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Characterization of personal health determinants in a sample of adolescents from Hidalgo

Caracterización de determinantes personales de la salud en una muestra de adolescentes de Hidalgo

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Abstract:

Introduction: Personal health determinants are recognized as essential modifiable risk factors of chronic diseases. **Objective:** Characterize personal health determinants in a sample of adolescents. **Methods:** This descriptive, cross-sectional, retrospective study used the state databases of the Health Determinants and Healthy Lifestyle Monitoring Questionnaire from the 17 jurisdictions in Hidalgo, México 2020, with 66 items and four sections: Demographic information, health perception, and risk factors; perception of eating behavior; perception of physical activity behavior, weight, and height. Selection criteria were complete. The final sample consisted of n=687. Statistical analysis: We used the chi-square test and the odds ratio with a 95% confidence interval. **Results:** There were 69% women and 31% men (16.7 ± 1.6 years); 7.6% had short stature, 27.1% were possibly overweight, 11.2% were overweight, and 0.7% were obese. The adolescents from 17-19 years were 3 (95% CI 1.90, 4.78) times more likely to smoke tobacco. By sex, men were 1.5 (95% CI 1.02, 2.34), and were 2 (95% CI 1.19, 3.39) times more likely to have smoked e-cigarettes. Those between 17-19 years were 4.5 (95% CI 3.29, 6.26) times more likely to have their blood pressure measured, 3.5 (95% CI 2.52, 4.94) times their glucose measured, and 2.0 (95% CI 1.39, 3.10) times their lipids measured. Regarding exercise, 61.1% performed physical activity <30 min/day, and 66.5% sat for >2 hours. Men were 1.9 times more likely to engage in physical activity ≥3 times/week (95% CI 1.32, 2.72) and 1.8 times (95% CI 1.11, 2.97) to engage in ≥30 minutes/day; 66.2% reported consuming 1-2 glasses of sugary drinks daily. **Conclusions:** We found a high risk of overweight, cardiometabolic risk factors, physical activity, and consumption of sugary drinks and tobacco, with significant differences by sex and age.

Keywords:

Adolescents, Personal Health Determinants, Eating Habits, Addictions, Physical Activity.

Resumen:

Introducción: Los determinantes personales de la salud son reconocidos como importantes factores de riesgo modificables en las enfermedades crónicas. **Objetivo**: Caracterizar los determinantes personales de salud en una muestra de adolescentes. **Metodología**: Estudio descriptivo, transversal, retrospectivo. Se usaron bases de datos estatales del Cuestionario de Monitoreo de Determinantes de la Salud y Estilos de Vida Saludables de 17 jurisdicciones de Hidalgo, México 2020, con 66 items, 4 secciones: Información demográfica (sexo, edad), percepción de salud y factores de riesgo; percepción del comportamiento alimentario; percepción del comportamiento en actividad física, peso y talla. Después de aplicar los criterios de selección: la muestra final fue de n=687 registros. Análisis estadístico: Se utilizó la prueba de chi-cuadrado, y razón de probabilidades con un intervalo de confianza del 95 %.

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Resultados: Se evaluaron 69% mujeres, 31% hombres, con una media de edad de 16.7±1.6 años. 7.6% presentó baja talla, 27.1% riesgo de sobrepeso, 11.2% sobrepeso y 0.7% obesidad. Los adolescentes de 17-19 años tuvieron 3 (IC 95% 1.90, 4.78) veces mayor probabilidad de fumar. Por sexo, los hombres tuvieron 1.5 (IC 95% 1.02, 2.34), 2.0 (IC 95% 1.19, 3.39) de haber fumado cigarros electrónicos. De 17-19 años 4.5 (IC 95% 3.29, 6.26) veces más probabilidad de alguna vez haberse medido la presión arterial, 3.5 (IC 95% 2.52, 4.94) la glucosa en sangre, 2.0 (IC 95% 1.39, 3.10) los lípidos. 61.1% realizó actividad física <30 min/día y 66.5% está sentado >2 horas. Los hombres tuvieron 1.9 mayor probabilidad de realizar ejercicio ≥3 veces/semana (IC 95% 1.32, 2.72) y 1.8 (IC 95% 1.11, 2.97) de realizar ≥30 minutos/día. 66.2% consumió 1-2 vasos diarios de bebidas azucaradas. **Conclusiones**: Se observó alto riesgo de sobrepeso, factores de riesgo cardiometabólicos, actividad física, consumo de bebidas azucaradas y tabaco, con diferencias significativas por sexo y edad.

***Palabras Clave**:*

Adolescentes, Determinantes Personales de la Salud, Hábitos de Alimentación, Adicciones, Actividad Física.

INTRODUCTION

Personal health determinants are recognized as essential modifiable risk factors of chronic non-communicable diseases (CNTD).[1,2] This group of personal, social, and environmental factors influences healthy behaviors and lifestyles and creates the necessary and intermediate conditions to determine a person´s health.[3,4] Regarding lifestyles, the World Health Organization (WHO) proposes monitoring eight risk factors that have reflected much of the burden of CNTD: smoking, alcohol consumption, nutrition, physical inactivity, obesity, high blood pressure, blood sugar, and blood lipids.[5]

According to the WHO, adolescence is the growth period that occurs after childhood and before adulthood, between 10 and 19 years of age. The WHO reports 1,200 million adolescents, representing 16% of the world population. It is history's largest, most educated, and most urbanized generation. In addition, 90% of adolescents live in low and middle-income countries, and 125 million in areas with armed conflict.[6] CNTD is a serious public health problem in the adult population. In the case of adolescents, it is possible to identify the risk factors that predispose them, such as overweight and obesity, at increasingly earlier ages.[7]

In the last 30 years, in Mexico, overweight and obesity have become an epidemic that affects one in three adolescents and children. In 2021, the United Nations Children's Fund warned Mexico that these conditions are a public health emergency that requires immediate changes since they affect children's and adolescents' growth and physical and mental development.[8] The national prevalence reported in adolescents 12 to 19 years old in 2020 was 24.7% (26.4% women, 23% men) overweight and 18.0% (15% women, 21.5% men) obese.[9] Most overweight and obesity cases are due to primary or nutritional causes, with polygenic characteristics associated with an obesogenic environment. It includes a sedentary lifestyle and a disproportionate ingestion of calories, often dependent on the family and community environment in which children and young people are raised.[10] Healthy eating is a multifaceted concept, which is not only related to nutritional guidelines but also to the various definitions that consumers associate with food consumption, such as acceptance, quantities, preparations, and frequency.[11] Therefore, evaluating food consumption is essential to achieve a complete nutritional diagnosis.[12]

On the other hand, according to the Global Status Report on Physical Activity 2022, about 81% of children between 11 and 17 years do not meet the physical activity recommendations of the WHO.[13] The Mexican Physical Activity Report for Children and Adolescents concluded that Mexico has low movement behaviors and limited performance opportunities. It reported that only 34.5% meet physical activity recommendations, 48.4% participate in organized sports, 35-75.8% practice active outdoor play, 54.1% use active transportation, and 43.6% spend <2 hours in sedentary behavior per day.[14] Alcohol and tobacco consumption are risk factors for various health problems, including infectious and chronic diseases. Their consumption continues to increase in adolescents. In 2020, the prevalence of current smokers was 1.9% in adolescent women and 7.4% in adolescent men. The consequences of excessive consumption include the risk of mental disorders, violence, self-inflicted injuries, and injuries to others. At the same time, tobacco use increases the risk of suffering different types of cancer, chronic obstructive pulmonary disease, and cardiovascular disease.[15]

According to United Nations International Children's Emergency Fund (UNICEF), "the adolescent brain develops at an unseen rate since early childhood," which leaves them hypersensitive to environmental influences. The quality of these environments and their relationships and experiences determine their possibilities, in addition to the help and care they receive, access to services, social norms that govern their communities, and the degree to which they can influence the decisions that affect them. Their tendency to seek out new experiences can serve as a stimulus for them to innovate and achieve goals, but it can also increase their vulnerability to addictions.[6]

CNTD risk factors are followed in Mexico, and health promotion services are provided with a life course approach that promotes positive health determinants. However, there is not enough documented national evidence on the efficacy of these health promotion interventions. This situation hinders the sustainable action necessary for informed decision-making to formulate public policies that contribute to improving health and forging alliances with other sectors.[16] Thus, this research aimed to characterize personal health determinants in a sample

of adolescents from Hidalgo. The data for this study comes from the Hidalgo Health Promotion area, which annually evaluates the population with pre- and post-health promotion interventions to assess the results and impact of the health promotion actions offered to the state populations. This study used the pre-intervention database.

MATERIALS AND METHODS

This is a descriptive, cross-sectional, retrospective study of a sample of adolescents and the protocol was evaluated and approved by the Ethics and Research Committees of the Health Services of Hidalgo (FSSA2021103). The study complied with the ethical standards of the Declaration of Helsinki.

Data collection

This study reviewed 7,508 records from databases in the 17 jurisdictions of Hidalgo in 2020, with age ranges of 8-90 years. The inclusion criteria for this study were adolescents aged 10-19 years according to the WHO (n=800).[6] Eliminating n=100 records because their age frequencies were very low (10-37 study subjects), and n=13 that did not have a record of weight and height, leaving a total of n=687. According to the General Health Promotion Administration, the Strategies and Development of Healthy Environments Administration, and the Intersectoral Policies in Health Administration of The Ministry of Health of Mexico, the databases are established at a state level in areas identified with prevalences of poor nutrition, overweight and obesity, as well as other risk factors for the development of CNTD, in public, work, and school environments.[17]

The information in the databases on personal health determinants came from the "Health Determinants and Healthy Lifestyle Monitoring Questionnaire", which aimed to reflect knowledge, attitudes, and behaviors constructed as an adaptation of the WHO progressive method for monitoring risk factors for noncommunicable diseases (STEPS);[5] the Module of Sports Practice and Physical Exercise Questionnaire (MOPRADEF) from the INEGI;[18] the questionnaire to assess the eating behavior of Mexican students in the health area from the University of Guadalajara and the Healthy and Safe Work Environments Program Diagnostic tool for workers of the ISSSTE (Institute of Social Security and Services for State Workers).[19,20] The questionnaire is applied annually by health promotion personnel to a population in specific settings (school, work, or community).[17] It consists of 66 questions divided into four sections: 8 questions on demographic information (time of application, code, date, entity, sex, age, highest level of education, current employment status); 16 multiple choice questions on health perception and risk factors; 31 questions on perception of eating behavior; 10 questions on perception of physical activity behavior, and four anthropometric measurements (weight, height, waist, and hip circumference). It aims to determine a final score, assigning 1 point to responses of a positive determinant of health and zero (0) to responses indicating unfavorable health factors.[3] For this study, all items were described. The sociodemographic data, age and sex, and the anthropometric measurements, weight (kg) and height (cm), were taken by trained and standardized nutritionists of the operational program,[17] and used to calculate the WHO child growth indicators, with Height-for-Age Z Scores cut-offs value "normal" (> -1 SD to >+2 SD), "stunting" (< -2 SD) and "Severe stunting" < -3 SD. And the BMI (Body Mass Index) For Age cut-offs value: "Severely wasted" (< -3 SD), "Wasted" (<-2 SD), "Normal weight" (< +1 SD to > -2 SD), "Possible Risk of Overweight" (> +1 SD to +2 SD), Overweight (> +2 SD to +3 SD), and Obese" (> +3 SD).[21] The WHO AnthroPlus Software was used for children and adolescents aged 5 to 19.[22] Age was classified according to the WHO into two categories: 14-16 years (middle adolescence) and 17-19 years (late adolescence).[23]

Statistical analysis

The databases were exported and analyzed with SPSS version 24 for Windows. We used Pearson's chi-squared test for statistical analysis with a significance of $p<0.05$, and odds ratio with a 95% confidence interval.

RESULTS

The total number of evaluated adolescents was n=687, 31% male and 69% female. Table 1 shows it, with other sociodemographic characteristics of the participants, together with the results of the BMI-for-age and height-for-age indicators in the overall sample. The Health Determinants and Healthy Lifestyle Monitoring Questionnaire includes the Food Consumption Frequency Recall section, summarized in Table 2, with no statistically significant differences by age and sex for all the foods evaluated. The rest of the Questionnaire items that showed significant differences by age or sex are summarized in Table 3. The results analysis found that 9.8% of all adolescents reported excellent health, 26.1% very good, 45.9% good, 26.1% fair, and 0.7% poor. Regarding body weight, 21.0% reported feeling overweight, 6.7% underweight, 14.3% did not know, and 58.1% said they had a healthy weight. 58.1% visited a health service in the past year, while the remainder did not (40.1%). The questions related to blood pressure, glucose, and blood lipids measurement showed no statistically significant differences by age group or sex. The values of those with affirmative responses to risk were low: 3.1% reported having heart problems, 13.1% experienced chest pain during exercise, 8.9% experienced loss of balance or consciousness, 3.8% were diagnosed with high blood pressure, 2.5% were receiving treatment. 1.7% had high glucose levels, and 19% were in treatment, 3.6% were diagnosed with dyslipidemia-related diseases, and 3.1% were in treatment. 16.7% of the total sample had smoked cigarettes, with 31.4% having done so over a month ago, 30.6% more than a year ago, 24.1% in the past week, 9.5% the last 30 days, and 4.4% on the day of the survey (n=137). Of those who reported having smoked at least once (n=102), 59.8% said they tried to quit, and 40.2% had not. 19.0% mentioned having tried electronic cigarettes (n=374).

***Table 1**. Description of sociodemographic variables and growth indicators BMI-for-age and Height-for-age in total sample*

Variables	%
Age	
Average age	16.7±1.6
14-16 years old	44
17-19 years old	56
Sex	
Men	31
Woman	69
BMI-for-age	
Normal weight	58.7%
Risk of overweight	27.1%
Overweight (%)	11.2%
Obesity (%)	0.7%
Emaciation (%)	1.7%
Severely emaciated	0.6%
Height-for-age	
Normal	91.3%
Stunting	7.6%
Severe stunting	1.1%

n=687; Own elaboration; BMI: Body Mass Index

In the analysis of alcohol consumption, no significant differences were observed by sex, but there were differences by age (Table 3). In the total sample, 42.2% had consumed alcoholic beverages at least once, while the rest had not (57.8%); by age, 27.2% of middle adolescents vs. 54% of late adolescents reported having consumed alcohol at least once. The frequency of alcohol consumption was at least once a month for 15.4% of adolescents aged 14-16 years vs. 32.3% of adolescents aged 17-19 years; at least once a week was reported by 1.8% of younger adolescents vs. 7.7% of late adolescents; in the category of daily consumption, there were no reports for middle adolescents vs. 0.3% for older ones; in the no consumption category, 82.8% were middle adolescents and 59.7% were late adolescents.

For responses regarding the likelihood of alcohol consumption, it was rated as not probable for 53% of adolescents aged 14-17 years vs. 37.1% for older adolescents, somewhat unlikely for 28.3% vs. 30.5%, quite likely for 15% vs. 23.8%, and very likely for 3.7% vs. 8.6%, respectively. Regarding alcohol abuse, defined as the frequency of getting drunk, which was the only question with statistical significance by sex and age, it was found that 12.7% of women vs. 17.8% of men reported getting drunk at least once a year; 3.4% of women vs. 7.1% of men had done so at least once a month, and 1.5% of women vs. 0.5% of men at least once a week. 14.7% of women vs. 12.2% of men reported not consuming alcohol. By age, 7.9% of middle adolescents expressed having been drunk, vs. 19.3% of late adolescents. 3.2% of women vs. 5.7% of men reported getting drunk at least once a month; 0.3% vs. 1.8% at least once a week, and 17.2% of adolescents aged 14-16 reported not consuming alcohol vs. 11.5% of older adolescents aged 17-19.

***Table 2.** Consumption frequency recall of a sample of adolescents*

Product	n	Daily	Week	Month	Seldom	Never
Packaged foods	682	9.5	40.2	22.1	26.1	2.1
Packaged sugary drinks	687	16.7	44.1	19.9	17.9	1.4
Desserts and sweet foods	687	8.9	39.2	24.9	23.1	3.9
Meat products	684	31.0	52.6	8.0	8.0	0.4
Fish and seafood	684	11.7	23.7	33	27.5	4.1
Dairy	683	40.3	42.6	8.2	7.9	1.0
Cereals and tubers	678	70.2	23.2	3.4	2.8	0.4
Legumes	673	36.1	48.4	7.1	7.6	0.8
Egg	687	33.5	50.1	7.6	7.8	1.0
Oilseeds	686	17.3	27.1	28.3	23.1	4.2
Plain water	684	85.7	8.5	1	4.7	0.1
Fruit	686	69.1	26.2	2.1	23	0.3
Vegetable	684	64.6	29.1	3.1	3.1	0.1

Values are percentages. Own elaboration

Fruit consumption showed statistically significant differences only by age. The percentage of late adolescents who denied consuming fruit was 0.3% compared to 1.6% of older adolescents. 31.3% of adolescents aged 14-16 years reported consuming one piece per day, vs. 35.6% of adolescents aged 17-19 years; 2-3 servings per day by 51% vs. 52.5%, respectively; and 4-5 servings per day by 17.5% vs. 10.4%. No significant differences were identified in vegetable consumption by age and sex. Due to its importance, the results are broken down for the overall sample: 29.3% reported consuming one piece per day, 52.7% 2-3 pieces or servings per day, 16.7% 4-5 pieces per day, and 1.3% reported not consuming any vegetables. The consumption of plain-water glasses differed significantly by age: 27.2% of adolescents aged 14-16 years reported consuming 1-2 glasses per day compared to 18.4% of those aged 17-19 years; 46% vs. 40.8% for 3-5 glasses per day; 20.2% vs. 29.6% for 6-8 glasses per day; and 5.0% vs. 10.4% for more than 8 glasses per day, respectively.

***Table 3**. Results of the Health Determinants and Healthy Lifestyles Monitoring Questionnaire in evaluated adolescents that showed differences by sex and/or age.*

Ask	Sex p-value	Age p-value
	n=687	
Perception of your health	0.002	0.000
Perception of body weight	0.676	0.000
Blood pressure measurement by health professionals	0.285	0.000
Diagnosis of high blood pressure or hypertension	0.029	0.328
Blood glucose measurement by a healthcare professional	0.074	0.000
Diagnosis of high blood glucose or diabetes	0.087	0.055
Prescription of medication to control high glucose	0.985	0.036
Measurement of cholesterol and triglycerides in blood	0.038	0.000
Diagnosis of dyslipidemias by a health professional	0.098	0.220
Smokes or has smoked cigarettes	0.039	0.000
If you smoke, have you tried to quit smoking? n=102	0.052	0.166
If you have never smoked cigarettes, the probability of doing so, n=374	0.033	0.015
Has tried electronic cigarettes n=374	0.008	0.285
Have you ever consumed alcoholic beverages?	0.495	0.000
Frequency with which you consume alcoholic beverages n=604	0.613	0.000
If you do not consume alcoholic beverages, the probability of doing so, n=683	0.686	0.000
If you have already consumed alcoholic beverages, how likely are you to do so again? n=686	0.912	0.000
How often have you been drunk? n=686	0.046	0.000
Thinking about your daily diet, do you think that it is: varied, adequate, sufficient, complete, and hygienic?	0.323	0.004
Amount of fruit consumed on a typical day	0.282	0.019
Most consumed drink on a normal day	0.335	0.055
Number of glasses of plain water consumed on a typical day	0.093	0.001
What actions would you take to reduce salt consumption	0.003	0.202
Spaces or situations that you consider necessary to improve your diet	0.041	0.001
Do physical activity at least 3 times a week	0.000	0.687
Reasons why you do or would do physical activity	0.000	0.000
Days per week that you do physical activity, n=686	0.000	0.338
Minutes per day of physical activity, n=355	0.015	0.157
Intensity of the physical activity you perform	0.000	0.001
It has public facilities nearby for physical activity	0.044	0.413

Pearson Chi Square Test; Own elaboration.

Consuming one glass per day of soda or juice did not show significant differences by age and sex; however, the values are presented due to their importance in the diet: in the overall sample, 66.2% consumed 1-2 glasses per day, 16.2% consumed 3-5 glasses per day, 3.6% consumed 6-8 glasses, 0.2% consumed more than 8 glasses, and 13.8% did not consume these beverages at all. Responses to what they consider necessary to improve their diet were significant by age. 24.8% of younger adolescents aged 14-16 years indicated that they needed more information compared to 17.1% of older adolescents aged 17-19 years; 24.2% and 24.9%, respectively, felt they needed to see a health professional; 16.9% vs. 18.2%, respectively, required healthier options; 12.6% vs. 21.6% wanted time to prepare their meals; 7.9% vs. 9.9% needed greater personal motivation; and 14.2% vs. 7.3% felt their diet was healthy. 0.3% vs. 1.0% were not interested in improving

their diet. The odds ratios (OR) and their confidence intervals were obtained for variables with dichotomous responses, by age group, 14-16 and 17-19 years, and by sex (Table 4).

For age, late adolescents aged 17-19 years were 4.5 times more likely to have ever measured their blood pressure (95% CI 3.29, 6.26), 3.5 times more likely their blood glucose (95% CI 2.52, 4.94), 2.0 times more likely their blood lipids (95% CI 1.39, 3.10) and 3.0 times more likely to smoke or have smoked tobacco (95% CI 1.90, 4.78) than middle adolescents aged14-16 years. By sex, men were 1.5 (95% CI 1.02, 2.34) times more likely to smoke or have tried tobacco, 2.0 (95% CI 1.19, 3.39) times more likely to have smoked e-cigarettes, 1.9 (95% CI 1.32, 2.72) times more likely to engage in physical activity at least three times per week, and 1.8 (95% CI 1.11, 2.97) times more likely to engage in exercise ≥30 minutes/day.

***Table 4**. Probabilities and confidence intervals of items with statistically significant dichotomous responses*

Ask	p	OR	IC 95%
By age			
Blood pressure measurement by health professionals	0.000	4.5	3.29, 6.29
Blood glucose measurement by healthcare professionals	0.000	3.5	2.52, 4.94
Measurement of cholesterol and triglycerides in blood	0.000	2.0	1.39, 3.10
Smokes or has smoked cigarettes	0.000	3.0	1.90, 4.78
By sex			
Smokes or has smoked cigarettes	0.039	1.5	1.02, 2.34
Have tried electronic cigarettes n=374	0.008	2.0	1.19,3.39
Do physical activity at least 3 times a week	0.000	1.9	1.32, 2.72
Minutes per day of physical activity, n=355	0.015	1.8	1.11, 2.97

p=p-value; Pearson Chi Square Test; Own elaboration.

Table 1 also presents the classification of the Height-for-age indicator based on Z-score anthropometric indicators. 91.1% of participants had a Height-for-age classification within normal limits according to WHO standards. Among the adolescents diagnosed with stunting (7.6%), 1.1% were severe, and no statistically significant differences were observed by age (p=0.197) or sex (p=0.924). Regarding the BMI-for-age indicator, we classified 58.7% of the individuals as having a normal weight, 27.1% as being at risk of being overweight, and the combined prevalence of overweight and obesity was 11.9%. There were no statistically significant differences by age (p=0.197) or sex (p=0.09).

DISCUSSION

Differences by age and sex were found in the analysis of personal health determinants in a sample of adolescents from Hidalgo. In general, 81.8% perceived their health as good and excellent; however, more than half of the men considered their health as excellent (16.0%) compared to women (7.0%) (p=0.000). By age (p=0.00), a moderately higher number of youths aged 14-16 years perceived their health as "excellent" (15.3% vs. 5.5% of those aged 17-19 years).

Regarding body weight, 58.1% reported it as healthy, a value not far from the actual proportion of the Body Mass Index-for-age, normal weight (58.7%). By age, individuals 17-19 years said they felt more weight (26.8% vs. 13.6%). However, when considering the classification of normal weight by BMI-for-age, contrary to their perception, older adolescents (17-19 years) showed a higher proportion of normal weight (64.4% vs. 51.3%) and a lower percentage of malnutrition due to excess (33.5% vs. 46.0%), which includes the sum of the risk of overweight, overweight, and obesity. There are validated tools and questionnaires to measure the perception of body image and satisfaction-dissatisfaction, which suggests the need to evaluate them in future surveys. However, these data are consistent with the literature on perception and dissatisfaction with body image, which are often associated with risk eating behaviors in adolescents.[24]

Regarding health care associated with CNTD, we identified differences in outcomes by age in blood pressure, blood glucose, and blood lipid measurements. Youths aged 17 to 19 years were 4.5 times more likely to have had their blood pressure measured than younger adults (14-16 years) (95% CI 3.29,6.26), 3.5 times more blood glucose (95% CI 2.52,4.94) and 2.0 times more blood lipids (95% CI 1.39, 3.10). Despite the low proportions of individuals who responded that they had been diagnosed and treated for having risk values for blood pressure, glucose, and blood lipids, it is known that the onset of pathological processes can arise during childhood and adolescence, leading to the appearance of the disease in young adulthood. But if they are not measured, they cannot be detected.[25]

On the other hand, the prevalences show that the comorbidity of overweight and obesity is present in 39.0% (with the sum of the risk of overweight at 27.1%, overweight at 11.2%, and obesity at 0.7%). Although BMI-for-age is considered the best anthropometric measure in adults, it remains a standard along with the Height-for-age indicator in the pediatric population.[21] Obesity and hyperlipidemia usually go hand in hand. Hyperlipidemia is considered a high-impact cardiovascular risk factor.[26] For example, high cholesterol in childhood is a strong predictor of atherosclerosis in middle adulthood, often asymptomatic, which is why we seek to detect sensitive and crucial ages for its detection in childhood.[27]

Referring to the combined prevalence of overweight, obesity, and risk of overweight obtained in this study (39.0%), it is consistent with those reported at the national level (39.3%) and state level (41.1%).[9,28] The serious problem of overweight and obesity in Mexico at all ages has already been the subject of study due to the implications for health and well-being. Stakeholders at all levels (parents, teachers, school and health personnel, and industry) must recognize that childhood and adolescent obesity is a shared responsibility that requires action at various levels to achieve significant healthy lifestyles and compelling improvements in health.[29] Our study shows that 47.3% said they did not have public facilities nearby to do physical activity, and 17.3% have them but are in poor condition. On the other hand, our results also show that men are 1.9 times more likely (95% CI 1.32, 2.72) to do physical activity at least three times a week and 1.8 (95% CI 1.11, 2.97) to do so ≥30 minutes/day, from here the hypothesis arises as to whether it is a question of gender perspective, where men have more freedom to go out to do physical activity in distant facilities and alone. The differences by sex are relevant since, for example, in this study, it was identified that the primary motivation of men to do physical activity was for fun, vs. women, which was to relax and reduce stress, and for health. Their proportions are similar when doing physical activity to look good. Another finding was that more than half of the sample evaluated (61.1%) engaged in physical activity for less than 30 min/day (recommended time). In addition, a moderate intensity was identified for the most part (45.0%) and 66.5% reported sitting for more than 2 hours a day. Among the main reasons for not doing physical activity were lack of time, fatigue, lack of facilities, inadequate schedules, lack of motivation, and health problems, in that order.

On the other hand, the characteristics of eating behavior are established during adolescence and persist into adulthood.[11] In our study, 66.2% considered their diet healthy, 20% correct, a term in nutrition that means being complete (in integrity), sufficient (in quantity), balanced, harmless (safe), accessible (economical and available), varied, with social value (compatible with the group to which it belongs), and adequate (to the characteristics and circumstances of the diner).[12] Close to 40% commonly eat between meals (snacks) and foods not recommended for daily consumption (cookies or sweet bread 19.2%, salty snacks 14.8%, candy and chocolates 4.8%). According to ENSANUT 2020, snacks, candies, and desserts were consumed by 46.1%, sweetened cereals by 35.5%, and fast food by 34.2%.[9] Of the adolescents in this study, 70% consume fruit daily, almost half eat 2-3 servings a day (51.8%), 33.6% eat one serving, and 13.5% eat 4-5 servings. The same occurs with the vegetable consumption, 64.6% do so daily and in quantities of 2-3 servings (52.7%), 29.3% eat one serving, and 16.7% eat 4-5 servings. The significant differences by age in fruit consumption could indicate a greater concern for younger adolescents by their parents. Vegetable consumption did not show differences after adjusting for age and sex. Nearly 50% of adolescents consume eggs, meat, and dairy products for animal-based protein, and legumes for plant-based protein. Nationally, the reported consumption of these recommended foods (ENSANUT 2020) was 42.5% of fruits, and only one in three adolescents consume vegetables.[9]

According to the frequency questionnaire, 16.7% of adolescents consumed packaged sugary drinks daily, and 44.1% consumed them weekly. In Mexico, in the 5-19 year-old population, 60% exceeded the 10% recommended limit for energy from added sugars. The sweetened beverages group had the highest contribution to this high intake.[30] It is interesting that women consider that their diet could improve by having more healthy options and more time (12.2 and 19.8%, respectively) vs. men (14.1 and 12.5%, respectively) (p=0.04). In summary, they consider that to improve their diet, they require information (including that of an expert), healthier options, and time, so that interventions could consider strategies regarding these points.

Regarding tobacco and alcohol characterization consumption in the evaluated adolescents, 16.7% had smoked, and 9.5% had smoked in the last 30 days. Older adolescents (17-19 years) (OR=3.0, 95% CI 1.90, 4.78) and males (OR=1.5, 95% CI 1.19, 3.39) had the highest risk of smoking or having smoked. 83.3% had not tried tobacco, according to the questionnaire; however, 65% reported the intention to smoke. Smoking continues to be the main preventable risk factor for chronic diseases such as ischemic heart disease, cerebrovascular disease, respiratory infections, and chronic obstructive pulmonary disease, four of the main causes of death worldwide. Tobacco use in adolescence represents a serious risk for individual health, as it is associated with greater intensity of use and nicotine addiction in adulthood. In México (ENSANUT 2022), 4.6% of adolescents (10 to 19 years) reported currently smoking, 3.7% smoked in the past, and 91.7% had never smoked. Moreover, the sale and distribution of e-cigarettes is prohibited in Mexico; however, nationally, 2.6% of adolescents use them.[31] This study reported 19.0% having tried e-cigarettes, and again, it was men who were up to 2 times more likely to do so (95% CI 1.19, 3.39). It is known that children and adolescents who use e-cigarettes are at least twice as likely to smoke cigarettes later in life.[32]

Regarding alcohol consumption, our study found that 42.2% had consumed it at some point. In Mexico, the prevalence is 20.6%, and in the last month, 5.2%. At the national level, 13.9% consumed alcohol excessively over this year, and the prevalence was higher in older people, in a higher socioeconomic level, and in those without studies.[33] Our study shows that 20% abuse alcohol, especially men (p=0.046) and older individuals (17-19 years, p=0.000) in higher proportions and more frequently. Alcohol consumption has enormous health effects, with intoxication, dependence, and a higher rate of injuries associated with alcohol consumption, which leads to an increase in deaths and disabilities in this age group.[34] Globally, almost 1 in 5 adolescents reported having consumed alcohol.

Levels are highest in Western Europe and North America, where 6 in 10 adolescents have consumed alcohol.[35]

CONCLUSIONS

This research demonstrates sex- and age-related differences in certain evaluated items, including screening clinical and biochemical indicators associated with non-communicable diseases (NCDs), more frequently measured in late adolescents (17–19 years old) and females. Males and late adolescents are the groups at higher risk of exposure to the effects of tobacco use, including electronic cigarettes. From a dietary perspective, consuming 1–2 daily servings of packaged sugary beverages (approximately 250–500 mL/day) by more than half of adolescents is a concerning finding. Accompanied by a high intake of unhealthy foods such as snacks, and the moderate consumption of fruits and vegetables. On the other hand, males were more likely to engage in exercise three times per week (OR: 1.9) and to perform at least 30 minutes of physical activity per day (OR: 1.8). This difference may be influenced by safety concerns and limited accessibility for females, as nearly half of the sample lacked access to nearby public facilities for physical activity, and 17.3% reported having access to facilities in poor condition. Identifying personal health determinants enables the development of targeted and structured interventions and improvements in existing health promotion programs.

We recommend that future surveys be administered separately for different age groups rather than as a general assessment. Additionally, we suggest including variables such as body image perception, body image satisfaction/dissatisfaction, risky eating behaviors, academic stress, stress-induced food consumption, and food availability and accessibility, as these issues are particularly relevant to specific age groups. This recommendation stems from applying the current questionnaire to a broad demographic that includes adolescents, adults, and older adults.

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