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ORIGINAL ARTICLE

Risk of chronic non-communicable diseases in workers at a health rehabilitation center

Riesgo de enfermedades crónicas no transmisibles en trabajadores de un centro de rehabilitación de la salud

Patricia M. Espinel[1] • **Jesenia E. Rodríguez**[2]

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Abstract A cross-sectional study was conducted in a health rehabilitation center to identify workers' risks of chronic non-communicable diseases. Food preferences, physical activity, and toxic habits were analyzed through surveys. Anthropometric indicators (BMI, waist circumference, and waist/hip ratio) and biochemical indicators (hemoglobin, total cholesterol, triglycerides, and glycemia) were determined. The results showed that most workers were overweight, with 13.69% obese. More than 75% had central obesity, correlat-ed with waist circumference and waist/hip ratio. The 62.7% had a sedentary lifestyle, while 28% showed impairments in iron nutritional status. A signi icant percentage presented high risks of chronic diseases related to glycemia, cholesterol, and triglycerides; 7% of cases showed severe impairments in two of these variables. Frequent cigarette consumption was reported by 22% of workers, a habit that elevates the risk of degenerative diseases.

Keywords non-communicable diseases, diet, lifestyles, sedentary lifestyle, occupational healths.

Resumen Se realizó una investigación transversal un centro de rehabilitación de salud para identificar riesgos de enfermedades crónicas no transmisibles en trabajadores. Mediante encuestas se analizaron las preferencias alimentarias, actividad física y hábitos tóxicos. Se determinaron indicadores antropométricos (IMC, circunferencia de cintura e índice cintura/cadera) y bioquímicos (hemoglobina, colesterol total, triglicéridos y glicemia). Los resultados mostraron que la mayoría de los trabajadores tenía sobrepeso, con un 13,69 % de obesidad. Más del 75 % presentó obesidad central, corre-lacionada con la circunferencia de cintura e índice cintura/cadera. El 62,7 % tenía un estilo de vida sedentario, mientras que el 28 % mostró afectaciones en el estado nutricional del hierro. Un porcentaje signi icativo presentó riesgos elevados de enfermedades crónicas relacionados con glicemia, coles-terol y triglicéridos; un 7 % de los casos mostró afectaciones graves en dos de estas variables. El 22 % de los trabajadores tenía un consumo frecuente de cigarrillos, lo que incrementa el riesgo de enfermedades degenerativas.

Palabras clave enfermedades no transmisibles, dieta, estilos de vida, sedentarismo, salud laboral.

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✉ Patricia M. Espinel
patricia.espinel@mspz4.gob.ec

[1]Ministerio de Salud Pública, Manabí. Portoviejo, Ecuador.
[2]Yachay Experimental Technology Research University, Imbabura, Ecuador.

PUBLIS EDITORIAL

Introduction

Health status is fundamentally conditioned by genetic and environmental factors, where the most critical external variable is nutrition. An adequate diet must meet daily nutritional needs and incorporate cultural, gastronomic, and personal satisfaction values (Rakha et al., 2022). Changes in eating habits, lower energy expenditure associated with sedentary lifestyles, population aging, smoking, and alcohol consumption are the main risk factors for noncommunicable diseases and constitute an increasing health challenge (Majić et al., 2023).

The type and amount of food and drink consumed play a role in the struggle for weight control and overall good health. Less attention has been paid to how much energy we expend if physically active, but the two aspects are closely linked (Esquivel, 2021).

The rapid expansion of various relevant scientific fields and abundant population-based epidemiological data have helped to clarify the role of diet in preventing and controlling morbidity and premature mortality caused by noncommunicable diseases (Pham et al., 2022). Some specific dietary components that increase the likelihood of developing these diseases in individuals and appropriate interventions to modify their impact have been identified (Gherasim et al., 2020).

Diet has been shown to have a significant influence, both positive and negative, on health throughout life. Dietary adjustments influence current health and can determine whether or not an individual suffers from diseases such as cardiovascular disease, cancer, obesity, and diabetes in later life. However, these insights have not led to changes in policy or practice. In many developing countries, dietary policies focus only on malnutrition and do not consider preventing chronic diseases (Gherasim et al., 2020). This research aimed to identify some risks of chronic noncommunicable diseases in health rehabilitation workers.

Methodology

The study was conducted in a health rehabilitation center during April and May. A descriptive cross-sectional design was used to evaluate anthropometric and biochemical parameters, lifestyle habits, and nutritional adequacy of the workers' diet. Ninety-five workers were selected through non-probabilistic convenience sampling. Inclusion criteria were active workers during the study period, voluntary participation with a willingness to perform measurements and answer surveys, age between 18 and 60 years, and absence of medical conditions that significantly affected anthropometric or biochemical variables (e.g., pregnancy, severe metabolic diseases).

Workers who refused to participate in measurements or surveys, had physical or psychological conditions that made obtaining reliable data impossible or were absent during data collection activities were excluded.

Weight, height, waist, and hip circumference were measured using standardized anthropometric techniques. Weight was measured with a precision scale (SECA brand, Double Roman model), expressed in kilograms. Height was determined with a measuring tape in an erect position, expressed in meters. Workers were assessed for waist and hip circumference and body mass index (BMI) (Hewage et al., 2023).

Structured questionnaires were applied to evaluate physical activity (frequency and intensity of physical exercise, more than 30 minutes and more than days a week) and toxic habits (smoking and alcohol consumption, classified according to frequency. Venous blood samples were obtained after 12 hours of fasting, and each sample was processed using a Hitachi model 912 autoanalyzer. Glycemia, cholesterol, triglycerides, and hemoglobin were determined.

The menus consumed during the study period were recorded, and the adequacy of energy and nutrient recommendations was analyzed using a frequency of consumption questionnaire. The data were analyzed using SPSS software, version 11.1. Descriptive statistics were used to calculate means, standard deviations, and percentage distributions. The Chi-square test was used with a confidence level of 95% ($p \leq 0.05$) to determine significant associations between an-thropometric and biochemical variables and habits.

Results and discussion

Table 1 presents the composition by sex and age of the sample studied. Thirty-two men and 63 women were studied, representing 33.7% and 66.3% of the sample.

Table 1. Percentage distribution of the population sample, according to age and sex

Age (years)	Sex	Frequency	Percentage
18-30	Male	6	6.32
	Female	8	8.42
30-60	Male	25	26.32
	Female	54	56.84
> 60	Male	1	1.05
	Female	1	1.05
Total		95	100

This result was consistent with the composition of the universe of workers at the center. The average age of the participants was 38 years; the majority (83.12%) were between 30 and 60 years old.

Figure 1 shows the percentage distribution of the BMI of the center's workers, highlighting that the majority weighted the reference for their height, representing half of the sample. Within this group, 13.69% were classified as obese, including three men who were in the morbidly obese range. Overweight predominated in women, with 77% of them affected, while obesity was more prevalent in men, affecting 54% of male participants.

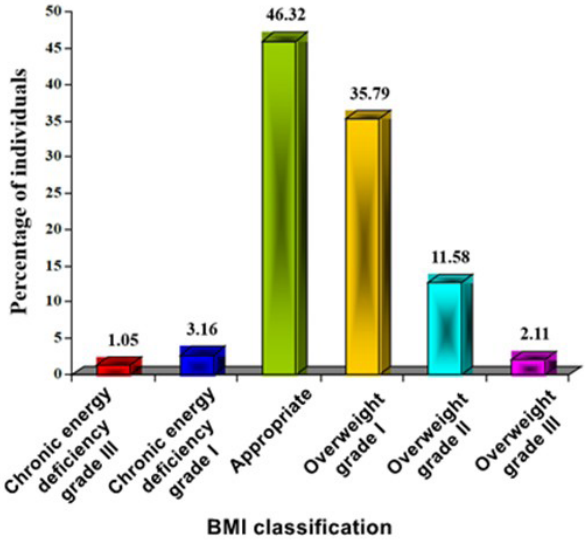

Figure 1. Percentage distribution of body mass index (BMI) of the analyzed population.

Almost half of the sample had an adequate weight for their height, with 23 men and 46 women in this category. The remaining 4% of workers had weights below the reference range for adequate weight, with one in chronic energy deficiency grade III.

BMI was used to estimate the prevalence of overweight and obesity in the study population and the associated risks (Al-Ghamdi et al., 2018). However, due to variations in body proportions, this indicator may not reflect the same degree of obesity in different populations (Jeong et al., 2023).

The risks associated with increasing BMI follow a continuous gradient starting from a BMI greater than 25. In this study, 35.79% of individuals were at increased risk, while just over 10% showed moderate or severe risks. This is worrying in a health institution where the prevention and treatment of diseases, especially chronic noncommunicable diseases, are a primary objective. These conditions are the leading causes of mortality worldwide (Ouyang et al., 2022).

Among adults, there is clear evidence that modest weight reduction in susceptible individuals can significantly slow the development of type 2 diabetes and even prevent it altogether. Weight loss can reverse the type 2 diabetic state (Ko & Kim, 2022).

It has been noted that the interpretation of risk associated with BMI may vary across populations. BMI and measures of body fat distribution are relevant for estimating comorbidity risk, especially concerning cardiovascular disease and other chronic conditions (Powell-Wiley et al., 2021).

In the distribution of body fat according to the waist-hip ratio of the workers, the central type of obesity predominated, also known as abdominal, android, or male (Gadekar et al., 2020). This pattern was represented in 80% of the sample, with a higher prevalence in the female sex, which covered 83% of the cases classified in this category.

Table 2 compares body mass index according to sex and waist circumference. In both sexes, obesity was directly and significantly associated with central fat distribution. In women, overweight also showed a significant relationship with increased and remarkably increased risk of these diseases (13.9% and 24.8% of women, respectively). This pattern was not evident in the male group.

Table 2. Relationship between waist circumference and body mass index

BMI	Men			Women		
	Waist circumference			Waist circumference		
	MR (%)	RI (%)	RMI (%)	MR (%)	RI (%)	RMI (%)
Low Weight	4.1	0.0	0.0	4.0	0.0	0.0
Normal	42.9	4.1	0.0	16.8	17.8	10.9
Overweight	16.3	6.1	2.0	2.0	13.9	24.8
Obese	6.1	8.2	10.2	1.0	1.0	7.9
Significance statistics	X^2=27.48; p=0.000			X^2=35.32; p=0.000		

BMI: Body Mass Index, SR: No risk, RI: Increased risk, RMI: Very increased risk.

Central fat distribution is considered metabolically active, which increases the risk of chronic noncommunicable diseases, such as cardiovascular diseases, hypertension, type II diabetes, and atherosclerosis. This risk is due to increased metabolically active intra-abdominal adipocytes (Dhawan & Sharma, 2020). These adipocytes release free fatty acids directly into the portal circulation, which could interfere with insulin clearance by the liver, thus affecting several metabolic (Chait & den Hartigh, 2020) and pathophysiological processes, which can trigger lipid alterations (such as decreased HDL and increased LDL), vascular alterations, arterial hypertension, and non-insulin-dependent diabetes mellitus, among others (Strikić et al., 2023).

An increased risk of mortality, as well as diseases such as diabetes, hypertension, heart attacks, and strokes, has been found in people with central obesity (Cercato & Fonseca, 2019). Dehesh et al. (2023) found that abdominal obesity can predict the risk of breast cancer in women, this risk affecting 9.7% of the study participants.

Physical exercise is essential to prevent excess weight and reduce the risks of noncommunicable diseases, such as heart disease, high blood pressure, and diabetes mellitus (Saqib et al., 2020), as well as counteracting stress (Kim & Han, 2016).

Figure 2 shows the percentage distribution of people according to their habit of exercising for 30 minutes or more each time they do it. As can be seen, most respondents did not exercise (62.7%) or did so for less than 30 minutes each session, which favors a sedentary lifestyle and a reduction in total energy expenditure.

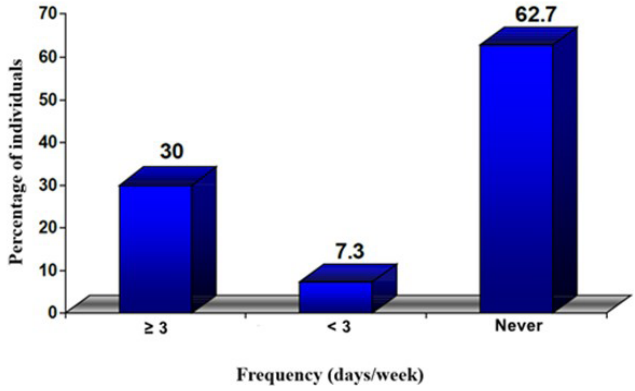

Figure 2. Percentage distribution of people's frequency according to whether they perform 30 minutes of physical exercise weekly.

This behavior promotes body weight gain and other metabolic disorders, such as diabetes mellitus (Carbone et al., 2019) and metabolic syndrome, which is characterized by hypertriglyceridemia, elevated LDL levels, reduced HDL cholesterol, arterial hypertension, overweight with central fat accumulation (intra-abdominal), and reduced insulin secretion with impaired glucose tolerance. These are high-incidence diseases worldwide (Jha et al., 2023).

Figure 3 shows the percentage distribution of individuals who presented values associated with a higher risk of suffering from chronic noncommunicable diseases, according to the biochemical indicators of nutritional status.

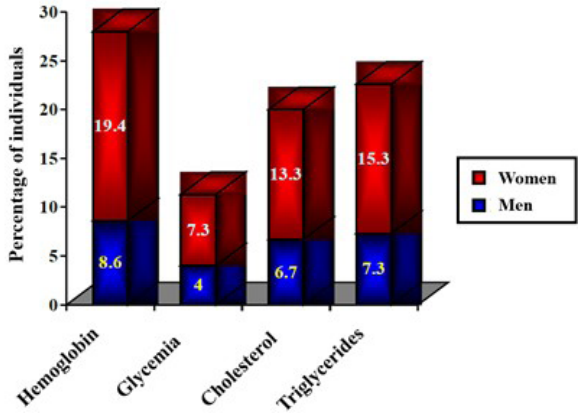

Figure 3. Percentage distribution of individuals with alterations in biochemical parameters.

More than a quarter of individuals (28%) presented hemoglobin values below normal ranges, with women contributing most to this result (19.4%). The prevalence of anemia was notable in men (26%), indicating possible severe iron deficiencies. 11.3% of cases showed elevated glucose levels, with 6% exceeding 6.1 mmol/L, indicating a risk of diabetes mellitus. The remaining 5.3% presented glycemia levels between 5.6 mmol/L and 6.1 mmol/L, which increases the risk of developing diabetes.

Elevated cholesterol levels were observed in 20% of subjects, while 22.6% had elevated triglyceride levels. A slight bias was noted towards men for elevated cholesterol, with 14% of men affected compared to 13% of women. The prevalence of elevated triglycerides was consistent between sexes, at 22%.

When combining biochemical risk parameters (cholesterol, triglycerides, and blood sugar), none of the individuals had elevated levels of all three indicators. However, 11 individuals (4 men and 5 women) showed combinations of ele-

vated cholesterol and triglycerides, indicating an increased risk of cardiovascular and cerebrovascular diseases.

Diabetes is considered one of the significant health challenges of the 21st century. Its complications, such as coronary artery disease, peripheral vascular disease, cerebrovascular events, diabetic neuropathy, amputations, kidney failure, and blindness, will increase disability, reduce life expectancy, and drive-up healthcare costs globally (Zakir et al., 2023). It is estimated that nearly 500 million people worldwide have diabetes, and this number is projected to increase by 25% by 2030 and 51% by 2045 (Saeedi et al., 2019).

Epidemiological studies have shown that coronary artery disease and cerebrovascular disease are two to three times more common in people with diabetes than in those without the condition. Cardiovascular disease is the leading cause of death in people with type 2 diabetes (Colom et al., 2021). Diabetes can cause cardiovascular injury in a variety of ways. Pathological processes are not independent, and each can accelerate or worsen the others. As the disease progresses, the heart and blood vessels suffer multiple damages (Galicia-Garcia et al., 2020).

Diabetes is associated with a higher prevalence of other risk factors, such as hypertension and dyslipidemia, in addition to being a risk factor itself. These factors combined significantly increase cardiovascular risk. For each risk factor present, the risk of cardiovascular death is three times higher in people with diabetes compared to those without the disease. Consequently, people with diabetes are two to four times more likely to develop cardiovascular disease than the general population (Bays et al., 2021).

The relationship between cholesterol concentrations and coronary mortality is direct and continuous, with no specific threshold value for the onset of risk of ischemic complications of atherosclerosis. The risk of coronary heart disease increases progressively as cholesterol levels are between 3.9 mmol/L and 5.2 mmol/L. From 5.2 mmol/L, the risk increases significantly, such that an individual with cholesterol between 6.24 mmol/L and 7.8 mmol/L has a coronary risk four times higher than those with levels below 5.2 mmol/L (Lloyd-Jones et al., 2003).

The physical activity of the population ranged from light sedentary to very active, depending on the job occupation of each respondent and the frequency and duration of physical exercise outside the workplace (van As et al., 2022), with the analyzed group having a weighted average energy value of 2432 kcal. Table 3 presents the average energy and macronutrient values of the foods offered during the two months of registration, observing that the energy offered is above 110%

Table 3. Macronutrient diet contribution

Indicator	Mean (Standard deviation)	Recommendations	Adequacy (%)
Energy (kcal)	3025.32 (232.1)	2432	124.40
Proteins (g)	98.08 (55.2)	73	134.36
Fats (g)	81.57 (23.04)	54.2	150.50
Carbohydrates (g)	467.86 (24.4)	413.3	113.20

adequacy, which is why it is classified as excessive.

A similar result was observed for macronutrients; the values for the dietary variables analyzed suggest a positive energy balance if maintained steadily, which may be a contributing factor to some extent to weight gain, whose long-term expression may be obesity (Hollstein & Piaggi, 2020).

Table 4 presents the percentage adequacy of vitamins and minerals in the diet. Thiamine and niacin met the nutritional recommendations regarding B vitamins, reaching the adequacy values (Mielgo-Ayuso et al., 2018). The average amounts of riboflavin, pyridoxine, and folic acid in the diets were below the minimum recommended values for both women and men.

Folic acid deficiency was reported to be considered an independent risk factor in cardiovascular disease since, together with deficiencies in other vitamins such as pyridoxine, increases in the concentration of the amino acid homocysteine were observed, which seems to promote coagulation and deterioration of the arterial wall (Wang et al., 2019).

Cyanocobalamin showed average levels that exceeded the recommended limit in the population analyzed, possibly due to the daily presence of meat on the institution's menus. Although deficits of these micronutrients could cause deficiency diseases in the medium and long term, excesses are not recommended either; however, in the case of cyanocobalamin, the excess is easily eliminated through body fluids since it is a water-soluble vitamin (González-Montaña et al., 2020).

It must ensure the adequate daily intake of B vitamins

since they perform essential functions in the body as coenzymes and cofactors in energy metabolism reactions. They are essential for functioning the muscular, nervous, and hematopoietic systems, the skin, and the gastrointestinal tract (Hanna et al., 2022).

Table 4. Adequacy of vitamins and minerals

Indicator	Adequacy (%)
Vitamins	
Vitamin A	89
Vitamin C	52
Vitamin E	62
Thiamine	111
Riboflavin	78
Niacin	90
Pyridoxine	87
Acid folic acid	65
Cyanocobalamin	140
Minerals	
Copper	324
Zinc	130
Iron	64
Calcium	88

Regarding mineral intake, copper and zinc exceeded the maximum adequacy limit (110%). These minerals are beneficial in the diet, as they are part of enzymes that inactivate free radicals, which could help prevent DNA damage and the oxidation of proteins and lipids, preventing radical reactions and the appearance of chronic diseases (Weyh et al., 2022). The high levels of copper in the diet were due to the daily consumption of various beans on the menus. On the other hand, red meat, chicken, and legume grains were the main foods contributing to zinc levels exceeding the maximum adequacy limit.

The calcium and iron content of the foods offered was inferior. The deficit could have compromised the nutritional status of these nutrients, affecting the nutritional status and health of the population analyzed early on. In this case, calcium is essential for forming and renewing bone tissue, so women, who made up the majority of the sample, could be at risk of osteoporosis (Šromová et al., 2023).

Iron may contribute to the development of iron deficiency anemia, the most common nutritional deficiency in the world, which causes fatigue, decreased productivity, and alterations in cognitive development (Kumar et al., 2022), which is reflected in this study, given the high percentages of women and men with hemoglobin values below the minimum desirable value. Variations in dietary habits, reduced energy expenditure associated with a sedentary lifestyle, and population aging, together with smoking and alcohol consumption, were the risk factors for suffering from chronic noncommunicable diseases (Ejigu & Tiruneh, 2023).

Figure 4 shows the toxic habits of the population studied. It was observed that most people were not dependent on these products. However, a relatively high percentage smoked more than six cigarettes a day (22% of the population), which classified them as frequent smokers. Regarding alcohol, it was not presented as a concern since only 25% of individuals consumed it occasionally, with a frequency less than once a week (Surma & Więcek, 2022).

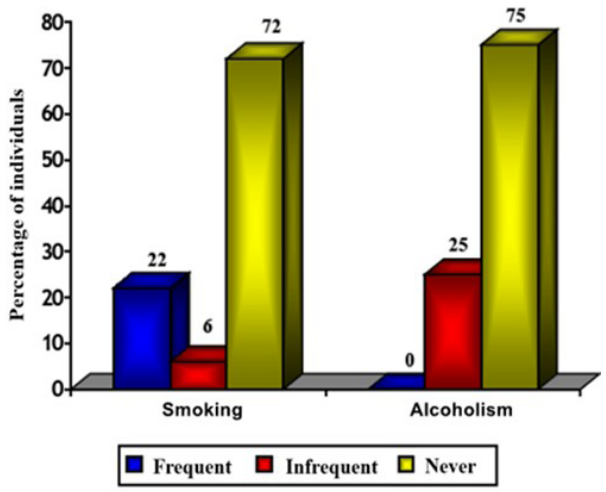

Figure 4. Percentage distribution of individuals with toxic habits.

One of the factors that possibly favored the surveyed workers could have been the ban on smoking and drinking in health facilities or a higher cultural and educational level than individuals working in other state agencies. Smoking is the leading cause of morbidity and mortality in most developed countries and is associated with a risk factor for respiratory and cardiovascular diseases and different types of cancer. It is especially harmful during pregnancy (Gallucci et al., 2020).

The exact number of cigarettes that constituted a risk for chronic noncommunicable diseases was not found because smokers generally have other risk factors, such as alcohol, high consumption of saturated fats, and cholesterol, mainly from red meat, among other foods (Kopp, 2022). It has been reported that a single cigarette could increase heart rate, respiratory rate, and blood pressure (Linneberg et al., 2015).

The relationship between alcohol consumption and mor-

tality risk has been compared in numerous epidemiological studies, with many indicating that the risk of primary ischemic heart disease decreased at all levels of alcohol intake, taking into account recognized cardiac risk factors (Norström & Landberg, 2023). High alcohol consumption and its relationship with blood pressure was associated with an increased risk of hemorrhagic and ischemic stroke. High consumption was a widely recognized and highly prevalent risk factor for hypertension, but few studies evaluated the effect of more moderate consumption on the risk of hypertension (Tumwesigye et al., 2020).

The short-term beneficial effect of moderate alcohol consumption on atherothrombotic events, including ischemic stroke, coronary heart disease, and peripheral arterial disease, as well as congestive heart failure, has been demonstrated. This hypothesis supports slowing clot formation by stimulating tissue plasminogen activators (Chiva-Blanch & Badimon, 2019).

Conclusions

Most of the health center workers were overweight, and a significant group was obese. In these cases, the risk of developing cardiovascular diseases and other non-communicable diseases is directly correlated with waist circumference, and over three-quarters of the participants had central obesity, confirmed by the waist-hip ratio. A considerable percentage of the individuals were classified as sedentary. The workers had iron-related conditions. High risks of chronic noncommunicable diseases were identified based on blood sugar, cholesterol, and triglyceride results. A small part of the sample showed a very high risk, presenting alterations in at least two of the biochemical indicators evaluated. The risk of chronic diseases could be increased due to the regular consumption of foods with high energy density, such as products rich in sugars, fried foods, fats, and meats. Among the habits considered to be risky, frequent cigarette consumption stood out as a significant factor that increases the probability of developing degenerative diseases.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: Patricia M. Espinel, Jesenia E. Rodríguez. **Data curation:** Jesenia E. Rodríguez. **Formal analysis:** Patricia M. Espinel, Jesenia E. Rodríguez. **Research:** Patricia M. Espinel, Jesenia E. Rodríguez. **Methodology:** Patricia M. Espinel, Jesenia E. Rodríguez. **Software:** Jesenia E. Rodríguez. **Supervision:** Patricia M. Espinel, Jesenia E. Rodríguez. **Validation:** Patricia M. Espinel, Jesenia E. Rodríguez. **Visualization:** Patricia M. Espinel, Jesenia E. Rodríguez. **Writing the original draft:** Patricia M. Espinel, Jesenia E. Rodríguez. **Writing, review and editing:** Patricia M. Espinel, Jesenia E. Rodríguez.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Statement on the use of AI

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