Introduction

Ultraviolet (UV) radiation has various effects on health. Some are positive, such as the production of vitamin D₃, essential for bone mineralization.¹ A protective effect, mediated by vitamin D₃, has also been suggested against multiple sclerosis² and the development of prostate cancer,³ although the evidence is still not conclusive.⁴ Other effects are negative, acting as a risk factor for skin cancer, immunosuppression and cataracts.⁵

Malignant skin tumours, basal cell carcinoma and spinoctelial carcinoma as well as melanoma, are a growing problem in Spain due to their steady increase in recent decades. Annual increases in

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There are mortality of 2% have been recorded for melanoma, and the incidence of this neoplasms ranges between 4 to 9/100,000 for men and 3 to 10/100,000 for women. Despite this increase, similar to that seen in other countries in southern Europe like Portugal and Greece, the mortality rate from melanoma in Spain is still one of the lowest in Europe, probably because of the characteristics of the cutaneous pigmentation of the population. Nevertheless, the increase in this disease could reflect changes in the sun exposure habits of the Spanish population.

There is strong evidence that solar radiation is the main environmental risk factor for the three main types of skin cancer, with the effect increasing as the intensity of exposure rises. There are variations in the relationship between the types of cancer and their localization regarding the time and type of sun exposure, but this association is seen even for short-term intermittent exposures and basal cell carcinoma or melanoma. Scientific evidence also supports the relationship between exposure to artificial sources of UV radiation and certain types of skin cancer, increasing the risk of occurrence of these neoplasms, according to sociodemographic variables. Despite this increase, similar to that seen in other countries in southern Europe like Portugal and Greece, the mortality rate from melanoma in Spain is still one of the lowest in Europe, probably because of the characteristics of the cutaneous pigmentation of the population. Nevertheless, the increase in this disease could reflect changes in the sun exposure habits of the Spanish population.

Knowledge of the effects of exposure to ultraviolet radiation and skin cancer, according to sociodemographic variables

<table>
<thead>
<tr>
<th>Knowledge that prolonged sun exposure is a risk factor for skin cancer</th>
<th>Knowledge that prolonged exposure to ultraviolet ray lamps is a risk factor for skin cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Total</td>
<td>2,007</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>984</td>
</tr>
<tr>
<td>Women</td>
<td>1,023</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>18-29</td>
<td>540</td>
</tr>
<tr>
<td>30-44</td>
<td>768</td>
</tr>
<tr>
<td>45-64</td>
<td>699</td>
</tr>
<tr>
<td>p linear trend</td>
<td></td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>615</td>
</tr>
<tr>
<td>Higher secondary education</td>
<td>697</td>
</tr>
<tr>
<td>Lower secondary education</td>
<td>473</td>
</tr>
<tr>
<td>Primary education or below</td>
<td>222</td>
</tr>
<tr>
<td>p linear trend</td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>1,470</td>
</tr>
<tr>
<td>Students</td>
<td>181</td>
</tr>
<tr>
<td>Houseworkers</td>
<td>205</td>
</tr>
<tr>
<td>Unemployed/retired</td>
<td>151</td>
</tr>
</tbody>
</table>

a Odds ratios adjusted for the rest of the variables in the table.

The questionnaire was drawn up from questions normally used with an adult population and structured into four sections: 1) Knowledge: Do you think that prolonged exposure to the sun is a risk factor for skin cancer? (Yes, No, Not sure); Do you think that prolonged exposure to UV ray lamps is a risk factor for skin cancer? (Yes, No, Not sure); 2) Protective measures: Do you use protection against the sun in summer? (Always, Nearly always, Sometimes, Never); and 3) Exposure variables: Do you sunbathe in the summer for sun tanning between 12 midday and 4 in the afternoon? (Always, Nearly always, Sometimes, Never); Have you used UV ray lamps for tanning during the last year? (Yes, No); and 4) Effects: Have you suffered sunburn during the last 12 months, including any occasion when an area of skin, even only a small one, was red for more than 12 hours? (Yes, No).

Data analysis

Logistic regression models were constructed differentiated for each indicator, simultaneously introducing the following analysis variables: gender, age (18-29, 30-44 and 45-64 years of age), educational level (university, higher secondary education, lower secondary education, primary education or below), and employment status (employed persons, students, houseworkers, unemployed persons/retired). Prevalence odds ratios (OR) were calculated with their corresponding 95% confidence intervals (95%CI). The first-order interactions between gender, age, educational level and employment status were also calculated in each.

Methods

Study design and population

A cross-sectional study carried out in 2007 as part of the Sistema de Vigilancia de Factores de Riesgo de Enfermedades No Transmisibles (SIV FRENT) [Behavioural Risk Factor Surveillance System for non-communicable diseases] of the Madrid region, which continually monitors the health habits and preventive practices of the non-institutionalised population aged 18-64 years. A total of 2,007 participants were selected in a representative way from the household directory for fixed line telephone services (covering 92% of all households), by stratified sampling with proportional allocation of the population structure according to gender, age and geographical area. The interviews were conducted using a Computer Assisted Telephone Interviewing (CATI) system, for one week each month, except for August.

Study variables

The questionnaire was drawn up from questions normally used with an adult population and structured into four sections: 1) Knowledge: Do you think that prolonged exposure to the sun is a risk factor for skin cancer? (Yes, No, Not sure); Do you think that prolonged exposure to UV ray lamps is a risk factor for skin cancer? (Yes, No, Not sure); 2) Protective measures: Do you use protection against the sun in summer? (Always, Nearly always, Sometimes, Never), which of the following do you use?: clothing (cap, T-shirt); sun protection creams; sunglasses; 3) Exposure variables: Do you sunbathe in the summer for sun tanning between 12 midday and 4 in the afternoon? (Always, Nearly always, Sometimes, Never); Have you used UV ray lamps for tanning during the last year? (Yes, No); and 4) Effects: Have you suffered sunburn during the last 12 months, including any occasion when an area of skin, even only a small one, was red for more than 12 hours? (Yes, No).
one of the models. P-value for linear trend was estimated for the variables age and educational level.

The level of statistical significance was set at p<0.05. The statistical analyses were carried out using Stata v.10 (StataCorp, College Station, 2008).

Results

The response rate (completed interviews as a percentage of the total sum of completed, partially completed and incomPLETED/refused interviews) was 65.1%. The sample studied was similar in structure in terms of age and gender to the population between 18 and 64 years of age in the Madrid region.

Regarding knowledge of risk factors, 92.3% [95% CI: 91.0-93.4] knew that prolonged sun exposure is a risk factor for skin cancer and 73.6% [95% CI: 71.6-75.5] knew about the association of skin cancer with prolonged exposure to UV ray lamps. Table 1 shows the odds ratio (OR) adjusted for gender, age, educational level and employment status. Knowledge of these risk factors was higher, after adjustment there were no statistically significant differences for the use of sunglasses. Women more frequently used sun creams and sunglasses than men. No clear pattern was seen for educational level or employment status. The use of UV ray lamps for tanning was also higher among women. No differences were seen for the use of UV tanning equipment by educational level after adjustment for the rest of the sociodemographic variables. Regarding employment status, a lower use of such equipment was recorded for students. Women reported suffering less sunburn throughout the last year than men, OR of 0.58 [95% CI: 0.39-0.87]. By educational level, those with lower secondary education suffered less frequently from sunburn in the last year (OR of 0.58; 95% CI: 0.39-0.87). By employment status, students were the group that most frequently reported sunburn in the last year, estimating an OR of 1.60 [95% CI: 1.07-2.40]. No statistically significant interactions were found between the variables studied.

Discussion

The main results of this study suggest that most of the population, especially among people of a higher educational level and women in general, knows the relationship between exposure to UV radiation and skin cancer. The most commonly used protection was sun cream, and a variable distribution was seen by gender, age and educational level, according to the types of measures employed.
Some 13.2% suffered sunburn during the last year, with a greater risk detected for men, young people and students. Knowledge that sun exposure is a risk factor for skin cancer is very high in this population (92.3%), but is lower for artificial UV exposure, with one in four people unaware of the risk. Indeed, this latter estimate is lower compared to that of a recent study in Denmark, where 88% identified artificial UV exposure as a risk factor for cancer and skin alterations. Our results also show this discrepancy, which is probably due to a certain level of skin tanning still being socially considered to be attractive and an indicator of good health.

Exposure to solar radiation in the peak afternoon hours is low (15%), much lower than that recorded in Israel (63%). Again, it is associated with women and with young people, as in the UK. Similarly, the prevalence of artificial UV exposure is very low in our region (4.3%), at least when compared with countries with limited sun exposure, such as Denmark, with a prevalence of 29%. This prevalence is also lower than that in the USA (15%). In our study, artificial UV exposure is higher among women and young people, which is consistent with the findings of previous studies.

Our data do not reflect an association with educational level, in contrast to other studies that have found associations in different directions, in some cases being linked to a lower educational level and in others, to a higher educational level.

In our study, the prevalence of sunburn in the last year (13.2%) is much lower than that seen in the Anglo-Saxon countries, using the same or a very similar question: 34-39% in the USA, 56% in Canada and 51-70% in Australia. In Europe, specifically in Stockholm, a prevalence of 55% has been estimated for the population of 13-50 years of age. Factors that could contribute to these differences are that, as previously mentioned, the population of the Madrid region more frequently uses sun protection measures, but also that the dominant skin phenotype of the population is more resistant to sun exposure. Hence, for example, when only people of Latin origin were included in the interviews conducted in the USA, the percentage of sunburn was reduced to 20% for men and 17.2% for women. Yet in Melbourne, with a less...
resistant skin phototype, a study published in 2008 showed how the percentage of people suffering sunburn was 9.1% due to the influence of strong prevention campaigns.17

Although women sunbathe more often, they suffer less sunburn than men, a finding consistent with those of other authors.24,25,27,28,31–34 It is possible that the greater use of protective sun creams by women may have influenced these results, although the difference could also be due to variations in total sun exposure times, as in general men spend more time outdoors than women.35 According to our results, the youngest people in the study, who also have a higher sun exposure, have a higher incidence of skin lesions, as indicated in other studies.18,24,25,27,28,32,33,36 Irrespective of age, students have a greater probability of suffering sunburn, as seen in previous reports.32,36 However, no clear association was found between sunburn and educational level, a relationship that has contradictory information in the literature. Although some studies have found no relationship,25,27,28 others have found a greater probability of sunburn for people with the highest educational level,2,3,36 or for those with a low educational level.33 Finally, there did not appear to be a higher risk of sunburn for employed people, which could suggest that its occurrence is linked to leisure-time sun exposure, looking for a tan.38

There are certain methodological limitations in our study that should be pointed out, in order to obtain a better interpretation of the results. Data have not been obtained for those over 64 years of age, among whom there are many cases of skin cancer, or for those under 18 years of age, where prevention is very important. The general way of measuring the variables has not allowed the gathering of detailed information, for example, about the level of protection of sun creams or the frequency of application, the inclusion of which would be useful in subsequent surveys. Although subject to the classic memory bias of this type of measurement, self-reported information from questionnaires has demonstrated an acceptable validity.37,38 Another limitation is related to the differences in the questions and response categories used in questionnaires, which make comparison between studies difficult, leading to a recent proposal for standardized measurements.14

This study is based on a broad representative sample (in terms of age and gender) of a region that has 13.5% of the population of Spain. Nevertheless, it is possible that people with a low educational level could be underestimated.39 The telephone questionnaire of SIVFREN'T (A Behavioural Risk Factor Surveillance System for non-communicable diseases in the Madrid region), in which the section about sun exposure was included, has shown a good reproducibility40 and convergent validity as compared to home surveys.39 Moreover, the distribution of the interviews throughout all the months of the year avoids estimates being influenced by seasonal variability. For example, a higher prevalence of sunburn has been described by those interviewed in the summer.32

In summary, most of the population, especially people with a high level of education and women in general, know the relationship between exposure to UV radiation and skin cancer, even if a discrepancy was seen between this level of knowledge and the use of protective measures and sun exposure habits. The use of sun creams is the most frequently used protective measure, and one in seven people normally sunbathe during the summer in the peak afternoon hours, with this habit being more frequent among women and young people. Some 13.2% of the sample population suffered sunburn in the last year, with a higher risk among men, young people and students. These results indicate the need to maintain preventive strategies to continue improving knowledge about the risk of exposure to UV radiation and reduce risk behaviour to exposure, as well as strengthening environmental protection measures, such as guaranteeing that public recreational spaces have abundant shady areas for protection against direct exposure to the sun.

Authorship contributions

I. Galán and E. Cámara designed the study. I. Galán performed statistical analysis. I. Galán, A. Rodríguez, L. Díez and E. Cámara significantly contributed to the interpretation of the data and to the article writing. All authors read and approved the final manuscript.

Financial support

This study was funded by the Madrid Regional Health Authority, Spain.

Conflict of interest

None declared.

Acknowledgements

We thank the interviewers and respondents, as well as Miguel de la Fuente for the fieldwork support.

References