital outside their locality for having presented an emergency (emergency referrals), 25 (80%) reported having had it at least once with their children; and the most frequent were due to acute diarrheal diseases in 9 (36.0%) children; and fever and accidents in 5 (20%) children (Table 2).

Emergency	Number of participants	Causes of the emergency
Acute Diarrheal Diseases	9 (36%)	Diarrhea and vomiting
Fever	5 (20%)	Increased body temperature
Respiratory diseases	3 (12%)	Asthma, bronchiolitis, and pneumonia
Accidents	5 (20%)	Fractures, head injuries, and viper bite
Others	3 (12%)	Seizures and attempted suicide.
n=25		

Table 2 Main causes of emergencies in children reported by participants

Regarding the current health status of the children who had had to be treated in an emergency, the mothers mentioned that 24 (96%) were healthy; and only one continued his treatment in a psychiatric hospital.

The discourse of mothers and caregivers about how they realize that something is happening to their child, they perceive that it depends on the child's illness or condition; In the case of getting sick with diarrhea, children present weakness, drowsiness, abdominal pain and they go to the toilet:

"The child stops playing, he looks tired, he is sleepy".

"Well, his belly hurts and he makes water when he goes to the bathroom, he does several times".

In the case of respiratory diseases, mothers and caregivers state that respiratory distress, which they call "acid", is a very common condition in children:

"... I was taking my 8-year-old granddaughter to the hospital and a neighbor asked me what the girl has and I told her that acid, she always has it for the month of May, it is dry season"

"Children suffer a lot from asthma, when she shows up she gives a lot of acid, she is suffocating because they feel like they are drowning and they can't stand it anymore"

When mothers and caregivers realize that something is happening to the child, the most experienced are the ones who usually make the decision that the child should be evaluated and according to their experience, they first resort to a remedy at home before taking them to the doctor. There is also the belief that illnesses can only be alleviated by a healer, through an abdominal massage called "sobada", to alleviate abdominal pain; if the pain persists, then take it to the doctor:

"First we give them a remedy for stomach pain and then if it does not improve we take it to the health center, the remedy is something fresh made up of mint, peppermint and pennyroyal plants and we give it to them to drink."

"The most important thing to do is give him serum; and when he has had diarrhea more than 3 times in an hour, he must be taken to the doctor.

The caregivers also mentioned that when they realize that children are sick with something respiratory, if they only have the flu, they usually give them a remedy. What alerts most caregivers that they have to go to an emergency service is when they see that the child cannot breathe, or begins to breathe very quickly. In the community, this type of breathing is called "acid":

"..... and he tells me: if you are not afraid, when the hail falls, let the girl come out to pick it up, whatever she wants to eat, let her eat it ... When the hail fell, my daughter told me: Mommy, If the neighbor says that this is the girl's medicine, let her go out to collect, and I say well, let her stay at the blessing of God, if it is your cure, at once, jump to collect (the hail). She got wet, her clothes got soaked and as she picks it up, she eats it. The lady told me that I have to pick up some and put the hail in a little bottle, that's what my granddaughter is going to drink. There she is! So, I did ..., From that my granddaughter was cured".

... I go out to look for the mauve herb, but when I get rid of it, I just cut the pure root, I take out up to two bushes like that, I wash it well and put it to boil, like for a liter of water, and it remains reddish like rust; They drink it, without sugar or anything, it doesn't taste bad, just bitter, but it does feel weird when taking the first drink. But if I tell him that this is his medicine, he makes an effort and takes it and notice that it stopped harming him, because if not, he can't hold out like that, with rain on top, then the acid starts from the asthma he suffers, but that is his cure, the root of the mallow grass".

Caregivers perceive that children in the community get more ill due to lack of care and lack of housing; They know about the things that put children at risk of getting sick with diarrhea and in the discourse, concepts emerge about the lack of hygienic measures and the conditions in which the home is found:

"Sometimes children's hands are dirty with mud, because our houses have no soil and that makes them sick".

"Here in the town, they sell food on the street, if they don't have clean hands and eat it, they can get sick".

Another issue that emerged was accidents, which mothers and caregivers perceived to be something really worrisome and for which children die in the community. Despite the fact that other ailments such as diarrhea and respiratory problems are more common, when the phrase "risk of dying" was mentioned, caregivers perceive that they are very marked that "accidents are something important that must be prevented and addressed." They mentioned burns at home and asphyxia and trauma as the main accidents. When accidents occur, if it is a small injury, they can put a remedy, but if it is something more than that, they usually go directly to the emergency service, "the remedies in this case are practically ruled out and we seek immediate attention." They also mentioned that the majority of accidents are the fault of the mother's carelessness:

"... sometimes mothers who are careless burn children. There is a girl who was 6 years old, her mother had something on the fire and when she approached (the girl) to the candle, her clothes caught fire, she was hospitalized for about a month, her little arm and her chest burned; burns are frequent here".

"Let the babies lie down, turn around and suffocate, sometimes just playing children fall and hit their heads, sometimes we send them to buy, and they can run over them and the child can suddenly come out."

Regarding access to health services, the discussion focused on the routes to seek care, on which they mentioned that the shift for outpatient care in the health center is very limited and that doctors are needed to provide the service during the weekend; that is why they have to go to a private consultation or leave the community to seek the child's care:

"We take our son to the private, because in the health center there are never records".

"When (the child) does not look good with what they give him in the health center, I take him directly to the pediatrician".

"It happened to me that I went to the health center and since there was no one to take care of the child, I quickly returned home for the motorcycle and we went to Ticul, that took me a few minutes because I live close".

Conclusions

The perceptions of mothers and caregivers about the illnesses suffered by children under the age of five in the Pustunich community coincide with the main causes of consultation reported by the local health center. However, they perceive that accidents in children are much more frequent than they are reported, so the focus must be placed on preventing them and obtaining a better record. Home remedies are in the first instance the solution to many of the problems, without having to take the child to the health center; only if the remedy is ineffective is it evaluated by the doctor; These practices are also observed in other communities around the world where resources for emergency care are scarce (Dewan, Mummareddy, Wellons 3rd and Bonfield, 2016).

From the discourse of mothers and caregivers we can see that they have a good knowledge of the signs and symptoms that correspond to the conditions and there are local practices that they trust and with which they have had good results. These same results are presented in other countries and are part of the cultural identity of the population (Bhalla, Gupta, Nanda, Mehra and Verma, 2019; Nitin et al, 2016).

Perceptions about children's health care reflect that there is still much to be done to improve the quality of access and timely care of emergencies. The lack of a doctor, resources and local equipment to treat the most basic emergencies puts the minor at high risk of suffering fatal consequences during their transfer to another clinic. In Yucatán, since the regionalization of health services in 1986 (Valencia, Marco, Olvera, Serrano and Márquez, 1986) there are no studies that provide evidence to propose the changes that are required to improve the quality of access and care for the health of minors. The new regionalization is a process that must be implemented in the short term, to reduce the gaps that prevail in rural communities and that put the health of children under five years of age at risk.

References

- Oliver, S.J. The role of traditional medicine practice in primary health care within Aboriginal Australia: a review of the literature. *J Ethnobiology Ethnomedicine* 9, 46 (2013). <https://doi.org/10.1186/1746-4269-9-46>
- OMS. Estrategia de la OMS sobre medicina tradicional 2014-2023 (2013). Disponible en: <https://apps.who.int/medicinedocs/documents/s21201es/s21201es.pdf>
- Salaverry, O. Interculturality in health. *Rev Peru Med Exp Salud Publica*. 2010 Mar;27(1):80-93. DOI: 10.1590/s1726-46342010000100013 <https://www.ncbi.nlm.nih.gov/pubmed/21072454>
- Espinosa, L., Ysunza, A. (2009). Diálogo de saberes médicos y tradicionales en el contexto de la interculturalidad en salud *Ciencia Ergo Sum*, vol. 16, núm. 3, pp. 293-301. Available in: <http://www.redalyc.org/articulo.oa?id=10412057010>
- Bravo, A., Nohra, X., Rodríguez, S., Guerrero, N., Portela, H. (2012). Diálogo intercultural en salud: una estrategia para rescatar los saberes y prácticas médicas en torno a la salud materno infantil de las comunidades afrocaucanas. *Revista Virtual Universidad Católica del Norte*, núm. 37, pp. 180-211. Available in: <http://www.redalyc.org/articulo.oa?id=194224568010>
- OMS. Reducción de la Mortalidad en la Niñez. (2018). Accessed August 27, 2019 available at: <http://www.who.int/es/news-room/factsheets/detail/children-reducing-mortality>
- CONAPO. (2017). Indicadores demográficos de Yucatán en el año 2017. Available at: http://www.conapo.gob.mx/work/models/CONAPO/Mapa_Ind_Dem18/index.html
- INEGI. (2018). Características de las defunciones registradas en México durante 2017. Retrieved August 27, 2019 from: <https://www.inegi.org.mx/contenidos/saladeprensa/boletines/2018/EstSociodemo/DEFUNCIONES2017.pdf>
- INEGI. (2017). Principales causas de mortalidad por residencia habitual, grupos de edad y sexo del fallecido. Accessed August 27, 2019 available at: <https://www.inegi.org.mx/sistemas/olap/registros/vitales/mortalidad/tabulados/ConsultaMortalidad.asp>
- Rodríguez, E., Martín, A., Andueza, M., Ojeda, R. (2017). Major causes of death in children under five years by sanitary jurisdiction. *Yucatán 2010-2014. Journal Law and Economy*; 1(1):19-27.
- Rodríguez, E., Hernández, B., Palmisano, E., Ojeda, R., Hoil, J., Andueza, G. (2019). Defunciones en menores de cinco años por área geográfica en Yucatán, Méx. *Visum Mundi*, Vol. 3, No. 1, online AcademiaJournals.com
- Usfar, A., Iswarawanti, D., Davelyna, D., Dillon, D. (2010) Food and personal hygiene perceptions and practices among caregivers whose children have diarrhea: a qualitative study of urban mothers in Tangerang, Indonesia. *J Nutr Educ Behav*. Jan-Feb 2010;42(1):33-40. doi: 10.1016/j.jneb.2009.03.003.

Chidziwisano, K., Slekiene, J., Mosler, H.J., Morse, T. (2020). Improving Complementary Food Hygiene Behaviors Using the Risk, Attitude, Norms, Ability, and Self-Regulation Approach in Rural Malawi. *Am J Trop Med Hyg.* ;102(5):1104-1115. doi: 10.4269/ajtmh.19-0528.

Valencia, A., Thomson, C., Duncan, B., Andrew, A. (2016). Evaluating Latino WIC Mothers' Perceptions of Infant's Healthy Growth: A Formative Assessment. *Matern Child Health J.* 20(3):525-33. doi: 10.1007/s10995-015-1850-7.

Pueblos de América.com. Pustunich, Ticul, 2020 <https://mexico.pueblosamerica.com/i/pustunich-2/>

Ulin, P., Robinson, E., Tolley, E. (2006). Investigación aplicada en salud pública. Métodos cualitativos. Organización Panamericana de la Salud. Publicación científica y técnica 614. Washington, D.C. 286 p.

Dewan, M., Mummareddy, N., Wellons, J., Bonfield, Ch. (2016). Epidemiology of Global Pediatric Traumatic Brain Injury: Qualitative Review. *World Neurosurg*;91:497-509.e1. doi: 10.1016/j.wneu.2016.03.045. Epub 2016 Mar 25

Bhalla, K., Gupta, A., Nanda, S., Mehra, S., Verma, S. (2019). Parental knowledge and common practices regarding acute respiratory infections in children admitted in a hospital in rural setting. *J Family Med Prim Care*;8(9):2908-2911. doi: 10.4103/jfmpc.jfmpc_510_19. eCollection 2019 Sep.)

Nitin, J., Punya, S., Hariharan, B., Dhanush, K., Fathima, R., Mohamed, J., Nita, J., Shashidhar, M., Sharada, Rai. (2016). Prevalence, risk factors and treatment practices in diarrhoeal diseases in south India. *Environ Health Prev Med.* ;21(4):248-57. doi: 10.1007/s12199-016-0521-7. Epub 2016 Mar 4.)

Valencia, G., MARCO, J., OLVERA, J., SERRANO, O., MÁRQUEZ, A. (1986). Regionalización de México basada en indicadores de atención primaria a la salud propuestos por la OMS. <https://saludpublica.mx/index.php/spm/article/view/5354/5573>).

Identification of bacteria and parasites with medical importance present in common fly (*Musca domestica*), captured in a highly marginated community

Identificación de bacterias y parásitos de importancia médica presentes en mosca común (*Musca domestica*), capturadas en una comunidad de alta marginación.

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Abstract

The common fly (*Musca domestica* L.) is a mechanical vector and can be a biological vector through ingestion and regurgitation. In rural communities is common to observe numerous populations of this, consequence of multiple unsanitary sites. The present study was carried out in order to identify the species of bacteria and parasites with medical importance present in the common fly, captured in homes and microhabitats (chicken coops, pigsty and backyards) in homes of the community of Cholul, Cantamayec. 20 species of bacteria were identified: *E. coli* (41.78%) was the most frequent species in all processed flies. In turn, households (45.20%) were the place where the greatest amount of bacterial species was isolated, being *E. coli* (42.42%), the frequent species, in the same way in pigsty (45.65%), chicken coops (38.09%) and backyards (30.76%). Regarding the enteroparasites identified from the digestive cavity of flies, *Endolimax nana* (38.46%) was the frequent cyst and *Ascaris lumbricoides* (15.38%), the only nematode found. In turn, the pigsty (n = 5) was the site with the highest number of isolated enteroparasites. The results obtained show that flies carry pathogens that could be involved in human infections of community origin.

Musca domestica, Enteroparasites, Microhabitats

Resumen

La mosca común (*Musca domestica* L.) es un vector mecánico, puede ser vector biológico mediante la ingestión y regurgitación. En las comunidades rurales es común observar numerosas poblaciones de ésta; consecuencia de múltiples sitios insalubres. El presente estudio se llevó a cabo con la finalidad de identificar las especies de bacterias y parásitos de importancia médica presentes en la mosca común, capturadas en casas y microhábitats (gallineros, chiqueros y patios) en domicilios de la comunidad de Cholul, Cantamayec. Se identificaron 20 especies de bacterias, la cual: *E. coli* (41.78%) la especie frecuente en todas las moscas procesadas. Las casas (45.20 %), resultó el sitio donde se aisló mayor cantidad de especies bacterianas, siendo *E. coli* (42.42 %), la especie frecuente, de igual modo en chiqueros (45.65 %), gallineros (38.09 %) y patios (30.76 %). En cuanto a los enteroparasitos identificados de la cavidad digestiva de las moscas, *Endolimax nana* (38.46 %) fue el quiste frecuente y *Ascaris lumbricoides* (15.38 %) el único nematodo encontrado. A su vez el chiquero (n = 5) fue el sitio con mayor cantidad de enteroparasitos aislados. Los resultados obtenidos demuestran que las moscas portan patógenos que podrían estar involucrados en infecciones humanas de origen comunitario.

Musca domestica, Enteroparásitos, Microhábitats

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Introduction

For the population, a large number of arthropod species are important in the medical field, mainly insects, since they act as vectors, or carriers of microorganisms that cause infectious diseases, transmission is carried out in two ways: mechanical transmission (by drag mechanical transmission of infectious or parasitic agents such as flies or cockroaches) and biological transmission (such as bites or defecation) (Calderón (2004)

According to the World Health Organization (WHO), vector-borne diseases represent at least 17% of infectious diseases, and cause approximately 700,000 deaths each year, the distribution of these diseases is determined by demographic, environmental and social factors and is they occur more frequently in tropical areas and developing countries, mainly affecting the population of low socioeconomic level (Cabrera M, Verástegui M, 2005).

In numerous studies, the presence of infectious agents such as *Escherichia* has been shown in the common fly. Col, i *Salmonella typhi*, *Shigella flexneri* among others; and its role as a mechanical vector (Béjar C et al., 2006; Brazil et al., 2007; Quiceno et al., 2010). However, one of the most important biological vectors can also be one of the most important due to the protective effect that the pathogen gives inside its body, representing another of the potential pathways through ingestion, regurgitation prior to each meal and defecation of the pathogens. The alternation of habitat during the day makes it a dangerous vector when moving in the kitchens and dining rooms of homes. (Crosskey & Lane, 1993; Fernández B. et al., 2014)

Among the main infectious diseases transmitted by *M. domestica* are those that come from food, water contamination, fomites and poor sanitation, causing gastrointestinal infections, mainly those that produce diarrhea, the most important cause of morbidity and mortality worldwide (Castillo et al, 2012). These diseases are the leading cause of mortality in the age group under 4 years of age, whose rate is estimated at 3.3 million per year for Latin America, Africa and Asia; They are considered one of the main factors that contribute to child malnutrition and hospitalization (Cárdenas & Martínez, 2004).

In Mexico during 2019, among the main causes of disease, intestinal infections still remain of epidemiological importance. In the state of Yucatán, salmonellosis and intestinal infectious diseases by other organisms occupy the first places (Secretary of Health & General Directorate of Epidemiology, 2019). In Yucatán, the population most vulnerable to suffering from acute diarrheal disease are children under 5 years of age, since in the state, due to the habits and customs ingrained in the population, hygiene practices are almost nil, which produces the increase of these diseases (Peña 2012).

The agents involved in infectious diseases are mostly enteric bacteria of the Enterobacteriaceae group, because *M. domestica* mainly feed on feces and other waste that are a rich source of these pathogens, including enteropathogenic strains such as enteroaggregative *E. coli* (EAEC), Enterohememagical *E. coli* (EHEC), Enterotoxigenic *E. coli* (ETEC), and Enteropathogenic *E. coli* (EPEC), *Vibrio cholera*, and *Bacillus anthracis* that cause enteric disease, cholera, and anthrax, respectively, and others including: *Klebsiella* spp, *Pseudomonas*, *Staphylococcus*, *Streptococcus*, *Clostridium* spp. and *Enterococcus*, to name just a few (Solá-Ginés et al., 2015). Also some species of parasites belonging to the genera: *Ascaris*, *Entamoeba*, *Trichiuris*, hookworms and protozoa cause enteric diseases with various clinical pictures, among which are: abdominal pain, nausea, anorexia, fatigue, diarrhea and weight loss (Cárdenas & Martínez, 2004; Eke et al., 2016)

In rural communities it is common to observe numerous populations of *M. domestica*, particularly in the vicinity of markets, food outlets, homes, garbage dumps, animal farms in general and educational facilities, with greater emphasis where sanitary management is inappropriate being these the main sources of origin of microbial infections. Animal farms represent an important source of the spread of *M. domestica*, nutrient-rich substrates such as animal manure provide excellent development and larval feeding of flies. (de Román et al., 2004; Gallego Berenguer, 2014)

In studies carried out to identify the suitability of the flies' growth sites in descending order, it was found that horse manure, human excrement, cow manure, fermentation of vegetable and kitchen residues are optimal sites for development. In the same way, pens for pigs, horses, sheep, cattle and poultry are places where flies concur, being pig pens where there are more flies, however, the others are not omitted as a possible source of spread. Likewise, fruits and vegetables, garbage piles, and compost are also highly favored sites for development, and these types of microhabitats are quite common in communities. (Sarwar 2016)

Despite the presence of abundant populations of *M. domestica*, coupled with the relatively high prevalence of parasites due to lack of hygiene, there is no knowledge of documented studies in the interior of the state of Yucatán, on the isolation of parasites in *M. domestica*. In view of the importance, this research was carried out in order to isolate and identify pathogens of medical importance in *M. domestica* from a rural community, as well as micro habitats to determine the possible sources of spread of pathogens. and the microbiological risks of environments, where the common fly occurs and constitutes the first study carried out in a rural community in the state and provides information for future research.

Materials and methods

Study site

The study was carried out in the community of: Cholul, Cantamayec, Yucatán located at the parallels: 20 ° 26'30.00'' N and 89 ° 09'11.00'' W. It has an average height of 24 meters above sea level. It is bordered by the following municipalities: to the north with Sotuta, to the south with Tixméhuac and Chacsinkín, to the east with Yaxcabá and to the west with Teabo and Mayapán. The region is classified as warm subhumid, with rains in summer (May - July), which when interrupted are the so-called mid-summer droughts, has an average annual temperature of 26.3 °C and an average annual rainfall of 1,200 millimeters. The prevailing winds come in an east-west direction. Average annual relative humidity, ranging from 66% to 89% (Tolrá Hjorth-Andersen, 2015).

Collection and identification of flies

15 homes were sampled, during the months of March and June 2018, the flies were captured in sites inside the house, patio, chicken coops and pens as a reference for the search for possible sources of contamination of the flies. A minimum of five flies were captured per site. For the collection, backpack backpacks (BKPr. México®) and entomological nets were used. The entomological analysis and taxonomic determination of *M. domestica* was carried out in the microbiology laboratory and supported by dichotomous keys (Murray et al., 2004)

Sample processing

The collected insects were stored in sterile plastic bottles with refrigerants and transferred to the microbiology laboratory, in a period of less than 24 hours. In a laminar flow hood, five flies were separated with sterile forceps into 1.5 mL conical microcentrifuge tubes and labeled with the sample code.

Sediment culture

External structure of the fly

To each tube with the five flies inside, 500 µL of sterile physiological saline was added and the supernatant with a previously sterilized and cooled round bacteriological loop was stirred for 1 min, the seeding was carried out by the cross-streak plate method. turning the box while scratching to form a pentagon in the agar: MacConkey (BD Bioxon, Becton Dickinson. México®), selective medium for Enterobacteriaceae and gram negative bacilli, salty Mannitol agar (BD Bioxon, Becton Dickinson. México®), medium selective for staphylococci and gram positive bacteria. At the end, they were placed in a bacteriological oven (Riossa series: ECML. México®), at 37 ° C for 24 hours.

Internal structure of the fly

With sterile entomological forceps, the flies were placed in a 1.5 mL conical microcentrifuge tube, 500 µL of 70% alcohol was added, mixed by inversion, and the supernatant was discarded. This step was repeated three times. To remove excess alcohol, it was washed with 500 µL of sterile physiological saline and stirred by inversion.

At the end of the washes with sterile forceps, the flies were placed on object slides, with number 11 scalpels (DLP, Dentilab. México), A sagittal cut was made in the abdomen to extract the digestive cavity, it was passed in a conical microcentrifuge tube and 500 μ L of sterile physiological saline was added to macerate with sterile pistils until the sample was homogenized. Subsequently, the sowing was carried out by the cross-streak method on a plate, turning the box until a pentagon was formed in the agar: MacConkey (BD Bioxon, Becton Dickinson. México®) and salty Mannitol (BD Bioxon, Becton Dickinson. México®), to take them to a bacteriological oven (Riossa series: ECML. México®), at 37 ° C for 24 hours.

Observation of parasitic forms

To observe the presence of protozoa and nematodes, 100 μ L of saturated saline solution was added to each conical tube of the external wash and internal maceration, then 10 μ L of each sample was taken to pass to a slide in which a drop of Lugol was added. (HYCEL. México®), to observe them at 10x and 40x in an optical microscope.

Identification of bacteria and parasitic forms

Tables from the Manual Of Clinical Microbiology were used to identify pathogenic bacteria. 2013, 8th Edition of Murray. For the parasitic forms, tables from the book: Microbiology and Human Parasitology were used. 2007, 3rd Edition of Romero. (Murray et al., 2004; Romero, 2007)

Results

Specimens of *M. domestica* were collected in 15 homes in the town of Cholul, Cantamayec municipality, of which 140 belonged to homes, 95 to pens, 45 to chicken coops and 25 to yards. Of the total of specimens, 61 samples were processed, from which 146 strains of different species of bacteria were isolated.

The *Escherichia coli* species was the most frequent (41.78%), followed by coagulase negative *Staphylococcus* (12.32%), *Enterobacter* spp. (10.95%), *Klebsiella* spp. (5.47%) and *Providencia* spp. (5%), the following species were also isolated in less frequency: *Enterobacter sakasakii* and *Klebsiella pneumoniae* (2.73%). *E. agglomerans*, *Shigella* spp, *Staphylococcus aureus*, *Proteus* spp., *Citrobacter* spp. and *Serratia* spp. (2.05%). *Morganella* spp., *Klebsiella oxytoca* and *Edwardsiella* spp. (1.36%). *Morganella morgani*, *K. ozaenae*, *Shigella flexneri* and *Yersinia* spp. (0.68%). Specifically, table 1 shows in detail the number of the main species isolated by processed structure (external and internal) in *M. domestica*. The results demonstrate the presence of different bacterial species of medical importance in *M. domestica*. However, strains of *E. coli*, coagulase negative *Staphylococcus*, *Enterobacter* spp., *Klebsiella* spp. Were found more frequently and *Providencia* spp.

Species	External structure	Internal structure	Total
<i>Escherichia coli</i>	23	38	61
<i>Staphylococcus coagulasa negativo</i>	9	9	18
<i>Enterobacter</i> spp.	10	6	16
<i>Klebsiella</i> spp	2	6	8
<i>Providencia</i> spp.	4	3	7

Table 1 Number of most frequent bacterial species isolated, by processed structure in *M. domestica*

Regarding the capture sites, frequency and species of isolated bacteria, differences were obtained in all the capture sites, in (Table 2), it can be observed that the houses (45.20%), was the site where the highest isolation was number of bacteria, and the most frequent species were: *E. coli* (42.42%), *Staphylococcus coagulase negativo* (15.15%), *Enterobacter* spp. (10.60%) and *Klebsiella* spp. (7.57%).

Species	Houses	Pigsty	Hen house	Courtyard
<i>Escherichia coli</i>	28	21	8	4
<i>Staphylococcus coagulasa negativa</i>	10	6	0	2
<i>Enterobacter</i> spp.	7	0	6	3
<i>Klebsiella</i> spp.	5	2	0	1
<i>Providencia</i> spp.	3	4	0	0
<i>Enterobacter sakasakii</i>	1	1	1	1

Table 2 Number of the most frequent bacteria isolated, by capture sites

On the other hand, the pigpen was the second site where the highest frequency of bacteria was isolated (31.50%), in the same way *E. coli* was the most isolated species (45.65%), followed by *Staphylococcus coagulase negative* (13.04%) and *Providencia* spp. (8.69%). In the same way, 14.38% of the total isolated species were isolated in chicken coops, with *E. coli* the most frequent species (38.09%), followed by *Enterobacter* spp. (28.57%) and *Serratia* spp. (14.28%). Finally, 8.09% of the total isolated species were isolated in patios, as in the other sites, *E. coli* was the most frequent species (30.76%), followed by *Enterobacter* spp. (23.07%) and *Staphylococcus coagulase negative* (15.38%). (Table 2).

An interesting pattern analyzed in this study revealed that *Staphylococcus coagulase negative* was the second species isolated in: houses (15.15%), pens (13.04%) and yards (15.38%), which confirms its wide distribution in nature and its clinical significance. In most cases it is difficult to establish since it can be commensal found in the microbiota of the skin and mucous membranes of mammals including man and birds. Table 3 shows in detail the species and number of bacteria isolated by structure processed in *M. domestica* in the different capture sites and the number of strains isolated in the internal and external parts of the fly, being *E. coli*, the most commonly found species.

Species	Houses		Pigsty		Hen house		Courtyard	
	External	Internal	External	Internal	External	Internal	External	Internal
<i>Escherichia coli</i>	10	18	8	13	3	5	1	3
<i>Staphylococcus coagulase negativa</i>	5	5	3	3	0	0	1	1
<i>Enterobacter</i> spp	3	4	0	0	3	3	2	1
<i>Klebsiella</i> spp	1	4	0	2	0	0	1	0
<i>Providencia</i> spp.	2	1	2	2	0	0	0	0
<i>Enterobacter sakazakii</i>	1	0	0	1	0	0	0	1
<i>E. agglomerans</i>	0	1	0	0	1	1	0	0
<i>Klebsiella pneumoniae</i>	1	2	0	1	0	0	0	0

Table 3 Number of isolated strains per bacterial species in internal and external structure processed of *M. domestica* in each capture site

Similarly, the presence of *Enterobacter* spp. in chicken coops (28.57%), patios (23.07%) and houses (10.60%) it is highly relevant for this study. The medical importance lies particularly in: *Enterobacter aerogenes* and *E. cloacae* since they have been associated with nosocomial outbreaks and are considered opportunistic pathogens. *Enterobacter* spp. can cause numerous infections such as: brain abscess, pneumonia, meningitis, septicemia, urinary tract (especially related to catheter) and abdominal cavity and intestinal infections.

Regarding the parasites isolated in *M. domestica*, the results shown were the following: 13 enteroparasites were identified in the internal macerates of *M. domestica*, of which four cysts were isolated (Figure 1A and 1B), *Endolimax nana* being the most frequent (38.46%), followed by *Entamoeba* spp. (30.76%), finally *Blastocystis* spp, and *Cryptosporidium* spp. (7.69%). A nematode egg belonging to *Ascaris lumbricoides* (15.38%) was also identified (Figure 1C). The pigsty was the site where the highest number of enteroparasites was found (n = 5), in Table 4, you can see the parasites isolated from the internal macerates of *M. domestica* in the four sites collected.

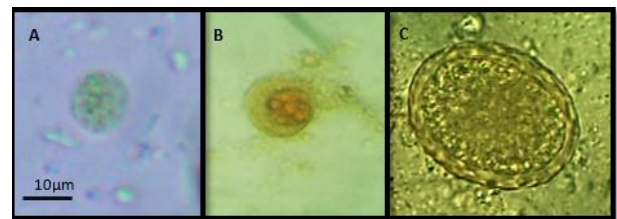


Figure 1 Lugol staining in saturated saline solution, parasites observed under light microscope at 40x. (A) *Endolimax nana* cyst. (B) cyst of *Entamoeba* spp. (C) egg of *Ascaris lumbricoides*

Parasites	Hen house	Pigsty	Courtyard	Home	%
<i>Entamoeba</i> spp.	0	0	2	2	30.76
<i>Blastocystis</i> spp.	1	0	0	0	7.69
<i>Endolimax nana</i>	2	3	0	0	38.46
<i>Cryptosporidium</i> spp.	0	0	0	1	7.69
<i>Ascaris Lumbricoides</i>	0	2	0	0	15.38
Total (n):	3	5	2	3	100

Table 4 Parasites identified in internal macerates of *M. domestica*

Discussion

Currently there are no studies that report the frequency of Enterobacteriaceae in flies from pig pens and poultry houses in rural areas, the objectives are focused on the isolation of bacteria resistant to various antibiotics in pig and poultry farms, which makes sense for its commercial value. However, these types of studies provide an overview of the frequency of bacteria isolated from these sites compared to bacteria isolated from poultry houses and pens in rural areas.

The high percentage of bacteria isolated inside houses represents a greater concern, compared to pens, chicken coops and yards, which are optimal sites for the reproduction, propagation and dissemination of a greater quantity of pathogenic bacteria, due to the manure generated and organic matter in decomposition of the place. However, the sanitary conditions in the houses, the lack of protection in windows and doors against the entry of flies from unhealthy places with abundant fecal matter, such as chicken coops and pens, favor the synanthropic behavior of *M. domestica*. The mentioned characteristics of the environment and the conditions of the house as a whole are factors that could increase the frequency of *E. coli* in flies due to their ability to fly. However, the food that is prepared inside the houses could be the factor that favors the attraction of a greater number of flies and with it the high percentage of isolates of *E. coli* in these places.

Although the number of species isolated in patios was less, the results obtained reflect the sanitary conditions of the same in the community. *E. coli* is found in the intestines of animals and humans, it is attributed an important role in gastrointestinal and urinary infections. This characteristic is verified in the present study by analyzing a greater number of *E. coli* strains in the internal macerates of *M. domestica* at the capture sites. Which due to the regurgitation of the fly and the manure generated by the backyard animals could be the cause of the frequency of this pathogen, however, it was also isolated in the external part which would represent a risk of transmission.

The results agree with the study carried out by Cervelin et al. (Cervelin et al., 2018), where they isolated enterobacteria associated with *M. domestica* as an indicator of infection risk in pig production farms, in their results they found a high frequency of *E. coli* in flies (104 to 106 CFU per 20 flies). This finding was directly correlated with the high concentration of fecal matter that was in the place, this characteristic was the same observed in the community pens, the lack of cleanliness of the pens, are factors that favor the conditions for the development of lots of flies.

The presence of *Enterobacter* spp. in chicken coops (28.57%), yards (23.07%) and houses (10.60%), it is relevant, but currently there are no studies reporting the effect as a pathogenic agent of diseases and its possible transmission by flies, despite this, reports by Lamiaa et al., (2007), confirm its presence in flies from urban areas. For its part, the study by Nazni et al., (2005), was concentrated in yards, landfills, food processing areas and poultry farms, obtaining similar results.

Solá et al. (2012), analyzed the bacteria from flies in poultry farms, in their high frequency reports of *E. coli* (81%), it was attributed to the state of contamination of the farm, this characteristic observed in farms is similar to that observed in community; the difference is that the homes have little delimited chicken coops, this allows the birds to be in patios excreting throughout the area, even inside the houses; this fact increases the contamination of the place, which explains the frequency of *E. coli* in flies trapped in poultry houses. The foregoing supports that the characteristics of the environment contribute to the frequency of this species in *M. domestica*. The study carried out by Blaak et al., (2015), where they studied the distribution and diversity of *E. coli* in the environment of a poultry farm, confirms the contribution of these sites in the contamination of the environment and is consistent with the finding that it was detected in flies (15%).

The presence of *Serratia* spp. Although in a low percentage, in poultry houses it differs from that reported by Lamiaa et al (2007), in this study areas with the presence of backyard birds were included. Despite this, it is known to be an opportunistic pathogen and is one of the ten most common causes of bacteremia in North America. They are responsible for a variety of infections, including bacteremia, pneumonia, intravenous catheter-associated infections, osteomyelitis, endocarditis, and rarely, endogenous and exogenous endophthalmitis (Biedenbach et al., 2004; Van Houdt et al., 2007). Until recently, *Serratia* was considered to be a pathogen, mostly nosocomial, but one study (Laupland et al., 2008) showed that 65% of infections with *Serratia* species were actually of community origin. Which could confirm the presence in backyard chicken coops of the community.

The results obtained in this study are also similar to that reported by Muñoz & Rodríguez, (2015) where species of enteroparasites were found: *Blastocystis* spp. (35.1%), *Endolimax nana* (2.7%) and *Entamoeba* spp. (16.2%). Similarly, Guillén-Tantaleán et al (1984) analyzed a total of 900 flies captured in garbage dumps, homes and stables, in their results they found cysts of: *Endolimax nana* and *A. lumbricoides* eggs.

The problem of isolating *A. lumbricoides* in flies is the high frequency in infants in rural and urban communities, which is associated with developmental delay affecting the growth of infants, proof of this is the study carried out by Gutiérrez-Jiménez et al., (2019), where they observed a high prevalence of stunting in children from rural regions (79.8%), than urban ones (7.5%). And only children from rural municipalities were parasitized (72.6%), with *A. lumbricoides* and *Entamoeba histolytica* / *Entamoeba dispar* being the most prevalent parasites (57.1 and 38.1%, respectively).

Cárdenas & Martínez (2004), reported: *Cryptosporidium* spp., and *Endolimax nana* in internal macerates of *M. domestica* from garbage dumps and houses with poor sanitary conditions, according to the authors of this study, these findings were the causal agents of diseases in the population. *Cryptosporidium* spp. and *Blastocystis* spp. they are considered pathogens for man, they produce diverse clinical pictures, among which abdominal pain, nausea, anorexia, fatigue, diarrhea and weight loss stand out. The presence of them could be due to the insect's habit of living in contact and feeding on decomposing matter, mainly fecal from man and animals Van Houdt et.al (2007).

Conclusions

Flies are potential vectors of pathogens and are associated with the sanitary conditions of the environment where they develop, this behavior is corroborated with the results we obtained in the present study where 20 species of bacteria were identified: *Escherichia coli* (41.78%), *Staphylococcus coagulase negative* (12.32%), *Enterobacter* spp (10.95%), *Klebsiella* spp (5.47%), *Providencia* spp (5%), *Enterobacter sakasaki* and *Klebsiella pneumoniae* (2.73%). *Enterobacter agglomerans*, *Shigella* spp, *Staphylococcus aureus*, *Proteus* spp, *Citrobacter* spp and *Serratia* spp (2.05%).

Morganella spp, *Klebsiella oxytoca* and *Edwardsiella* spp (1.36%). *Morganella morgani*, *Klebsiella ozaenae*, *Shigella flexneri* and *Yersinia* spp (0.68%); four protozoan cysts: *Endolimax nana* (38.46%), *Entamoeba* spp (30.76%), *Blastocystis* spp (7.69%) and *Cryptosporidium* spp (7.69%); a nematode egg: *Ascaris lumbricoides* (15.38%). In the case of bacteria, *E. coli* (41.78%) was the most frequent isolated species in all processed flies; finally, the house (45.20%), was the site where the greatest amount of bacterial species was isolated.

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References

- Béjar C, V., Chumpitaz C, J., Pareja C, E., Valencia B, E., Huamán R, A., Sevilla A, C., Tapia B, M., & Saez F, G. (2006). *Musca domestica* como vector mecánico de bacterias enteropatógenas en mercados y basurales de Lima y Callao. *Revista Peruana de Medicina Experimental y Salud Pública*. <https://doi.org/10.17843/rpmpesp.2006.231.1032>
- Biedenbach, D. J., Moet, G. J., & Jones, R. N. (2004). Occurrence and antimicrobial resistance pattern comparisons among bloodstream infection isolates from the SENTRY Antimicrobial Surveillance Program (1997-2002). *Diagnostic Microbiology and Infectious Disease*. <https://doi.org/10.1016/j.diagmicrobio.2004.05.003>
- Blaak, H., Van Hoek, A. H. A. M., Hamidjaja, R. A., Van Der Plaats, R. Q. J., Kerkhof-De Heer, L., De Roda Husman, A. M., & Schets, F. M. (2015). Distribution, numbers, and diversity of ESBL-producing *E. coli* in the poultry farm environment. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0135402>
- Brazil, S. M., Steelman, C. D., & Szalanski, A. L. (2007). Detection of pathogen dna from filth flies (diptera: Muscidae) using filter paperspot cards. *Journal of Agricultural and Urban Entomology*. <https://doi.org/10.3954/1523-5475-24.1.13>

- Cabrera M, Verástegui M, C. R. (2005). Prevalencia de enteroparasitosis en una comunidad altoandina de la rovincia de Víctor Fajardo, Ayacucho, Peru. *Rev Gastro Perú*.
- Calderón, R. L., Tay. J., Sánchez, V. J. T., y Ruiz, S. D.(2004) Los artrópodos y su importancia en medicina humana. *Rev Fac Med UNAM*
- Cárdenas, M., & Martínez, R. (2004). Protozoarios parásitos de importancia en salud pública transportados por *Musca domestica* Linnaeus en Lima, Perú. *Revista Peruana de Biología*. <https://doi.org/10.15381/rpb.v11i2.2450>
- Castillo, E. C., Castro, M. M., Carhuapoma, C. C., Castro, T. H., Castro, T. R., y Chambi, C. J.(2008) Parásitos de importancia en salud pública transportados por *Musca domestica*. Lima-Perú..CIMEL Ciencia e Investigación Médica Estudiantil Latinoamericana
- Cervelin, V., Fongaro, G., Pastore, J. B., Engel, F., Reimers, M. A., & Viancelli, A. (2018). Enterobacteria associated with houseflies (*Musca domestica*) as an infection risk indicator in swine production farms. *Acta Tropica*. <https://doi.org/10.1016/j.actatropica.2018.04.024>
- Crosskey, R. W., & Lane, R. P. (1993). Houseflies, blow-flies and their allies (calyptrate Diptera). In *Medical Insects and Arachnids*. https://doi.org/10.1007/978-94-011-1554-4_11
- de Román, E. M., Tkachuk, O., & Roman, R. (2004). Detección de agentes bacterianos en adultos de musca domestica (diptera: Muscidae) recolectadas en maracay, estado aragua,venezuela. estudio preliminar. *Entomotropica*.
- Eke, S. S., Idris, A. R., Omalu, I. C. J., Otuu, C. A., Ibeh, E. O., Ubanwa, E. D., Luka, J., & Paul, S. (2016). Relative abundance of synanthropic flies with associated parasites and pathogens in Minna Metropolis, Niger State, Nigeria. *Nigerian Journal of Parasitology*. <https://doi.org/10.4314/njpar.v37i2.4>
- Fernández B., M., Martínez M., D. M., Tantaleán V., M., & Martínez R., R. (2014). Parásitos presentes en *Periplaneta americana* Linnaeus “cucaracha doméstica” de la ciudad de Ica. *Revista Peruana de Biología*. <https://doi.org/10.15381/rpb.v8i2.6565>
- Gallego Berenguer, J. (2014). Manual de parasitología: morfología y biología de los parásitos de interés sanitario. *Edicions Universitat Barcelona*.
- Guillén, T.Z., Martínez, R., Del aguila, A. y Cusi, R.(1984) Moscas y cucarachas como vectores de parasitosis en el Pueblo joven 14,5 Hectáreas - Callao. *Boletín Universidad Nacional Mayor de San Marcos*. Lima, Perú.
- Gutiérrez-Jiménez, J., Luna-Cázares, L. M., Martínez-De la Cruz, L., De Aquino-López, J. A., Sandoval-Gómez, D., León-Ortiz, A. T., Hernández-Shilón, J. A., Constantino-Jonapa, L. A., Matamoros, W. A., & Vidal, J. E. (2019). Children from a rural region in the chiapas highlands, Mexico, show an increased risk of stunting and intestinal parasitoses when compared with urban children. *Boletin Medico Del Hospital Infantil de Mexico*. <https://doi.org/10.24875/BMHIM.18000069>
- Lamiaa, B., Mariam, L., & Ahmed, A. (2007). Bacteriological analysis of *Periplaneta americana* L. (Diptera; Blattellidae) and *Musca domestica* L. (Diptera; Muscidae) in ten districts of Tangier, Morocco. *African Journal of Biotechnology*. <https://doi.org/10.5897/ajb2007.000-2315>
- Laupland, K. B., Parkins, M. D., Gregson, D. B., Church, D. L., Ross, T., & Pitout, J. D. D. (2008). Population-based laboratory surveillance for *Serratia* species isolates in a large Canadian health region. *European Journal of Clinical Microbiology and Infectious Diseases*. <https://doi.org/10.1007/s10096-007-0400-7>
- Moissant, E., Tkachuk, O., y Roman, R.(2004) Detección de agentes bacterianos en adultos de *Musca domestica* (Diptera: Muscidae) recolectadas en Maracay, Estado Aragua, Venezuela. *Entomotrópica*.

Muñoz, D. J., & Rodríguez, R. (2015). Agentes bacterianos y parasitarios en adultos de la mosca común *Musca domestica* recolectadas en el peñón, estado Sucre, Venezuela. *Revista Científica de La Facultad de Ciencias Veterinarias de La Universidad Del Zulia*.

Murray, P. R., Baron, E. J., Jorgensen, J. H., Tenover, F. C., & Tenover, R. H. (2004). *Manual of Clinical Microbiology*, 8th Edition. *Clinical Infectious Diseases*. <https://doi.org/10.1086/383067>

Nazni, W. A., Seleena, B., Lee, H. L., Jeffery, J., T Rogayah, T. A., & Sofian, M. A. (2005). Bacteria fauna from the house fly, *Musca domestica* (L.). *Tropical Biomedicine*.

Peña, F. (2012). Fortalecimiento de Medidas de Prevención de las Enfermedades Diarreicas A Través de una Intervención Educativa a Responsables de Menores de 5 Años en la Localidad de Samahil, Yucatán. (Maestría en Salud Pública en Servicio). Instituto Nacional de Salud Pública/ Escuela de Salud Pública. Cuernavaca, Morelos.

Quiceno, J., Bastidas, X., Rojas, D., & Bayona, M. (2010). La Mosca Doméstica Como Portador De Patógenos Microbianos. *U.D.C.A Act. & Div.*

Romero, R. C. (2007). Microbiología y Parasitología Humana. In *Microbiología y Parasitología Humana*.

Sarwar, M. (2016) Life History of House Fly *Musca domestica* Linnaeus (Diptera: Muscidae), its Involvement in Diseases Spread and Prevention of Vector. *International Journal For Research In Applied And Natural Science*.

Secretaria de Salud, & Dirección General de Epidemiología. (2019). *Boletín Epidemiológico Sistema Nacional de Vigilancia Epidemiológica Sistema Único de Información | Secretaría de Salud | Gobierno | gob.mx*. Boletín Epidemiológico.

Sheri, M., Brazil, C., Dayton, S., Allen, L. & Szalanski, S. (2007) Detection of pathogen DNA from filth flies (Diptera: Muscidae) using filter paper spot cards. *Journal of Agricultural and Urban Entomology*

Solà-Ginés, M., González-López, J. J., Cameron-Veas, K., Piedra-Carrasco, N., Cerdà-Cuéllar, M., & Migura-García, L. (2015). Houseflies (*Musca domestica*) as vectors for extended-spectrum β -lactamase-producing *Escherichia coli* on Spanish broiler farms. *Applied and Environmental Microbiology*. <https://doi.org/10.1128/AEM.04252-14>

Tolrá Hjorth-Andersen, M. C. (2015). Orden Diptera. *Revista IDE@-SEA*.

Van Houdt, R., Givskov, M., & Michiels, C. W. (2007). Quorum sensing in *Serratia*. In *FEMS Microbiology Reviews*. <https://doi.org/10.1111/j.1574-6976.2007.00071.x>

Relationship between electrostatic powder coating thickness measurements at different points on uneven surfaces

Relación entre medidas de espesor de recubrimiento electrostático en polvo en diferentes puntos sobre superficies irregulares

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Abstract

Measure relation of electrostatic powder coating thickness at different points on irregular surfaces. In this work, we found the relation between the thickness measures at different areas of a irregular surface, by the electrostatic powder coating on pieces with five different geometries and varyin slightly parameters like potential and application distance. At the products where the electrostatic powder coating are used, the thickness measure is an importante quality characteristic, however on the irregular surfaces is so noticeable when the thickness measure is not uniform on the entire piece. But when it is known that the thickness ratio varies from one area to another of the same piece, it is easier to establish a methodology that allows the process to have a measure of uniform thickness.

Electrostatic Powder Coating, Thickness, Finite Element

Resumen

Relación entre medidas de espesor de recubrimiento electrostático en polvo en diferentes puntos sobre superficies irregulares. En este trabajo se encuentra la relación entre las medidas de espesor de diferentes áreas de una superficie irregular, mediante la aplicación de recubrimiento electrostático en piezas con cinco geometrías diferentes y modificando levemente parámetros como potencial y distancia de aplicación. En los productos donde se utiliza el recubrimiento electrostático el espesor es una característica de calidad importante, sin embargo en las superficies irregulares es mas notorio cuando la medida de espesor no es uniforme en toda la pieza. Sin embargo cuando se conoce en que proporción varía el espesor entre un área y otra de la misma pieza, es mas fácil establecer una metodología en el proceso que permita tener una medida de espesor uniforme.

Recubrimiento electrostático en polvo, Espesor, Elemento finito

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Introduction

The application of electrostatic powder coating has been used since the 70's last century, and since its inception it was detected that it is complex to obtain a uniform thickness measurement in the coating layer, and when the substrate has a geometry irregular, that is, it was subjected to plastic deformation before the coating process, then it becomes more complex, since the deep regions in an irregular geometry cause the effect called the Faraday cage (EJF), which does not allow the dust particles reach the depths of the geometry.

In an electrostatic system for the application of electrostatic powder coating (for the case of this study it is paint), the electric field lines are directed from the electrode in the gun towards the substrate or surface to be covered, when the surface it is irregular so the electric field lines cancel out when reaching the deep regions so they do not penetrate to the bottom. The dust particles follow the electric field lines and since they do not penetrate to the deep regions then the dust does not reach either, causing smaller paint thickness measurements in those regions.

The effect of the Faraday cage in the electrostatic painting process has been known since this type of process arose; Efforts to solve it focus on controlling some individual or group parameters such as current intensity (Guskov, 1996), the amount of charge with respect to the mass of the dust cloud Q / m (Biris, 2011), the size of the particle (Rupp, 2012), etc.

Some equipment for the application of electrostatic powder paint, such as the WAGNER, have integrated programs with combinations of parameters appropriate to the type of surface to be covered; These surfaces are classified as flat surfaces, large surfaces and irregular surfaces, however the problem is not solved in a definitive way, and it is complicated because the EJF is inherent to electric fields on irregular surfaces, which means that it is not possible to eliminate it. completely, so research is focused on mitigating it in some way. Since the uniformity of the thickness measurement over the entire surface is an important characteristic to evaluate the quality of the product, it is considered advisable to carry out a study in which it is identified how the thickness measurement varies throughout the surface, and is related to the electric field intensity.

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With this objective, an experiment was designed with five types of surface which were covered by the electrostatic powder coating process to later measure the thickness at eight different points of each type of surface and thus determine the spatial variation in the measurement of thickness of each surface.

The structure of this document contemplates first the description of the electrostatic system, then a brief explanation of the finite element method, the materials, equipment and experimentation are specified, the results obtained and the general conclusions.

Electrostatic system

The set of equipment and materials that is needed to apply electrostatic coating either in powder or liquid is called electrostatic system, this study focuses on powder painting as electrostatic coating and in this section it is explained how is the paint application process and how to simulate electrostatic fields using the finite element method.

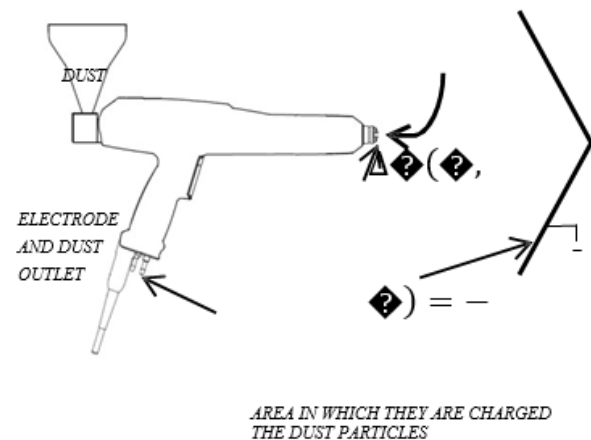


Figure 1 Electrostatic gun and substrate (drawing obtained from supplier's manual)

Equipment for electrostatic process

An electrostatic system for the coating process (Figure 1), includes an electrostatic gun with an electrode connected to a high voltage generator and a substrate connected to ground.

The gun is connected to a compressor, the air from the compressor drives the dust particles around the electrode, where the discharge corona is formed, and the particles are negatively charged and with the force of the electric field are directed towards the substrate.

$$\mathbf{E} = -\nabla u(\mathbf{x}, y) \quad (1)$$

The relationship between the electric field and charge density ρ is given by:

$$\varepsilon \nabla \cdot \mathbf{E} = \rho \quad (2)$$

Where ε is the permittivity of the material, substituting equation (1) in equation (2); the result is the Poisson equation of potential:

$$\Delta u(x, y) = -\frac{\rho}{\varepsilon} \quad (3)$$

The Poisson equation (3) describes how the potential and electric field lines are distributed. To solve this equation in an electrostatic system it is feasible to use the finite element method.

The finite element method in electrostatics

The finite element method has different ways of solving partial differential equations, one of the most used is the variational method. This method uses a functional, which is an expression of the potential energy in the domain. Through the minimization of the energy in each element, the electric field lines are obtained in the entire region. The equation to be solved for the electric field is the Poisson equation. Limit constraints are Dirichlet and / or Neumann conditions. The functional of the equation is:

$$I = \int_A \left\{ \frac{1}{2} \varepsilon_0 \left(\frac{\partial \Phi}{\partial x} \right)^2 + \frac{1}{2} \varepsilon_0 \left(\frac{\partial \Phi}{\partial y} \right)^2 \right\} dA - \oint \Phi \frac{\partial \Phi}{\partial n} dR \quad (4)$$

When the download is generated in the gun, an electric field is formed between the gun and the substrate. The electric field intensity is known by the potential gradient, which is represented as $u(x, y)$:

Where A corresponds to the region of integration, Φ is the potential and I is the functional. The first part of the functional represents the energy of the electric field.

By means of discretization, each element is defined according to a function, the number of its nodes and the potential, which is defined by the potential at the nodes.

$$\Phi = |N|(\Phi)^e = (N_i, N_j, N_k) \begin{bmatrix} \Phi_i \\ \Phi_j \\ \Phi_k \end{bmatrix} \quad (5)$$

Where $|N|$ is the matrix of functions of form. To find the minimum energy potential, the functional must be partially derived with respect to each node. Therefore:

$$\frac{\partial I^e}{\partial \Phi^e} = |K|^e \{\Phi\}^e \quad (6)$$

The matrix of each element is assembled into a global matrix and boundary conditions are applied.

$$|K|\{U\} = \{P\} \quad (7)$$

K represents the stiffness matrix; U is the vector of unknown potentials and P is the solution vector.

Methods

The experimentation was conducted in two ways, the first to calculate the electric field by the finite element method and the second to measure the thickness of the cured paint on the treated surface.

Design of experiments

An experiment was designed with 5 different geometries, three with angles of 60 °, 90 ° and 120 ° and two with a box shape with 1", depth and the width of the deep region in the first 1" and in the second of 2" (Figure 2), the material is low carbon steel, the paint used was Krhal, the variables to be measured are paint thickness in mils and electric field intensity in V / m.

Two different types of parameter combinations were used, each combination will be called treatment from here from now on, the first type of treatment is oriented towards measuring the thickness of paint and is numbered from one to eight (Table 1), the second type of treatment is for the calculation of the electric field intensity, said calculation was made the finite element method and the treatments are identified with the letters A, B, C and D (Table 2).

A 200 ° C convection oven was used to cure the paint for 10 minutes and a Positector 6000 thickness gauge was used.

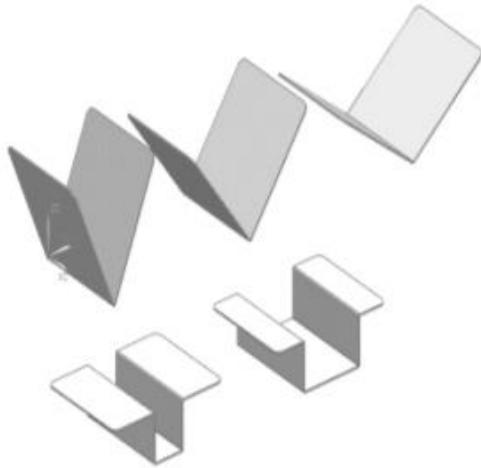


Figure 2 Five different geometries

Treatments for thickness			
Treatment	Voltage (kV)	Distance (cm)	% dust
1	70	15	50
2	70	15	60
3	60	15	50
4	60	15	60
5	70	20	50
6	70	20	60
7	60	20	50
8	60	20	60

Table 1 Parameters for measuring coating thickness

Electric Field Intensity		
Tratamiento	Voltage (kV)	Distance (cm)
A	70	15
B	60	15
C	70	20
D	60	20

Table 2 Parameters for calculating electric field

Electric field strength calculated with the finite element method

To calculate the electric field intensity, COMSOL® was used, a three-dimensional domain was established, forming a block in the shape of a rectangle, the small faces of the rectangle are found in the upper and lower part of the block, in the center of the upper face a point is located that represents the electrode, and the lower face takes the shape of the geometry to be analyzed (Figure 3); the boundary conditions were Dirichlet for the electrode with $u = V$ and for the grounded substrate with $u = 0$, the rest of the boundaries are Neumann with

$$\frac{\partial u}{\partial x}(x, y, z) = \frac{\partial u}{\partial y}(x, y, z) = \frac{\partial u}{\partial z}(x, y, z) = 0.$$

The calculation was made in eight different points of each piece (Figure 4), the same ones where the measurements of the thickness of the paint were made.

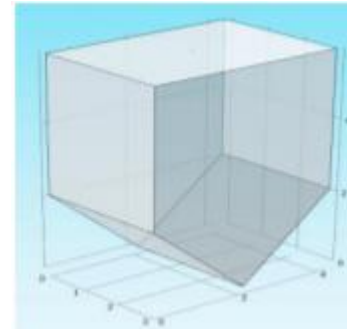


Figure 3 Domain

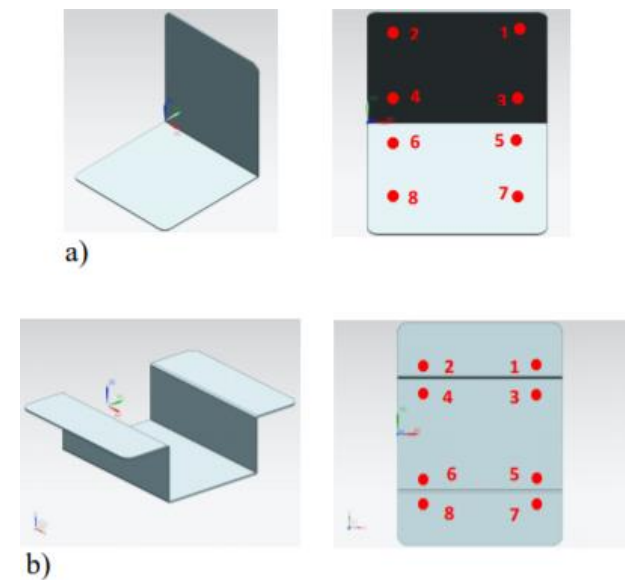


Figure 4 a) Points where thickness was measured in geometries with a center bend, b) Points where thickness was measured in geometries with deep regions

Results

The electric field intensity values were obtained at each point indicated, in the same way the thickness was measured at the same points and when graphing the results, similar patterns of variation were found between the electric field intensity graphs and those of the thickness, the Table 3 shows graphs of two of the geometries.

When the parameters that affect the thickness measurement are analyzed, the electric field intensity is not considered, however when reviewing the behavior of the thickness measurement in the eight measurement points and it was related to the measurement of the intensity and Electric field at the same points is observed as having similar variation patterns and when calculating the correlation between both parameters, it was found that the smallest correlation value is 67% and the largest is 99%, in addition the 50th percentile is 89% , which indicates that the smallest correlation values are more dispersed than the highest values. With the information obtained, it can be seen that the electric field intensity is a parameter that deserves to be more important if you want to control the uniformity of the thickness on an irregular surface.

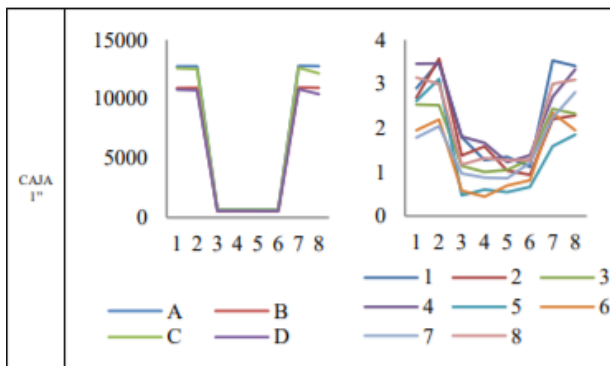


Table 3 Graph of electric field intensity and thickness of two different geometries

When it was observed that the behavior of the variation of the electric field intensity resembles the behavior of the variation of the thickness, the relationship between both parameters was measured by means of a correlation coefficient and it was found that the smallest correlation value is 67 % (table 4) which indicates that the thickness measurement is explained through the behavior of the electric field intensity at each measurement point.

Geom	A-1	A-2	B-3	B-4	C-5	C-6	D-7	D-8
60°	0.9659	0.9510	0.9415	0.8031	0.7659	0.7266	0.9591	0.9052
90°	0.8689	0.7107	0.8801	0.8865	0.7759	0.7650	0.7948	0.7250
120°	0.7217	0.8823	0.7177	0.7389	0.7010	0.6906	0.6720	0.7868
1"	0.9606	0.8622	0.9896	0.9011	0.8959	0.9809	0.8996	0.9973
2"	0.9747	0.9636	0.9741	0.8982	0.9852	0.9874	0.9779	0.9474

Table 4 Treatment correlation

Discussion

The thickness measurements on an irregular surface have important differences when comparing the thicknesses of the deep regions with the thicknesses of the upper regions, this is due to the effect of the Faraday cage.

References

Casaux, J., (2007), Critical thickness of electrostatic powder coatings from inside, *Journal of electrostatic*, 2007; 65: 764 – 774.

Chen, Y., Liang, X., Bai, & J., Xu, B., (2010), Finite element modeling of coating formation and transient heat transfer in the electric arc spray process, *International Journal of heat and mass transfer*, 2012; 13, 2012 – 2021.

Guskov, S., (1996), Electrostatic phenomena in powder coating, *Powder coating '96*, Nordson Corporation, Indianapolis Indiana.

Hayt, W.H. Jr. & Buck, J.A., (2006), *Teoría electromagnética*, México, Mc Graw Hill Interamericana Editores S.A. de C.V., 7ª ed.

Humphires, S. Jr., (2010), Finite element methods for electromagnetics, electronic edition of “Field solution on computers”, Ed. CRC Press a division of Taylor and Francis.

Hyuncheol, O., Kyoungtae, K., & Sangsoo, K., (2008), Characterization of deposition patterns produced by twin – nozzle electrospray, *Journal of aerosol science*, 2008; 39: 801 – 813.

Inculet, I.I., & Adamiak, K., (1993), Charge limits in corona charging of distorted liquid droplets, *IEEE Transactions on industry applications*, 1993; 29: 1058 – 1061.

Jalaal, M., Soleimani, S., Domairry, G., Ghasemi, E., Bararnia, H., Mohammadi, F. & Barari, A., (2011), Numerical simulation of electric field in complex geometries for different electrode arrangements using meshless local MQ-DQ method, *Journal of Electrostatic*, 2011; 69: 168 – 175.

Kreeger, K., (1994), Application variables for powder coating systems, Nordson Corporation.

Lackowski, M., Krupa, A. & Jaworek, A., (2010), Corona discharge ion sources for fine particle charging, *The European Physical Journal D*, 2010; 377 – 382.

Le Moyne, L., (2010), Trends in atomization theory, *International journal of spray and combustion dynamics*, 2010; 1: 49 – 84.

Matsusaka, S. & Masuda, H., (2002), Theoretical analysis of electrostatic forces between coated particles, *Advanced powder technology*, 2002; 13: 2: 157 – 166.

Nordson Corporation, (2004), *Corona charging and electrostatics for pipe coating*.

Plonus, M.A., (1994), *Electromagnetismo aplicado*, Barcelona, Editorial Reverté S.A.

Sarrate, J. & Clarisó, R., (2001), El método de los elementos finitos en problemas electromagnéticos: planteamiento y aplicaciones, *Revista internacional de métodos numéricos para cálculo y diseño en ingeniería*, 2001; 17: 1: 219 – 248.

Wu, Y., Castle, P. & Inculet, I.I., (2005), Induction charging of granular materials in an electric field, *IEEE Transactions on Industry Applications*, 2005; 41:1350 – 1357.

Ye, Q., Steigleder, T., Scheibe, A. & Domnick, J., (2002), Numerical simulation of the electrostatic powder coating process with a corona spray gun, *Journal of electrostatic*, 2002; 54: 189 – 205.

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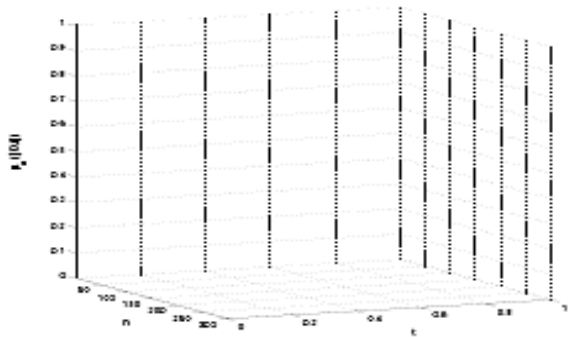
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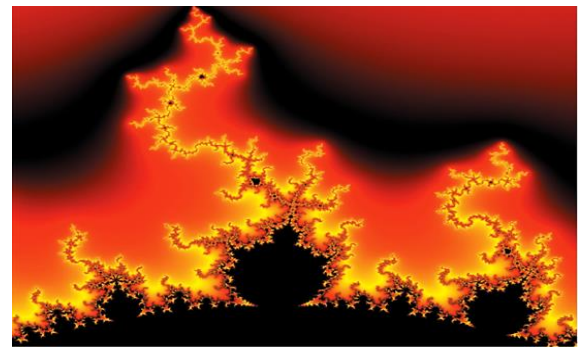


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