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Original

HÁBITOS DE CUIDADO DE LA PIEL Y FACTORES DE RIESGO DE CÁNCER DE PIEL EN ESTUDIANTES MEXICANOS DE EDUCACIÓN FÍSICA

SKIN CARE HABITS AND SKIN CANCER RISK FACTORS OF MEXICAN PHYSICAL EDUCATION MAJORS

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The instrument comprises nominal and ordinal questions formatted as open, single, and multiple-choice

RESUMEN

Objetivo: Identificar factores de riesgo, hábitos de cuidado de la piel y exposición solar en estudiantes de Educación Física en México. **Métodos:** Se aplicó un cuestionario semi estructurado validado, autoadministrado en línea, con preguntas nominales y ordinales con formato abierto, de opción única y de opción múltiple, a 847 estudiantes universitarios (571 hombres y 276 mujeres). **Resultados:** La edad promedio de los participantes fue de 21.9 ± 3.4 años. La exposición solar fue similar entre hombres y mujeres ($\chi^2 = 9.1$; $p = 0.107$). La mayoría de los estudiantes se expusieron al sol entre las 11:00 y las 12:59 horas y no reportaron quemaduras solares ($\chi^2 = 420.8$; $p \leq 0.0001$) ni manchas en la piel ($\chi^2 = 337.9$; $p \leq 0.0001$). Más hombres que mujeres se aplicaron productos de protección cutánea antes de realizar actividades al aire libre ($p = 0.010$). Los participantes expresaron poco interés en ser examinados por un dermatólogo. **Conclusiones:** Existe la necesidad de realizar campañas de concientización sobre el cuidado de la piel entre los jóvenes estudiantes de Educación Física mexicanos, ya que no toman medidas adecuadas para prevenir lesiones ocasionadas por la exposición crónica a la radiación ultravioleta.

Palabras clave: cáncer de piel, estudiantes, exposición al sol, radiación ultravioleta, México

SKIN CARE HABITS AND SKIN CANCER RISK FACTORS OF MEXICAN PHYSICAL EDUCATION MAJORS

ABSTRACT

Objective: This study aimed to identify Mexican Physical Education students' risk factors, skin care habits, and sun exposure. **Methods:** A validated semi-structured questionnaire comprised of nominal and ordinal questions in open, single-choice, and multiple-choice format was self-administered online by 847 college students (Men = 571, Women = 276). **Results:** The average age of the participants was 21.9 ± 3.4 yr. Both men and women had similar sun exposure ($\chi^2 = 9.1$; $p = 0.107$). Most students were exposed to the sun between 11:00 am and 12:59 pm and reported no instances of sunburn ($\chi^2 = 420.8$; $p \leq 0.0001$) or skin spots ($\chi^2 = 337.9$; $p \leq 0.0001$). More men than women applied skin protection products before outdoor activities ($p = 0.010$). The participants expressed little interest in being examined by a dermatologist. **Conclusions:** There is a need for awareness campaigns about skincare among young Mexican Physical Education students, as they do not take adequate measures to prevent injuries caused by chronic exposure to ultraviolet radiation.

Keywords: sun exposure, ultraviolet radiation, skin cancer, students, México



HÁBITOS DE CUIDADOS COM A PELE E FATORES DE RISCO DE CÂNCER DE PELE DE CUIDADOS COM A EDUCAÇÃO FÍSICA MEXICANOS

RESUMO

Objetivo: Este estudo teve como objetivo identificar os fatores de risco, hábitos de cuidados com a pele e exposição ao sol de estudantes mexicanos de Educação Física. **Métodos:** Foi aplicado um questionário semiestruturado validado, autoaplicável on-line, com questões nominais e ordinais nos formatos aberto, de escolha única e múltipla escolha, foi preenchido por 847 estudantes universitários (homens = 571, mulheres = 276). **Resultados:** A idade média dos participantes foi de $21,9 \pm 3,4$ anos. Homens e mulheres tiveram exposição solar semelhante ($\chi^2 = 9,1$; $p = 0,107$). A maioria dos estudantes foi exposta ao sol entre 11h00 e 12h59 e não relatou casos de queimaduras solares ($\chi^2 = 420,8$; $p \leq 0,0001$) ou manchas na pele ($\chi^2 = 337,9$; $p \leq 0,0001$). Mais homens do que mulheres aplicaram produtos de proteção da pele antes de atividades ao ar livre ($p = 0,010$). Os participantes expressaram pouco interesse em serem examinados por um dermatologista. **Conclusões:** Há necessidade de campanhas de conscientização sobre cuidados com a pele entre jovens estudantes mexicanos de Educação Física, pois eles não tomam medidas adequadas para prevenir lesões causadas pela exposição crônica à radiação ultravioleta.

Palavras-chave: exposição ao sol, radiação ultravioleta, câncer de pele, estudantes, México



INTRODUCTION

Solar radiation has a myriad of adverse effects on humans, including sunburn, immunosuppression, photo aging, and photo carcinogenesis (Garnacho Saucedo et al., 2020). Skin cancer is a primary occupational disease for specific professions that involve high exposure to the sun and ultraviolet radiation (UVR) (Glanz et al., 2007; Ramirez et al., 2005; Reeder et al., 2013; Reinau et al., 2013). Physical Education (PE) professionals, in particular, are at a higher risk due to their chronic exposure to the sun and UVR while working outdoors (Moncada Jiménez et al., 2004; Oliveira et al., 2011; Rizo Agüera et al., 2008; Rombaldi et al., 2017). It is important to note the given the nature of their profession, PE are responsible for promoting healthy lifestyles and habits among children and adolescents. In many countries, PE teachers typically work during hours when UVR levels are categorized as “very high” to “extremely high” (Barajas Pineda et al., 2022). This is concerning given their reported poor skincare habits, lack of interest, limited knowledge, and perceived risk associated with prolonged sun exposure (Castillo Zambrano, 2024; Guillén Prieto et al., 2023; Moncada-Jiménez & Meneses Montero, 2004; Sarmiento Barrera, 2020).

Several studies have explored parents' knowledge, attitudes, and skincare habits with their infants (Cos-Reyes et al., 2016), young children (Ramírez Wong et al., 2016), adolescents and young adults (Girón & Barrera, 2016; Huaman Campos & Ruiz Suasnabar, 2019; León-Huamaní, 2015), university students (Valdivia, 2021), and PE students (De Castro-Maqueda et al., 2021; Peña Ortega et al., 2004; Posada Gutiérrez et al., 2019), and adult population in Mexico (Castanedo-Cazares et al., 2006; Morales-Sánchez et al., 2021; Rivera Contreras et al., 2023). The scarce information on photoprotection and the few skincare habits are evident regardless of the age, occupation, or place of residence of all those who participated in these studies, especially when it comes to physical education students. Understanding the knowledge, risky behaviors, and skin care habits of the general population is a crucial starting point. This information is particularly valuable for those aiming to promote healthy habits, as it forms the basis for designing interventions that can effectively reduce the negative impact of sun exposure (Yera

Sánchez et al., 2024). These interventions, which could be implemented in educational and health settings as a form of primary prevention, should not only be informative since they are insufficient to influence a photoprotective behavior (Reeder et al., 2013). These should also incorporate teaching and instructional elements that are tailored to the specific population and context, as this is crucial for their effectiveness.

Following the above, educational interventions have been developed specifically to improve knowledge, attitudes, and practices of photoprotection in adolescents (Alemán-Bacallao et al., 2020; Cárdenas & Falcón, 2021), medical students (Sirera Rus et al., 2020), PE students (Rebolledo Casas & Solano Lara, 2014), and PE professionals (Guillén Prieto et al., 2023). All of these interventions have demonstrated effectiveness in improving knowledge about skin care. However, the effectiveness is reduced if long-term continuity in the interventions is not maintained (Sirera Rus et al., 2020).

The frequency of skin cancer in Mexico has shown a significant increase, and every year between 11 000 and 16 000 new cases are diagnosed. Indeed, melanoma alone is responsible for 80% of skin cancer deaths (IMSS, 2024). It is concerning that there is limited evidence regarding skin care and sun exposure habits of Mexican PE students. This occupational group, unlike others, will spend several hours exposed to direct sunlight, since most of their work will occur in open spaces (e.g., swimming facilities, football fields, sports courts).

This is important because they are at risk of health issues related to sun exposure as future professionals. Additionally, people between 18 and 20 years old receive 40-50% of their lifetime UV exposure (Garnacho Saucedo et al., 2020), making this a critical age range to study. These students' educational environment, stage of life, and training are crucial for promoting healthy skin care habits and lifestyles. To address these concerns, this study aims to determine the risk factors, skin care habits, and sun exposure of PE students in Mexico. This research will help in designing targeted educational interventions to promote healthy habits.

METHODS

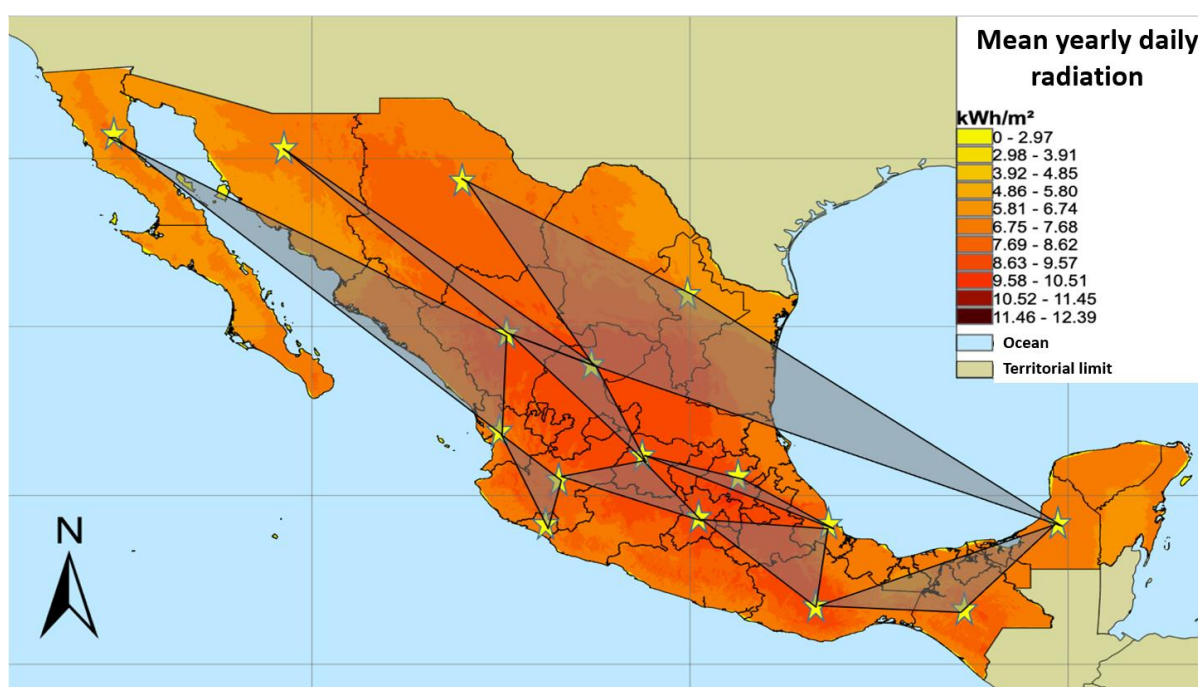


Participants

The study is a descriptive, cross-sectional, and quantitative research involving a convenient sample of 847 PE students, with 571 men (67.4%) and 276 women (32.6%). The students were from 19 higher education institutions across Mexico, representing its five regions: Central West (34.6%), Northwest

(40.4%), South Southeast (16.8%), Central Country (5.5%), and Southeast (3.3%). The states of Baja California, Campeche, Chihuahua, Colima, Durango, State of Mexico, Guanajuato, Hidalgo, Jalisco, Nayarit, Nuevo Leon, Oaxaca, Sonora, and Veracruz were included in the study by random selection (Diagram 1).

Diagram 1. Coverage of the sample of participants from the Mexican Republic ($n = 847$) and mean yearly solar radiation in 2023 according to the map adapted from the Mexican Solarimetric Service of the National Autonomous University of Mexico. The yellow stars represent the sampled sites.



Procedures

The “Sun Exposure Knowledge and Habits Questionnaire for Physical Education Students” was used as a measurement instrument. This is a semi-structured, self-administered survey. The instrument was sent through the Google Forms digital platform to all PE students from public universities and teacher training colleges. Volunteers agreed to participate in the study by reading and signing an informed consent before completing the questionnaire. The questionnaire was adapted by experts in PE from Costa Rica and Mexico and validated by the Aiken’s V statistic (Aiken, 1980).

The instrument comprises nominal and ordinal questions formatted as open, single, and multiple-choice. The instrument is divided into four categories: a) sociodemographic, b) risk factors for skin cancer, c) sun exposure and use of sunscreen, and d) skin lesions and medical consultation. All data were recorded and stored anonymously, following the ethical criteria set forth by the Helsinki Declaration (Mazini, 2000), current laws and regulations regarding data protection, and digital rights.

Statistical analysis



Data were analyzed using IBM SPSS Statistics software, version 26 (IBM Corp., Armonk, NY, USA) and Past 4.03 software (Hammer & Harper, 2001). Descriptive statistics included mean and standard deviation ($M \pm SD$) for continuous variables, and frequencies and proportions (f , %) for categorical variables. Inferential statistics comprised Student's t -tests for the age variable between men and women, and non-parametric χ^2 (χ^2) tests for categorical variables. Hypothesis testing was performed at a significance level of $p \leq 0.05$.

RESULTS

Sample characteristics

The study included 847 participants (Men = 571, Women = 276), and the response rate was 70.58%. The mean age of the participant group was 21.9 ± 3.4 years (Men = 21.97 ± 3.3 years, Women = 21.8 ± 3.4 yr.; $p = 0.377$). The largest proportion of participants (92.4%) reported having Mexican ancestry, followed by Latino (4.7%), European (2.1%), Asian (0.4%), and North American (0.4%) origins ($\chi^2 = 2783.6$; $p \leq 0.0001$).

Risk factors for skin cancer

Hypothesis testing for non-modifiable risk factors for skin cancer indicated that significantly more men reported having the "Brown" skin phototype (i.e., Fitzpatrick's type V skin) than women. Brown and black hair color was more frequent in men than women, but women reported having blond and red hair more than men. Finally, brown and black eye color was reported to be more frequent in men than women (Table 1).

Sun exposure and use of sunscreen

There were no sex differences in self-reported sun exposure ($\chi^2 = 9.1$; $p = 0.107$). Participants indicated that of the total number of subjects in which they were enrolled, they were directly exposed to the sun in more than five (26.7%), three (19.0%), four (16.6%), two (16.4%), five (11.3%), and one case (9.9%). The most frequent class times when they were exposed to the sun were from 11:00 to 12:59 (45.3%), from 13:00 to 14:59 (38.2%), from 9:00 to

10:59 (33.1%), from 15:00 to 16:59 (26.2%), from 7:00 to 8:59 (21.7%), and from 17:00 to 18:59 (14.6%) (Figure 1).

Of the cohort, 57.3% indicated that they did not use sunscreen daily, and more men indicated not to do so compared to women ($\chi^2 = 31.8$; $p \leq 0.0001$). Among the participants who used sunscreen daily, it was reported that they applied it one to two times per day (90.0%), three to four times per day (8.3%), and 5 to 6 times per day (1.7%), with no differences in the frequency of application between men and women ($\chi^2 = 0.9$; $p = 0.828$). These people applied the product for the first time between 30 and 60 min before outdoor practice (56.3%); another group did it immediately before going to practice (32.2%), and a smaller number did it 60 to 90 min before the activity (11.5%). More men than women apply the product immediately before outdoor activities ($\chi^2 = 9.2$; $p = 0.010$; Figure 2), probably due to a lack of knowledge about the proper use of these products.

Table 1. Summary table of individual frequencies (f) and non-parametric χ^2 tests for the association between skin cancer risk factors.

	Male <i>f</i>	Female <i>f</i>	χ^2	$p \leq$
Skin color¹			29.2	0.001
I Pale white	32	25		
II Fair	189	97		
III Darker white	259	144		
IV Light brown	86 ^a	10 ^b		
V Brown	5	0 ²		
VI Black	0 ²	0 ²		
Hair color			107.9	0.001
Brunette	175 ^a	169 ^b		
Black	391 ^a	89 ^b		
Blond	3 ^a	9 ^b		
Red	2 ^a	9 ^b		
Eyes color			11.9	0.008
Green	21	11		
Brown	416 ^a	228 ^b		
Black	133 ^a	37 ^b		
Blue	1	0 ²		
Light-blue	0 ²	0 ²		

Notes:

f =Frequency.

¹ Based on Fitzpatrick's classification of skin phototype.



² This category is not used in comparisons because its column proportion is equal to zero or one.

Values in the same row that do not have the same superscript are significantly different in the two-sided test of equality for column proportions.

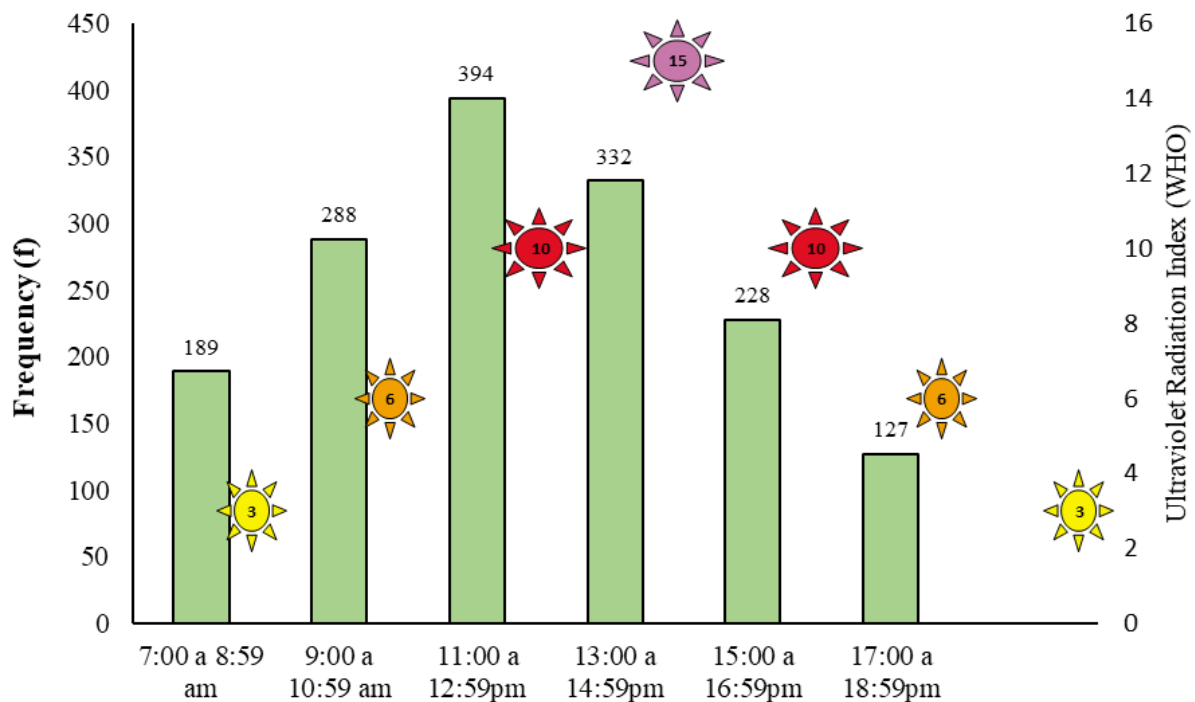
Tests are adjusted for all pairwise comparisons within a row using the Bonferroni correction.

Skin lesions and medical consultation

The majority of participants have not had sunburns ($\chi^2 = 420.8$; $p \leq 0.0001$), nor have they observed any spots on their skin ($\chi^2 = 337.9$; $p \leq 0.0001$). There were no differences in the reporting of sunburns between men and women ($\chi^2 = 0.6$; $p = 0.440$), and a higher frequency of men reporting not having spots on their skin was found compared to women ($\chi^2 = 5.3$; $p = 0.021$). It was found that 97.3% of

participants have not been periodically checked by a dermatology specialist, and there was no between-gender difference ($\chi^2 = 0.5$; $p = 0.823$). Among those who have done so, 89.1% indicated that they had not followed the recommendations given by the dermatologist, and there was no between-gender difference ($\chi^2 = 0.7$; $p = 0.394$). The 98.2% of respondents indicated that they had not had conflicts with the teaching staff due to the recommendations given by the dermatologist. Finally, 43.9% of participants indicated that they would like a specialist to assess their skin health free of charge, with a higher frequency of men than women indicating that they do not want this free check-up ($\chi^2 = 8.1$; $p = 0.005$).

Figure 1. Risk hours, ultraviolet index and frequency of class times with greater sun exposure.



DISCUSSION

The study aimed to identify the risk factors, skincare habits, and sun exposure of Mexican physical education (PE) students. It is crucial to promote healthy habits and lifestyles among these students, as they will play a significant role in shaping

photoprotection behaviors in the population, especially at a young age. Their influence can be substantial, given Mexico's geographic location, which results in high levels of UVR for most of the year (Diagram 1). In recent years, there has been a 500% increase in melanoma cases, with a projected upward trend until 2025 (World Health Organization



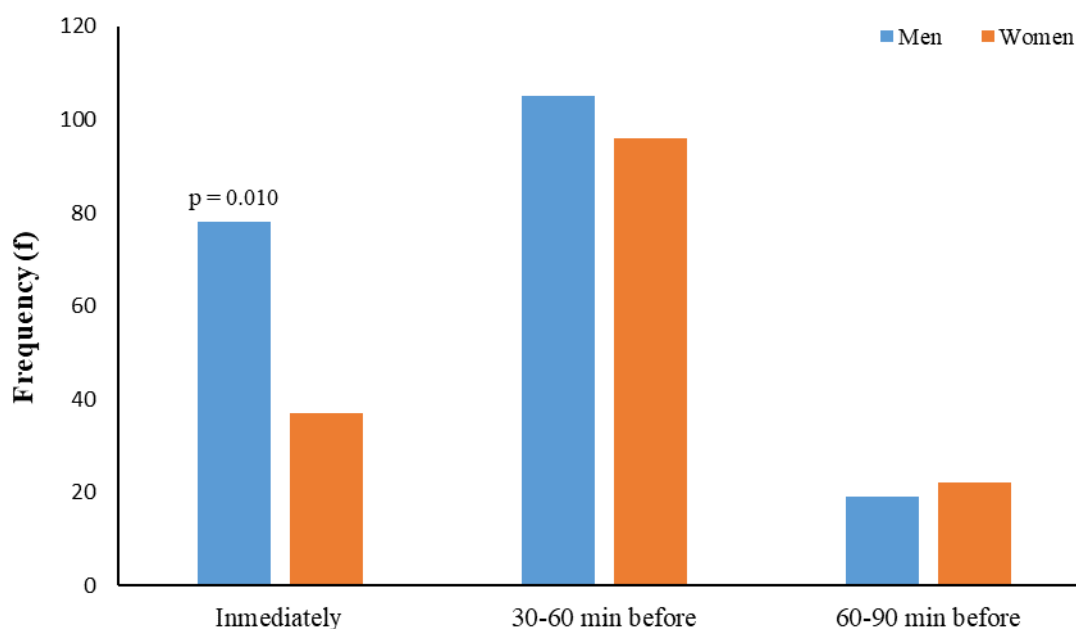
et al., 2003), attributed to chronic sun exposure as one of the contributing factors.

Non-modifiable risk factors and skin lesions

The average age of both male and female participants was 21.9 ± 3.4 yr., with no statistical difference between genders, and the majority were of Mexican descent. A rise in risky behaviors related to sun exposure has been observed in young Mexican

adults, such as spending time outdoors without sunscreen and having a low perception of future risk (Morales-Sánchez et al., 2021; Rivera Contreras et al., 2023). It has been reported that young people receive 51% of their annual UVR dose during school attendance between March and June (Castanedo Cázares et al., 2012). Therefore, it is crucial to intervene, especially among this population group.

Figure 2. Frequency of men and women who indicate applying some skin protection product before carrying out academic activities outdoors.



According to Fitzpatrick's classification, most people surveyed have dark brown skin (Type V). This type of skin is rich in melanin, which acts as a natural protection against UVR, absorbing this radiation to prevent damage to the deeper layers of the skin. As a result, this type of skin tends to burn minimally (Castanedo Cázares et al., 2012), and individuals with Type V skin may not perceive UV irritation (Secretaría de Educación Pública de México, 2023). Most people in the survey did not report sunburn or observe spots on their skin. However, in Mexico, the population with dark brown skin could experience continuous but intermittent damage from sun exposure after 18 minutes if the UVR index is 10 (Secretaría de Educación Pública de México, 2023),

despite having natural protection from a high amount of melanin. People with dark skin are sensitive to the harmful effects of UVR, particularly affecting their eyes and immune system (Castanedo Cázares et al., 2012). It is important to note that this group is at risk of chronic exposure to UVR without noticing the consequences (Rivera Contreras et al., 2023), making them the most vulnerable phototypes in Mexico because they do not perceive UVR damage acutely as Fitzpatrick's type III skin does (Castanedo-Cazares et al., 2006).

The study on Mexican PE teachers reported similar characteristics, such as a low incidence of burns or skin spots among individuals with similar skin



phototypes. However, 28.2% of the participants reported experiencing burning and redness (Barajas Pineda et al., 2022). Similarly, 74.6% of Spanish PE students reported experiencing at least one sunburn in the past year despite having a “light” skin phototype (Fitzpatrick’s type II skin) (De Castro-Maqueda et al., 2021). This confirms that skin type is a non-modifiable risk factor, and individuals exposed to UVR should pay greater attention and care to their skin.

Sun exposure and use of sunscreen

Several respondents reported spending more than five (26.7%) or three (19.0%) periods outdoors with direct sun exposure between 11:00 and 14:59 (83.5%), which are considered “very high” and “extremely high” levels of UVR (Castanedo Cázares et al., 2012), putting them at high risk of sunburn. This prevalence of high UVR levels is not unique to this study, as similar sun exposure times have been observed in Brazilian, Costa Rican, Mexican, and Honduran PE teachers (Moncada-Jiménez & Meneses Montero, 2004; Moncada Jiménez et al., 2004; Oliveira et al., 2011; Rombaldi et al., 2017). This indicates a widespread issue of many hours spent in the sun during peak UV radiation times. Therefore, raising awareness about the various health risks associated with prolonged sun exposure and promoting preventive measures, such as avoiding outdoor activities during peak UVR hours, engaging in physical activities in shaded areas, and using protective clothing, among other precautions.

Regarding sunscreen use, our research has uncovered a significant issue since over half of the participants (57.3%) do not use sunscreen daily. Instead, they apply it once or twice a day (90.0%) from 30 to 60 min before outdoor activities (56.3%), indicating insufficient sun protection. This trend is not unique to our study, as similar findings have been observed in the general Mexican population (Castanedo-Cazares et al., 2006), Spanish university PE students (De Castro-Maqueda et al., 2021), Brazilian male PE teachers (Oliveira et al., 2011; Rombaldi et al., 2017), and Mexican (Barajas Pineda et al., 2022; Moncada-Jiménez & Meneses Montero, 2004) and Colombian PE teachers (Sarmiento Barrera, 2020). These findings highlight a serious occupational risk in the field of physical education. Conversely, systematic

reviews of students in educational institutions have documented a need for more interest and knowledge about the risks of prolonged exposure to ultraviolet radiation (Castillo Zambrano, 2024).

Knowledge and medical consultation

In the present study, less than half of the participants (43%) were interested in a free consultation by a specialist, and a dermatologist had never checked the vast majority (97.3%). Among the small percentage who had been checked (2.7%), the majority (89.1%) did not follow the specialist’s recommendations. This indicates a concerning lack of awareness and action regarding protecting and preventing skin health. While knowledge about photoprotection is adequate (Girón & Barrera, 2016; León-Huamaní, 2015; Valdivia, 2021), knowledge improves with educational interventions (Alemán-Bacallao et al., 2020; Cárdenas & Falcón, 2021; Sirera Rus et al., 2020; World Health Organization et al., 2003). However, this knowledge only sometimes translates into protective behaviors, as many individuals continue to be exposed to the sun for extended periods without proper use of clothing and sunscreen.

Physical educators play an essential role in promoting healthy habits and lifestyles. However, they often need more proper skin care training during their education (De Castro-Maqueda et al., 2021; Peña Ortega et al., 2004; Posada Gutiérrez et al., 2019) and professional development (Castillo Zambrano, 2024; Guillén Prieto et al., 2023; Sarmiento Barrera, 2020). This prevents them from incorporating skincare promotion into their practices. As a result, physical educators may be at risk of developing health issues related to sun exposure due to inadequate sunscreen use, lack of interest in seeking dermatological advice, and insufficient training in health-related practices when conducting outdoor activities.

Limitations of the study

Convenience sampling may limit the representativeness of the population of physical educators in Mexico. Additionally, self-administered questionnaires might be affected by the lack of honesty from the respondents. It is recommended to



design longitudinal studies to assess changes in the occurrence of skin lesions within this specific group.

CONCLUSIONS

In conclusion, the lack of knowledge and skin care habits among physical educators is a worrisome problem. The situation is supported by the high proportion of participants who do not use sunscreen appropriately, as well as by the lack of interest in dermatological consultation. The phenomena should not occur since physical educators are purportedly preventive health agents in society. The findings of the present study may be explained by a lack of specific preparation in their school curricula; therefore, it is recommended that physical educators follow international guidelines for skin care, such as the WHO's UV Index Practical Guide (World Health Organization et al., 2003) and take measures to reduce sun exposure during peak hours, use protective clothing, hats, sunglasses, and sunscreen with a solar protection factor (SPF) of 15 or higher.

Also, they should avoid tanning beds and protect babies and young children. It is crucial to conduct awareness campaigns among physical education students and teachers to promote preventive measures and encourage them to pass on this knowledge to their students. It is essential to promote educational campaigns such as courses, and workshops, led by universities and health institutions, particularly those offering physical education majors, which should encourage public photoprotection policies.

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