KNOWLEDGE AND ATTITUDES OF ADULT CITIZENS FROM CENTRAL SLOVAKIA TOWARDS ARTIFICIAL ULTRAVIOLET RADIATION EXPOSURE
VEDOMOSTI A POSTOJE DOSPELEJ POPULÁCIE STREDNÉHO SLOVENSKA K EXPOZÍCII ULTRAFIALOVÉMU ŽIARENIU

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ABSTRACT

Introduction: Tanning in sunbeds has been associated with an increased risk of melanoma. It is classified as Group 1 Carcinogenic to humans by the World Health Organization. The malignant melanoma incidence in the past years has the rising trend worldwide. Indoor tanning represents an avoidable risk behaviour. The aim of the study was to find out knowledge and attitudes of adults citizens from Central Slovakia towards artificial ultraviolet radiation.

Materials and methods: The questionnaire survey was implemented during year 2017. There was a total of 529 participants, 66.4 % female and 33.6 % male ones. We processed the data by the PC program Microsoft Office Excel 2013 and Chi-square test. Probability values were reported as significant at $p < 0.05$.

Results: In total of 529 participants, sunbeds visited 139 (26.3 %) of them, female participants used it more often than male participants (83.5 % vs. 16.5 %; $p < 0.001$). Almost all participants (92.6 %) reported the use of UV protective aids especially university educated participants (94.4 %) ($p=0.03$). Sunscreen was the principal form of sun protection mentioned. There was a significant difference between the knowledge of skin phototype and gender (76.0 % vs. 24.0 %; $p < 0.05$).

Conclusion: Our results indicate negative findings in an unknowingness of participants to a character of their skin phototype. The findings of this study suggest that some personal and socio-economic characteristics may stimulate sun exposure and artificial tanning. An important step is to educate population in the field of prevention of excessive indoor tanning and risk of skin cancer.

Keywords: Health protection. Malignant melanoma. Skin phototype. Ultraviolet radiation. Sunbeds.

ABSTRAKT

Úvod: Používanie solárií je spojené so zvýšeným rizikom vzniku melanómu. Podľa Svetovej zdravotníckej organizácie je klasifikované ako dokázaný karcinogén pre človeka – skupina 1. Výskyt malígneho melanómu má v posledných rokoch na celom svete stúpajúci trend. Opaľovanie v soláriách považujeme za rizikové správanie, ktorému sa dá predísť. Cieľom štúdie bolo zistiť poznatky a postoje dospelých občanov stredného Slovenska k umelému ultrafialovému žiareniu.

Materiál a metódy: Dotazníkový prieskum bol realizovaný v roku 2017. Z celkového počtu 529 dotazníkov bolo 351 (66,4 %) žien a 178 (33,6 %) mužov. Údaje sme spracovali pomocou PC programu Microsoft Office Excel 2013 a chí-kvadrátového testu. Za štatisticky významné boli považované hodnoty $p < 0,05$.

Výsledky: Z celkového počtu 529 navštívilo solárium 139 (26,3 %) respondentov, ženy ho navštevovali častejšie ako muži (83,5 % vs. 16,5 %; $p < 0,001$). Takmer všetci respondenti (92,6 %) uviedli použitie UV ochranných pomôcok, predovšetkým respondenti s vysokoškolským vzdelaním (94,4 %) ($p = 0,03$). Opaľovací krém bol hlavnou formou ochrany. Významný rozdiel bol preukázaný medzi znalosťami o fototype kože a pohlavím (76,0 % vs. 24,0 %; $p < 0,05$).

Záver: Naše výsledky poukazujú na negatívne zistenia v nevedomosti účastníkov o ich fototype kože. Štúdia poukazuje na zistenie, že niektoré osobné a sociálno-ekonomické charakteristiky môžu stimulovať vystavovanie sa slnečnému žiareniu a umelému opaľovaniu. Dôležitým krokom je vzdelávanie obyvateľstva v oblasti prevencie nadmerného opaľovania v interiéri a rizika rakoviny kože.

Kľúčové slová: Ochrana zdravia. Malígny melanóm. Fototyp kože. Ultrafialové žiarenie. Soláriá.

INTRODUCTION

Ultraviolet radiation (UVR) is electromagnetic radiation with wavelength between X-ray radiation and visible light in the electromagnetic spectrum. It is emitted by the sun and artificial devices [1]. The human population is exposed with natural and also with artificial UVR for example from sunbeds. The skin damaged by UVR at young age significantly increases the relative risk of developing skin cancer in later life [2]. Research shows that worldwide, about 35 % of the adult population and 19 % of adolescents regularly visit sunbeds [3].

Sunbathing, in the option of many people, is an ideal way how to relax and improve one's mood. This improvement occurs because UVR stimulates the secretion of endorphins in human organism known as happiness hormones. UVR also affects the production of vitamin D3 which is important for absorption of calcium and potassium from alimentary tract [4-6]. UVR produces A-UV and B-UV radiation. An important feature of A-UVR is the physiological process of delayed tanning, which is associated with skin aging and epidermal cells damage [7].

The most frequent reaction of the skin to the effect of type B-UVR is erythema, thus an in-

flammatory reaction [6]. Erythema formation depends on several factors such as wavelength of UVR, skin phototype and protection or an age. A growing of scientific evidence argues for the carcinogenic pro-perties of exposure mostly to type C-UVR, with the shortest wave length [8]. Chronic exposure to UVR damages the skin structure, resulting in skin dehydration and wrinkles, or even in skin cancer. The World Health Organization (WHO) highlighted that 2–3 million non-melanoma and 123,000 melanoma cases who are diagnosed each year are attributable to UVR overexposure [9].

In general, cutaneous malignant melanoma (CMM) is the most serious type of skin cancer. This type of skin cancer is the fourth most common oncological disease in the Slovak Republic (SK). The most skin tumors are diagnosed in the age group of 54 years of age. On the other hand, the number of CMM increases in the group between 25–35 years, nowadays. Surprisingly the Slovak Republic as a country placed in the central Europe with moderate climate, has a higher melanoma incidence rate than is the European average. The incidence rate in the Slovak Republic over the last forty years has risen from 3.9 per 100,000 inhabitants in 1970 to 12.19 per 100,000 ones in 2012 [10]. The CMM is fatal for up to 79 % of patients suffering from malignancies of the skin. The standardized mortality rates in 2012 were 3.75 per 100,000 people [11]. While women have a higher incidence rate of melanoma, the rate of mortality is significantly higher in men. Thus, skin cancer prevention in both genders is equally important [12]. Skin cancer prevention as a public health priority should concern mainly the young people. Till now, this population is less receptive to health education [13]. The aim of the study was to evaluate the level of knowledge of Central Slovak residents on impact of artificial UVR on health and their knowledge and behavior attitudes associated with tanning.

MATERIALS AND METHODS

Study population

The cross-sectional anonymous online survey was conducted between February and September 2017 in the Slovak Republic. The sample of this study was composed of adult citizens from Central Slovakia. Link was promoted through websites, social media and online discussion platforms and potential survey participants were invited to take part the survey. The participants completed a few screening questions before the completion of the main questionnaire. The screening questions were used to ensure that the participants were 18 years of age or older and were the residents from Central Slovakia. The participants were requested to invite family, friends or colleagues to participate by forwarding the online survey link. The study population included 529 participants, who consented to participate in the study. Approximately 589 questionnaires were handed out and total of 529 (89.8 %) questionnaires were eligible for analysis.

Questionnaire

The data was collected using an anonymous non-standardized questionnaire. The questionnaire was designed by the authors of this study and includes two sections. In the first section authors collected socio-demographic data including age, gender, residence, education and profession. We divided residence into two types (urban and rural) and profession into healthcare workers and non-healthcare workers. The second section of the questionnaire consisted of 15 closed questions with only one correct answer and one question with more than one correct answer. One of the questions was an open question. This part of the questionnaire was focused on knowledge and attitudes of the participants towards UVR, exposure and protection habits, sunbeds, malignant melanoma, and skin phototypes. To prevent the additional difficulty of the questions themselves, the questions and choices were short and written in easy-to-read format.

Statistical analysis

Descriptive and analytical statistics were used. The data were presented with mean values and standard deviation (SD).The data was analysed using PC Programme Microsoft Office Excel 2013. The data analysis was performed using the Chi2 test. The significance level was $p < 0.05$.

RESULTS

Study population and demographics

The socio-demographic records of the study population are depicted in Table 1. There was a total of 529 participants, 66.4 % female and 33.6 % male ones. The mean age of the ensemble was 35.6 ± 4.8 years (x ± SD). The age range was from 18 to 58 years. Of a total number of participants lived 50.5 % in a city and 49.5 % lived in a village. Level

Table 1 Characteristics of the study population

Factor	n (529)	%
Gender		
Female participants	351	66.4
Male participants	178	33.6
Place of residence		
Urban participants	267	50.5
Rural participants	262	49.5
Education		
Primary school	0	0.0
Secondary school	303	57.3
University	226	42.7
Profession		
Healthcare professionals	274	51.8
Other workers	255	48.2

of education we divided into primary school (0 %), secondary school (57.3 %) and university (42.7 %). About 50 % participants worked in healthcare sector.

UVR and protection habits

Almost 79 % (416) of participants correctly declared that UVR is non-ionizing radiation. Males 149 (83.7 %) more often ($p < 0.05$) knew what UVR is than female ones 267 (76.1 %). The majority of the university educated participants (87.6 %) compared with primary and secondary educated participants achieved higher level of knowledge on the UVR ($p < 0.001$). As far as the knowledge was concerned, 75.8 % (401) of the sample reported that they knew the definition of malignant melanoma. Female participants more often than male participants knew this definition (83.8 % vs. 60.1 %; $p = 0.001$).

As shown in the Table 2, 490 (92.6 %) participants reported the use of UV protective aids especially university educated participants (94.4 %) ($p=0.03$). Most participants of this study reported use sunscreen (85.8 %) followed sunglasses (56.9 %) and protective clothing (5.9 %).

There was a significant difference ($p < 0.001$) between education and wearing sunglasses. Secondary school educated participants were wearing sunglasses more often than university educated (71.0 % vs. 38.1 %). Approximately half (46.21 %) secondary school educated participants, who applied sunscreen once a day. Only 31 (5.9 %) participants reported wearing protective clothing. Twenty-three (10.2 %) university educated participants did not use protective aids ($p < 0.001$). The term of sun protection factor knew 332 (62.8 %) participants, more females (68.7 %) and healthcare professionals (72.6 %). The 24.4 % participants used sunscreen with Sun Protection Factor (SPF) ≤10, 44.4 % a product with SPF 15-25, 17.0 % product with SPF >30 and 14.2 % participants did not use sunscreen. The Secondary school educated participants (60.0 %) more often than university educated (23.5 %) applied sunscreen with SPF 15-25. However, university educated participants more often than secondary school educated applied sunscreen with SPF. It was more than 30 (28.7 % vs. 8.3 %; $p < 0.001$).

Skin phototype

Table 3 shows the characteristics of study population in relation to skin phototype. Overall 312 (59.0 %) participants were aware of their skin phototype, compared to participants 217 (41.0 %) who did not know it. More females (237, i.e. 67.5 %)

Table 2 Ultraviolet protection habits according to education

Factor	Total Sample		Secondary School		University		p-Value (chi^2)
	n (529)	100 %	n (303)	57.3 %	n (226)	42.7 %	p (χ^2)
Use of protective aid							
Yes	490	92.6	287	91.7	203	94.4	p = 0.03
No	39	7.4	16	8.3	23	5.6	
Protective aid							
Sunscreen	454	85.8	285	94.1	169	74.8	p < 0.001
Sunglasses	301	56.9	215	71.0	86	38.1	
Protective clothing	31	5.9	11	3.6	20	8.8	
None	39	7.4	16	5.3	23	10.2	
SPF							
< 10	129	24.4	47	15.5	82	36.3	p < 0.001
15-25	235	44.4	182	60.0	53	23.5	
> 30	90	17.0	25	8.3	65	28.7	
None	75	14.2	49	16.2	26	11.5	

Table 3 Socio-demographic characteristics of the study population by skin phototype

Factor	Total sample n (312)	Skin phototype				p-Value (chi²) p (χ^2)
		I, II		III, IV		
		n	%	n	%	
Gender						
Female participants	237	172	72.6	65	27.4	p < 0.001
Male participants	75	13	17.3	62	82,7	
Place of Residence						
Rural participants	184	88	47.8	96	52.2	p < 0.001
Urban participants	128	97	75.8	31	24.2	
Education						
Primary school	0	0	0	0	0	p < 0.001
Secondary school	201	145	72.1	56	27.9	
University	111	40	36.0	71	64.0	
Profession						
Healthcare professionals	209	126	60.3	83	39.7	p < 0.001
Other workers	103	59	57.3	44	42.7	

were aware of their phototype skin compared with males (75, i.e. 42.1 %) ($p < 0.001$) and more health-care professionals (209, i.e. 76.3 %) than other workers (103, i.e. 40.4 %) ($p < 0.001$).

From 312 participants who were aware of their phototype skin, 185 (59.3 %) had skin type I, II and 127 (40.7 %) had skin type III, IV. The participants residing in urban areas more often than participants resisting in rural areas had skin phototype I and II (75.8 % vs. 24.2 %; $p < 0.001$).

Sunbeds use

In the ensemble of 529 participants, 139 (26.3 %) visited sunbeds. Table 4 shows the basic characterristics of the study population in relation to sunbed use. The sunbeds were used especially by female participants in comparison to male ones (83.5 % vs. 16.5 %; $p < 0.001$). There was a significant differ-rence between the participants residing in urban and rural areas (40.3 % vs. 59.7 %; $p = 0.01$). Secondary school educated participants (92, i.e. 66.2 %) visited sunbeds more often than university educated parti-cipants (66.2 % vs. 33.8 %; $p = 0.01$). One-third (42, i.e. 30.2 %) from the total sunbeds users did not know their skin type ($p < 0.001$).

The results show that among the total sunbeds users, 78 (43.9 %) visited sunbeds regularly. Of the total of 139 sunbeds users, 58 (82.9 %) other workers and 21 (30.4 %) healthcare professionals used the sunbeds more than five times a month.

The participants visited sunbeds predominantly during the spring and winter season (91, i.e. 65.5%). Among the total of sunbeds users, almost 60 % (82)

Table 4 Sunbeds users according to socio-demographic characteristic and phototype

Factor	Sunbeds users (139)		
	N	%	p-Value (χ^2)
Gender			
Female participants	116	83.5	p < 0.001
Male participants	23	16.5	
Place of residence			
Rural participants	83	59.7	p = 0.01**
Urban participants	56	40.3	
Education			
Primary school	0	0	p = 0.01
Secondary school	92	66.2	
University	47	33.8	
Occupation			
Healthcare professionals	69	49.6	p = 0.5
Other workers	70	50.4	
Skin phototype			
I, II	35	25.2	p < 0.001
III, IV	62	44.6	
I do not know	42	30.2	

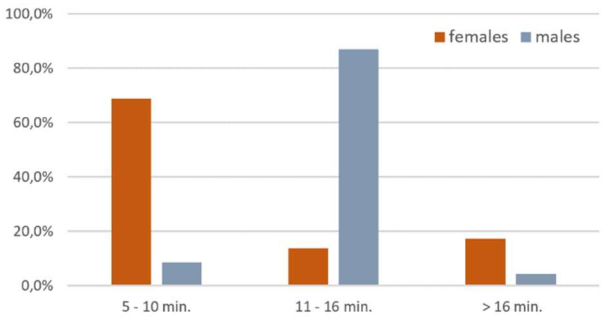

Fig. 1 Duration of use of the sunbeds according to gender

of participants spent 5–10 minutes in sunbeds, 36 (25.9 %) of them spent 11–16 minutes indoor tanning and 21 (15.1 %) used sunbed more than 16 minutes. Male participants (87.0 %) more often than female ones (13.8 %) spent 11–16 minutes in sunbeds ($p < 0.001$) (Fig.1).

More than half of participants (324, i.e. 61.2 %) were given instructions from sunbed employees about the proper use and potentially harmful effects of UVR. The respondents had information about harmful effect of sunbeds mostly from the Internet (45.2 %) and TV (38.1 %). As other sources of information participants reported newspapers and magazines (11.8 %), friends (3.3 %) and doctors (1.6 %).

DISCUSSION

In our study we assessed prevalent general and seasonal sunbed use as well as UV radiation health knowledge, UV protection attitudes, and habits among Central Slovakian citizens. Education to population about the risk of artificial UVR to health is important in terms of both the health protection and promotion. The research has shown a relationship between both melanoma and non-melanoma skin cancers and sun exposure or artificial radiation, and that skin cancer may be preventable through the use of effective UV protection [1, 9].

The evaluation of knowledge on UVR of adult participants showed that in some respects, there is still considerable potency for UV education. Although the male participants achieved the highest knowledge level on UVR, they protected themselves sparsely compared with the female participants. We found that more than two-thirds participants knew that UV is non-ionizing radiation. The similar results were given by Jakušová et al. [14]. According to them, respondents showed high level of knowledge on UVR. Our study showed that, UV protective aids used almost all participants. Sunscreens were the principal form of sun protection that used more than $^3/_4$ of participants. The least used sun protection was skin-covering clothing. Similar results were reported by the other studies that have addressed this issue [14–16].

Sunscreens were mainly designed for sunburn prevention. Using a sunscreen during outdoor or indoor tanning with a higher SPF protects human skin before UVR. SPF is the ability of a sunscreen to retard UV-induced skin erythemal reaction. More than one-half of all the participants recognized this definition. High SPF sunscreens (i.e., SPF ≥ 15) have been recommended for sun protection. In our study, the most widely used SPF was 15–25. A paradoxical result of our study was, that SPF higher than 30 have used less than one fifth of participants. Reinau et al. [15] presented, that more than half students usually used a product with SPF ≥ 20 and thirty percent did not mention the SPF statement.

UVR is one of the major risk factors for skin malignancies. Worldwide, the increase in malignant skin melanoma has increased by 237 % over the past 30 years. Slovakia reported a significant increase in mortality from malignant melanoma after 2012, from 178 in 2012 to 233 in 2015 [17].

For this reason, we wanted to know if the participants knew what the term malignant melanoma means. The survey found out that participants were informed above an average. Our results are consistent with those of Marušková et al. [5], where more than sixty percent of participants were familiar with malignant melanoma. Sardi et al. [18] reported that majority of participants knew the definition of malignant skin melanoma.

People with phototypes I and II are more at risk of malignant melanoma than people with skin phototype III and IV. More than half of the participants our survey knew their skin type. Jakušová et al. [14] reported similar results, according to their survey up to 2⁄3 participants have known their phototype. Our results did not match to those of Torzewski et al. [19]. Their survey showed that only 16 % participants knew their skin phototype. Another survey also showed that participants have insufficient knowledge of their skin type and only 32 % of them were aware of their phototype [6].

The knowledge regarding the risks resulting from excessive exposure to UVR, including the use of sunbeds, is extremely important. According to the information provided by the WHO and International Agency for Research on Cancer (IARC), the sunbeds are equally dangerous to human health as asbestos particles and tobacco fume. For this reason, IARC [20] has classified UVR as a carcinogen for humans. The increased incidence of diseases due to UVR is in addition to long-term stay in the sun, attributed to increased attendance of solariums. People attending solariums before 35 years of age have up to 75 % worse prognosis for development of malignant melanoma. For this reason, the international medical communities have advocated banning sunbed use for nonmedical purposes.

Because in the most developed countries, there is neither a legislation regulating sunbed use nor a complete ban.

According to meta-analysis including U.S., European, and Australian studies, 35.7 % worlds adult population used sunbeds, while on average 42 % of the adult population in Europe have used sunbeds [4]. In our sample sunbeds visited 23.6 % participants. The research by Torzewska et al. [19] revealed that 36 % of respondents use sunbeds. Schneider et al. [21] identified 21 % current adult users in the Germany. These results were higher compared to French data, where 13 % of the population reported visit sunbeds.

On average, tanning in sunbeds takes 5–10 min. per visit (60 %), the similar results were reported England survey. The same survey reported than a larger proportion of English participants were properly informed about the potential hazards of tanning in the sunbeds, compared to more than 60 % of our participants [22].

In our study female participants proved to be more prone to take a sunbed than male participants, nevertheless sunbeds were visited by females with phototype I. However, participants with skin types III and IV tend to use sunbeds more often than those with phototypes I or II. Meta-analysis of Schneider et al. [21] suggests similar results. Bränström et al. [23] showed than females were almost twice as likely as males to report using the sunbeds. In order to decrease of incidence of malignant melanoma worldwide WHO recommended to decrease or even stop the attendance of sunbeds [9]. Nowadays the Ministry of Health of the Slovak Republic together in cooperation with the Public Health Authority of the Slovak Republic are planning to strengthen the prevention in the area of the protection of youth health and to prevent the risk of skin cancer. In practice, this will mean that persons under the age of 18 will be legally banned from visiting commercial sunbeds [24].

CONCLUSION

Our survey results showed that despite having adequate knowledge about UVR, more participants visited sunbeds and did not know their skin phototype. Sunbed users often showed considerable lack of knowledge on sunbeds risks. The positive finding was than almost all participants had wearing UV protective aids-sunscreen and sunglasses. However, only a small part of them employ a combination of sunglasses and sunscreen. Since in the SK, there is not a proper legislation regulating sunbed use, it is important to educate population on UVR risks. In concord with our findings we consider that the issue of UVR should be given a greater emphasis and should be included as important agenda for preventive programs in the Slovak Republic.

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