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KNOWLEDGE ABOUT PHOTOPROTECTION AMONG MEDICAL STUDENTS: A CROSS-SECTIONAL ANALYSIS

CONHECIMENTO SOBRE FOTOPROTEÇÃO ENTRE ESTUDANTES DE MEDICINA: UMA ANÁLISE TRANSVERSAL

Júlia do Nascimento Marcon[1], Clandio Timm Marques[2], Diéssica Gisele Schulz[3], Claudia Zamberlan[4], Elisa de Ávila Lopes[5], Rosiane Filipin Rangel[6] e Luana Pizarro Meneghello[7]

ABSTRACT

OBJECTIVE: To analyze the knowledge of medical students about photoprotection. **METHODS**: This is a cross-sectional, descriptive and quantitative study, carried out with 241 students from a private university in the central region of Rio Grande do Sul, carried out in the second semester of 2024, through a self-assessment questionnaire. The students were divided into three groups according to their academic progress: Basic Cycle (from the first to the fourth semester), Clinical Cycle (from the fifth to the eighth semester) and Medical Internship (from the ninth to the twelfth semester). **RESULTS**: The answers obtained were analyzed in order to identify patterns of knowledge related to the academic level of the participants. There was a significant association between undergraduate advancement and knowledge about child photoprotection ($p<0.001$). **CONCLUSION**: The results show the need to improve the knowledge of medical students about photoprotection. The inclusion of content on solar prevention in academic training can significantly contribute to the training of future physicians, allowing them to guide patients more effectively.

Keywords: Dermatology; Sun Protection Factor; Health.

1 Acadêmica de Medicina da Universidade Franciscana - Santa Maria - RS / Brasil. E-mail: jnmarcon31@gmail.com ORCID: https://orcid.org/0009-0005-4187-2264

2 Doutor em Estatística e Investigação Operacional pela Universidade de Lisboa - Portugal. Docente do curso de Medicina da Universidade Franciscana - Santa Maria - RS / Brasil. E-mail: clandiomarques@gmail.com. ORCID: https://orcid.org/0000-0002-9984-0100

3 Médica Residente de Dermatologia no Hospital Universitário de Brasília - Brasília - DF / Brasil. E-mail: diessicaxls@gmail.com. ORCID: https://orcid.org/0000-0001-7780-0071

4 Enfermeira. Doutora em Enfermagem. Docente do Programa de Pós-Graduação em Saúde Materno Infantil da Universidade Franciscana - Santa Maria - RS/ Brasil. E-mail: claudiaz@ufn.edu.br. ORCID: https://orcid.org/0000-0003-1898-328X

5 Médica formada pela Universidade Franciscana - Santa Maria - RS / Brasil. E-mail: elisaavilalopes@outlook.com. ORCID: https://orcid.org/0009-0001-1366-0214

6 Enfermeira pelo Centro Universitário Franciscano. Doutora em Enfermagem pelo PPGEnf/FURG. Professora adjunta da Universidade Federal de Pelotas - Pelotas - RS / Brasil. E-mail: rosianerangel@yahoo.com.br. ORCID: https://orcid.org/0000-0003-4059-4176

7 Médica Dermatologista, Mestre em Saúde Materno Infantil pelo Programa de Pós-graduação em Saúde Materno Infantil da Universidade Franciscana, Docente do curso de Medicina da Universidade Franciscana - Santa Maria - RS / Brasil. E-mail: Luana.meneghello@ufn.edu.br. ORCID: https://orcid.org/0000-0002-5940-8874

RESUMO

OBJETIVO: *Analisar o conhecimento de estudantes de medicina sobre fotoproteção.* **MÉTODOS:** *Trata-se de um estudo transversal, descritivo e quantitativo, realizado com 241 estudantes de uma universidade privada da região central do Rio Grande do Sul, no segundo semestre de 2024, por meio de um questionário de autoavaliação. Os alunos foram divididos em três grupos de acordo com o progresso na graduação: Ciclo Básico (do primeiro ao quarto semestre), Ciclo Clínico (do quinto ao oitavo semestre) e Internato Médico (do nono ao décimo segundo semestre).* **RESULTADOS:** *As respostas obtidas foram analisadas com o objetivo de identificar padrões de conhecimento relacionados ao nível acadêmico dos participantes. Observou-se associação significativa entre o avanço na graduação e o conhecimento sobre fotoproteção infantil (p<0,001).* **CONCLUSÃO:** *Os resultados evidenciam a necessidade de aprimorar o conhecimento dos estudantes de medicina sobre fotoproteção. A inclusão de conteúdos sobre prevenção solar na formação acadêmica pode contribuir de forma significativa para a capacitação dos futuros médicos, possibilitando uma orientação mais eficaz aos pacientes.*

Palavras-chave: *Dermatologia; Fator de proteção solar; Saúde.*

INTRODUCTION

Brazil is considered a tropical country and is part of the geographic region with the highest ultraviolet radiation levels on the planet (SANTOS *et al*., 2021).

This exposure to solar radiation, although it can offer benefits, such as the synthesis of vitamin D and the production of beneficial substances such as beta-endorphins (AUGUSTINE; NAIR; KULKARNI, 2021), can also have severe health consequences, including sunburn, photo-dermatoses, and immunosuppression and, mainly, favor the appearance of skin cancer (SAUCEDO; VALLEJO; GIMÉNEZ, 2020). In addition, exposure to ultraviolet radiation (UVR) is also a significant factor in photoaging (GUAN; LIM; MOHAMMAD, 2021).

Skin cancer is considered the most common neoplasm in the country, with a predominance of non-melanoma type (SCHALKA *et al*., 2024). Although historically associated with fair-skinned individuals over the fourth decade of life, recent data indicate a change in this demographic profile due to increasing sun exposure among young people (INCA, 2019).

In 1975, Thomas Fitzpatrick created a scale widely used in Dermatology, which describes skin tones in six distinct phototypes, ranging from I to VI, according to the individual's response to sun exposure (GOON *et al*., 2021).

Phototypes I and II are more prone to burns than tanning, which means that individuals with these shades have an increased risk of skin cancer compared to those who have higher phototypes (BARROS, 2022). Phototype III shows a moderate response to both burning and tanning, while phototypes IV, V and VI tend to tan more easily than burning (BARROS, 2022).

Despite the limitations in the evaluation of populations with high phototypes (IV, V and VI), due to the diversity of skin tones and responses to sun exposure in these groups, the classification continues to be widely adopted and will be used as a reference in the present study (BARROS, 2022).

In this context, photoprotection and knowledge related to this theme play a fundamental role in the prevention of skin neoplasms and other dermatological conditions associated with sun exposure.

Studies show that approximately 80% of skin cancer cases could be prevented by reducing excessive exposure to solar radiation. This prevention can be achieved through the adoption of photoprotective measures (regular use of topical sunscreen, wide-brimmed hats, sunglasses with UV protection and long-sleeved clothing). Such practices are especially recommended when performing outdoor activities on sunny days (GARCÍA-MALINIS *et al.*, 2021).

A recent study revealed low adherence to photoprotective practices among university students - including those belonging to the health area, indicating weaknesses in guidance strategies conducted by primary care professionals (MARTINS; IVANTES; ROCHA-BRITO, 2021).

Furthermore, the region of Santa Maria - RS, located at a subtropical latitude (29° S), presents an environmental scenario that reinforces the importance of photoprotection. Recent data demonstrate a significant increase in ultraviolet B (UVB) radiation over the years, with an approximate growth of 50% between 2005 and 2021. This increase is particularly concerning, since UVB is primarily responsible for direct DNA damage and is closely associated with the development of skin cancer (BORIN *et al.*, 2025)

Given this scenario, the objective of this study is to analyze the knowledge of medical students about photoprotection. The research aims to develop future strategies adapted to this demographic segment. In addition, it is believed that the awareness of students on these topics can contribute to the health promotion of the general population, since, trained, they can encourage and educate patients about the relevance of photoprotection measures.

METHODS

This is a descriptive, cross-sectional study with a quantitative approach, carried out with undergraduate students in Medicine, from a private institution of higher education, located in the central region of southern Brazil. Academics aged 18 years or older, regularly enrolled in the second academic semester of 2024, were included. Those who were not present in the classroom at the time of the invitation to participate were excluded.

The sample was defined by calculation for finite populations (sampling error of 5%, 95% confidence interval and estimated proportion of 50%), resulting in 241 students randomly selected based on the roll number, using the BioEstat software. Data collection took place in the second semester of 2024, through a structured questionnaire in Google Forms. After approval by the Research Ethics Committee (opinion number 6.881.521), the main researcher went to the classrooms, and, through the students' call number, carried out the draw. The selected students were invited to be part of the study, and, upon acceptance, received the Informed Consent Form (ICF) by e-mail.

After signing the ICF and returning to the researchers, the questionnaire was made available by QR Code, with a mean response time of 10 minutes. Categorical variables were presented in relative frequencies, and quantitative variables in mean and standard deviation. For inferential analysis, students were grouped into three academic cycles: Basic (1st to 4th semester), Clinical (5th to 8th semester) and Medical Internship (9th to 12th semester).

Initially, the normality of the variables was assessed using the Kolmogorov-Smirnov test. For the analysis of overall scores between groups, a one-way analysis of variance (one-way ANOVA) was performed, followed by Tukey's post hoc test when appropriate. For qualitative variables, associations between groups were evaluated using Pearson's chi-square test. Differences and associations were considered statistically significant when the p-value was less than 0.05. All statistical analyses were performed using IBM SPSS Statistics version 25.

The study followed the ethical guidelines of Resolutions 466/2012 and 510/2016, with a guarantee of confidentiality, anonymity and exclusive use of data for scientific purposes.

RESULTS

Two hundred and forty-one (241) medical students participated in the study, 94 of them from the Basic Cycle (1st to 4th semester), 79 from the Clinical Cycle (5th to 8th semester) and 68 from the Internship (9th to 12th semester). It is observed that 48 basic cycle students (51.1%), 61 clinical cycle students (77.2%) and 68 medical interns (100%) reported having received guidance on photoprotection during undergraduate or extracurricular activities (Table I).

Table 1 - Relationship between photoprotection guidelines and academic cycles.

Question	Answer	Cycle			p
		Basic	Clinical	Internship	
Guidance about photoprotection during undergraduate/ extracurricular activities	Yes (n (%))	48 (51.1%)	61 (77.2%)	68 (100%)	<0.001
	No (n (%))	46 (48.9%)	18 (22.8%)	0 (0%)	

These data indicate a significant association ($p < 0.001$) between progress in the course and access to guidance on photoprotection.

To analyze the students' knowledge about photoprotection measures, the participants answered statements of the true or false type, shown in table II (Table II).

Table 2 - Knowledge about photoprotection by academic cycle.

Question	Basic Cycle (n(%))	Clinical Cycle (n(%))	Internship (n(%))	p
1. Using indoor tanning booths before the age of 30 increases the risk of melanoma.				
True	89 (94.7%)	78 (98.7%)	67 (98.5%)	0.203
False	5 (5.3 %)	1 (1.3%)	1 (1.5%)	
2. Ultraviolet radiation causes aging of the skin and various forms of skin cancer.				
True	94 (100%)	78 (98.7%)	68 (100%)	0.357
False	-	1 (1.3%)	-	
3. Shade protects against the effects of ultraviolet radiation.				
True	26 (27.7%)	16 (20.3%)	15 (22.1%)	0.487
False	68 (72.3%)	63 (79.7%)	53 (77.9%)	
4. Using sunscreens is the best way to protect yourself from ultraviolet radiation and prevent skin cancer				
True	86 (91.5%)	72 (91.1%)	56 (82.4%)	0.138
False	8 (8.5%)	7 (8.9%)	12 (17.6%)	
5. After the skin is tanned, it is not necessary use sunscreen when exposing yourself to the sun again.				
True	-	-	-	-
False	94 (100%)	79 (100%)	68 (100%)	
6. Infants under 6 months of age should not use sunscreen.				
True	23 (24.5%)	45 (57%)	49 (72.1%)	< 0,001
False	71 (75.5%)	34 (43%)	19 (27.9%)	
7. Clothing with dark colors protects from the sun more than clothing with light colors.				
True	25 (26.6%)	21 (26.6%)	22 (32.4%)	0.670
False	69 (73.4%)	58 (73.4%)	46 (67.6%)	
8. Children must use sunscreen with an index equal to or greater than 30.				
True	91 (96.8%)	72 (91.1%)	65 (95.6%)	0.237
False	3 (3.2%)	7 (8.9%)	3 (4.4%)	
9. On cloudy or rainy days, it is not necessary to apply sunscreen.				
True	2 (2.1%)	1 (1.3%)	1 (1.5%)	0.898
False	92 (97.9%)	78 (98.7%)	67 (98.5%)	
10. After swimming pool or sea baths, it is necessary to reapply sunscreen.				
True	93 (98.9%)	78 (98.7%)	67 (98.5%)	0,974
False	1 (1,1%)	1 (1.3%)	1 (1.5%)	

The first statement, which stipulated that the use of indoor tanning booths before the age of 30 increases the risk of melanoma, obtained the following answers: 89 basic cycle students (94.7%), 78 clinical cycle students (98.7%) and 67 medical interns (98.5%) indicated that the statement was true. In contrast, 5 basic cycle students (5.3%), 1 clinical cycle student (1.3%) and 1 student in the internship cycle (1.5%) classified the statement as false.

In the third statement, about the protection that the shade offers against the effects of ultraviolet radiation, there was a greater divergence in the students' responses. A total of 26 students from the basic cycle (27.7%), 16 from the clinical cycle (20.3%) and 15 from the Internship school (22.1%) stated that the shade provides this protection. In contrast, 68 students from the basic cycle (72.3%), 63 from the clinical cycle (79.7%) and 53 from the Internship school (77.9%) maintained that shade does not protect against the effects of ultraviolet radiation.

Statement 4 indicated that the use of sunscreen is the best way to protect oneself from ultraviolet radiation and to prevent skin cancer. Of the students in the basic cycle, 86 (91.5%) agreed, while 72 students in the clinical cycle (91.1%) and 56 in the Internship school (82.4%) also considered the statement true. However, 8 students from the basic cycle (8.5%), 7 from the clinical cycle (8.9%) and 12 from the Internship school (17.6%) classified this assertion as false.

Regarding statement 5, which stated that after the skin is tanned, it is not necessary to use sunscreen when exposed to the sun again, 100% of the students (n=241) marked the statement as false.

Statement 6, which addressed the topic of photoprotection in babies younger than 6 months, showed great divergence between the responses. Of the students in the basic cycle, 23 (24.5%) indicated that the statement was true, while 45 students in the clinical cycle (57%) and 49 in the Internship school (72.1%) also agreed. In contrast, 71 students in the basic cycle (75.5%), 34 in the clinical cycle (43%) and 19 in the Internship school (27.9%) considered the statement to be false. This result shows a significant association between the training cycle and knowledge about the use of sunscreen in babies ($p<0.001$). It is observed that, as students advance in their training, they acquire greater knowledge about the topic.

Statement 7 addressed the idea that dark-colored clothing offers greater protection against solar radiation compared to light-colored clothing. In this question, 25 basic cycle students (26.6%), 21 clinical cycle students (26.6%) and 22 medical interns (32.4%) considered the statement true, while 69 basic cycle students (73.4%), 58 clinical students (73.4%) and 46 students in the internship cycle (67.6%) classified it as false.

The penultimate statement dealt with the application of sunscreen on cloudy or rainy days. Only 2 basic cycle students (2.1%), 1 clinical cycle student (1.3%) and 1 student in the internship cycle (1.5%) believed that the application of sunscreen on these days was not necessary. The rest of the students stated that the use of sunscreen should be maintained regardless of weather conditions.

The last statement addressed the need to reapply sunscreen after swimming or sea baths. Most students agreed with the statement, with 93 of the basic cycle (98.9%), 78 of the clinical cycle (98.7%) and 67 of the internship school (98.5%) scoring true. Only 1 student in each cycle rated it as false.

Additionally, the Total Knowledge Score, defined as the sum of correct answers for each participant, was analyzed. The mean scores were compared among the three academic cycles using one-way ANOVA. A statistically significant difference was observed between the groups ($p = 0.011$). In the *post hoc* analysis, a notable difference was found between students in the Basic cycle (7.6 ± 0.9) and those in the Internship (8.0 ± 0.9) ($p = 0.008$). No statistically significant differences were observed between the Basic and Clinical cycles (7.8 ± 0.8) ($p = 0.207$), nor between the Clinical and Internship cycles ($p = 0.383$).

DISCUSSION

Sun protection education has been recognized as a fundamental photoprotection strategy (SCHALKA, *et al.*, 2024), especially when aimed at audiences with high potential for social impact, such as medical students. Thus, it is relevant to understand what knowledge this group already has, in order to direct more effective and specific educational actions, considering its future role as health promoters.

Among the questions with the highest rate of correct answers are those that address the effects of ultraviolet radiation on the skin, the need to reapply sunscreen after contact with water, and the maintenance of the use of the product even on cloudy days. The high rate of correct answers to these questions - greater than 98% - corroborates the results of a previous study, which indicated greater mastery over these topics among health students (DALLAZEM *et al.*, 2019).

Regarding the statement that the shade offers protection against the effects of UVR, there was a variation in the participants' responses. Although the use of shades or structures that provide them is a practical and effective measure to reduce exposure to solar radiation, it is essential to highlight that this strategy should not be used in isolation, since a significant amount of radiation can disperse in the surrounding environment (SCHALKA *et al.*, 2014).

With regard to the use of indoor tanning booths before the age of 30 being associated with an increased risk of melanoma, most students from different cycles recognized this relationship as true. A small number of interviewees at each stage of the training presented divergent understanding. These findings suggest a satisfactory level of knowledge among students. This understanding is in line with the technical note published by the Brazilian Society of Dermatology (SBD) in 2023, which warns that the risk of developing skin cancer increases by 59%, even after a single exposure to tanning booths before the age of 35 (SOCIEDADE BRASILEIRA DE DERMATOLOGIA, 2023).

In the fifth statement, a consensus was observed among the students. Although tanning is the skin's main physiological response to sun exposure, providing an estimated sun protection factor between 2 and 4, the application of the sun protector remains indispensable whenever the individual is exposed to solar radiation (SCHALKA *et al.*, 2014).

The statement related to the use of sunscreen in babies younger than six months presented one of the lowest percentages of correct answers among the students interviewed, showing an important knowledge gap on the subject. A similar result was observed in a recent study, in which only 26.1% of respondents demonstrated knowledge about these recommendations (DA SILVA *et al.*, 2024). According to the SBD guidelines, children in this age group should not be directly exposed to the sun, and the use of clothing and hats as forms of protection should be prioritized (SCHALKA *et al.*, 2014). Additionally, the discrepancy observed in this specific question reinforces that, when the topic requires technical knowledge in the fields of Pediatrics and Dermatology rather than relying on common sense, academic training plays a fundamental role in the acquisition and consolidation of

knowledge, as evidenced by the better performance of students in more advanced semesters compared to those in the earlier stages of their education. In this context, it is pertinent that future studies place greater emphasis on the pharmacological and clinical aspects of photoprotection, allowing for a more in-depth assessment of students' knowledge in these areas.

The statement regarding the protection conferred by dark-colored clothing was incorrectly marked by a significant number of participants, totaling 173 wrong answers. According to the SBD, clothes with dark shades - such as black, navy blue, dark red and dark green - have a higher concentration of dyes, which favors the absorption of ultraviolet radiation, reducing its transmission (SCHALKA *et al.*, 2014). Thus, they confer greater photoprotective efficacy compared to light-colored clothes, even when made with fabrics of similar composition and weft (SCHALKA *et al.*, 2014).

The analysis of the overall knowledge score revealed a significant difference between academic cycles, with better performance among Internship students compared to those in the Basic cycle. This finding suggests a progression of knowledge throughout medical training, possibly related to greater theoretical and practical exposure to the topic over the course of the program. On the other hand, the absence of a significant difference between the intermediate cycles may indicate that this progression occurs gradually.

These findings reinforce the importance of the systematic and transversal inclusion of contents on photoprotection and prevention of skin cancer in medical training. Considering the role of the physician in promoting health and educating the population, it is essential that this professional is adequately trained to guide patients based on up-to-date scientific evidence.

Additionally, it is important to consider the reliability of photoprotective products available on the market. Recent reports from independent consumer protection agencies have identified discrepancies between the labeled sun protection factor (SPF) and the actual performance of some sunscreens. In an analysis conducted in Australia, 16 out of 20 tested products did not meet their declared SPF, showing substantial variation between the labeled value and that obtained in laboratory testing (SERRELS, 2025). This scenario highlights that the physician's role goes beyond simply recommending sunscreen use, making it essential to guide patients in selecting effective products that have been properly tested and approved by regulatory agencies. Failures in product quality may directly compromise the effectiveness of photoprotection and, consequently, skin cancer prevention strategies.

CONCLUSION

The results of this study show a positive progression in knowledge about photoprotection among medical students in academic training. The association between progress in the course and the receipt of guidance on the subject suggests that curricular insertion and clinical experience contribute directly to the improvement of knowledge about photoprotection.

Despite this, relevant conceptual gaps still persist, especially with regard to photoprotection in children and complementary protective measures, such as the use of shades and the use of appropriate clothing.

Finally, it is essential to recognize some limitations of this study, such as the research being carried out in a single institution, making it impossible for the results to be generalizable to other populations or geographical contexts.

Thus, it is recommended that future studies expand this research in other educational institutions and evaluate the impact of educational interventions on students' behavior in the long term.

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