

Children's knowledge and behavior towards the sun and photo protection (Survey of 391 children in the region of Fez, Morocco)

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ABSTRACT

Background: Currently, the sun-cancer relationship is well established and it is clearly demonstrated that sun exposure during childhood increases the risk of skin cancer in later life. The main objective of our study was to evaluate the behavior and knowledge of children towards the sun, its dangers, particularly skin cancer, and the different means of photo protection. **Material and methods:** We conducted a descriptive cross-sectional survey using a questionnaire among students (primary and secondary) in the region of Fez (urban and rural). **Results:** Three hundred and eighty-one children delivered a completed and usable questionnaire. The average age was 13 years, the sex ratio M/F = 1,16. 71,9% of the children were from public schools and 66% had moderately pigmented skin. Among the 97% of children who practice outdoor activities during the vacations, 30.5% like to tan, and almost half spend more than 30 minutes a day under the sun. 69.6% of the children declared that they take with them during the vacations at least one sun protection product (sun cream, hat, sunglasses...) Concerning the application of sunscreen, 72.2% of children used sunscreen during their vacations, 27.7% reapply it every two hours and 82.4% apply it only in summer. At school, 72.6% of the students said they look for shade during recess and only 10% apply sun cream. 55, 8% of the children think that the sun can be dangerous, 44.2% know that there is a relationship between the sun and skin cancer, 52% think that the sun can cause burns and 37% skin aging. 71% said they have already been told by a parent that they should protect themselves from the sun, 41.5% were advised by their teachers and only 31% by a doctor. 43% of our children had heard of skin cancer and almost half of these children know that it can be caused by the sun. In general, the assessment of children's knowledge was average in about half of the cases, we noted that children are better protected during the summer vacations than at school. We also focused on the role of parents, schools, doctors and media in raising children's awareness, which was not sufficient. **Conclusion:** The prevention of children's sun exposure could decrease the incidence of skin cancer in the future.

Key words: Children; Photoprotection; School; Prevention

INTRODUCTION

Sunlight is essential for human life, not only as a source of energy and nourishment, but also because it is involved in certain biochemical and metabolic processes, regulates biological rhythms and contributes to psychological well-being [1]. However, excessive exposure to the sun can lead to a series of skin disorders,

such as sunburn, blemishes, skin aging and skin cancers [2]. Currently, the sun-cancer relationship is well established and it is clearly demonstrated that sun exposure during childhood increases the risk of skin cancer in later life, in fact, sun exposure and sunburns during the first 10 to 15 years of life have proven to play an important role in the etiology of all skin cancer types [3]. Several recent studies indicate that their

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incidence has increased significantly in recent years in many countries in the world [4,5]. All this justifies the setting up of prevention and information campaigns to try to modify the erroneous behaviors of the individuals with regard to the solar exposure and in particular those of the children [1]. In this work we will be interested in the knowledge, attitudes and practices of children in the region of Fez towards sun exposure in order to draw the necessary conclusions to rehabilitate information on the risks of photo exposure in our school programs.

MATERIALS AND METHODS

Study Design

This was a cross-sectional study, spread over a period of month, on may 2019, in the city of Fez in Morocco.

Sampling

The target population consisted of 400 students from primary and secondary schools in the Fez region. The 10 schools that participated in the study were chosen in order to have a significant sample representing the different students of the region of Fez taking into consideration the environment (urban/rural) as well as the sector (private/public) that we selected in the database of schools at the level of the regional academy of education, school map office. One to two classes were randomly selected from each school to participate in the study. We included in the study all the elementary school and private and public colleges located in the region of Fez (urban and rural) We excluded: CE 1 and CE 2 levels (elementary school) by what we judged that the children can not understand the questions and give adapted answers, High schools, Primary and secondary schools located in the Fez-Meknes region, outside the prefecture of Fez, schools for people with disabilities. The authorizations to access the schools were taken from the school health unit, regional delegation of education of the city of Fez.

Data Collection

The data was collected through an anonymous self-questionnaire filled out by the students in the different selected schools, they were distributed to the classes and completed during a regular lesson under the supervision of the class teacher. we were present in the classrooms for the necessary explanations.

Collection Tool: The Questionnaire

After bibliographical research on the subject, we established a questionnaire composed of four parts responding to the different objectives we had fixed ourselves. This questionnaire was validated in a multidisciplinary meeting, including experts in Dermatology, Clinical epidemiology and scientific research.

The questions were then tested and validated on a sample of children before the survey was conducted, we established a simple and easy to answer questionnaire for the children composed of three parts:

The first part concerned General information, includes questions such as age (year), sex (male/female), parents' occupation, school level, environment (urban/rural), sector (public/private), phototype, history of sunburn.

The second part concerned the evaluation of the children's behavior In this part, we analyzed Children's behavior towards the sun during the vacations: (The desire to tan, Schedule of outdoor activities, The application of sun cream, Wearing clothes, hats and sunglasses) and also The behavior of children during a sports session at school, (Looking for shade, The application of sunscreen, hats, covered clothes).

The third part concerned the evaluation of the children's knowledge about the sun and the means of photo protection, In this part we analyzed through 21 questions: Children's knowledge about the dangers of the sun, the sources of information of the children on the sun and the means of photo protection, Role of parents, teachers and doctors, Children's knowledge about skin cancer, The different means of photo protection (chemical, clothing, schedule).

For self-assessment of skin type, the questionnaires contained a table with sample color images of the 6 Fitzpatrick skin types and corresponding descriptions of skin, hair, and eye color and tanning ability.

Parental education level was assessed only by asking children about their parents' occupations, three categories were distinguished: Level 1=occupations requiring a university degree/Level 2 = occupations requiring a degree other than university/Level 3=occupations requiring no degree. The educational level of the parents for each child was considered to be the highest between the two parents.

Concerned The question about the three most important things kids takes with them on vacation asked whether kids think about taking sunscreen products. And to facilitate statistical analysis, we divided the responses into two categories: Category 1: the presence of at least one sunscreen product. Category 2: no sunscreen products.

At the end, we wanted to correlate our results with the many variables studied in our survey. To do this, we developed a knowledge level in collaboration with the medical epidemiology staff., We identified 3 levels of children's knowledge about the dangers of the sun, skin cancer and the different means of photo protection. These three levels were identified according to the number of correct answers to the different questions. good level of knowledge: > 8 correct answers/average level of knowledge: between 7 and 5 correct answers/low level of knowledge: < or = 4 correct answers.

Statistical Analysis

A descriptive, multivariate analysis using the SPSS 21 software were performed. In the descriptive analysis, quantitative variables were expressed by means \pm standard deviation and qualitative variables by percentages. The "Chi-square" test was used to compare percentages in order to determine the factors associated with the practice and the knowledge level. A p value less than 0.05 was considered statistically significant.

Training Material

We prepared to inform the students about the dangers of the sun and the different means of photo protection a 10 min power point projection presentation that was illustrated and explained in each class after completing the questionnaire. The presentation was made in Arabic, in an interactive way with the students.

This presentation contains: General definitions about the solar system, The sun, ultraviolet rays (UVA, UVB, UVC) and their degree of penetration in the skin layers, The benefits of the sun, Harmful effects of the sun (burns, skin cancers, other sun-related dermatoses),The different means of photo protection: Natural; Chemical: sun protection products with a video showing the correct way to apply sun cream Schedule, Clothing (with illustrations and animations).

Ethics Statement

Ethical approval was obtained from the ethics committees at Hospital Center University Hassan II in Fez, Morocco.

RESULTS

At the end of this survey, we were able to collect 391 completed and usable questionnaires.

Socio-Demographic Characteristics

The mean of age of the children was 13 ± 5 years (08 -18 years), The most frequent age range of our children were those older than 14 years. Male children represented 51.7%, a sex ratio of 1,16. 320 (81.8%) of the children interviewed were from the urban area, In general 246 (62.9%) children were in elementary school and 145 (37.1%) in middle school. 281 (71.9%) of the children contacted public sector schools. Children with moderately pigmented skin were the most represented in our study with a percentage of 66%. More than half (58.1%) of the parents of the children in our study have a low level of education. Of the 58.5% of children who reported sunburn, 32.1% had more than 2 sunburns in the previous year and only 20% visited a doctor for the sunburn (Table 1).

Table 1: Socio-demographic characteristics of the children in our study

Characteristics	Absolute number (%)
Age (years)	
8-10	84 (22%)
11-13	162 (41%)
≥ 14	145 (37%)
Sexe	
Female	181 (46,3%)
Male	210 (53,7%)
Area	
Urban	320 (81,8%)
Rural	71 (18,2%)
Scholarship level	
Primary	246 (62,9%)
Collège	145 (37,1%)
Sector	
Private	281 (28,1%)
Public	110 (71,9%)
Phototype	
Light skin	125 (32%)
Medium pigmented skin	258 (66%)
Dark skin	8 (2%)
Parents' educational level	
Level 1	38 (9,7%)
Level 2	126 (32,3%)
Level 3	277 (58,1%)
History of sunburn	
0	43 (16,5%)
1-2	135 (51,5)
>2	84 (32,1)

Assessment of Children's Behavior

On vacation

Among the 97% of children who declared to practice outdoor activities during the vacations, 30.5% like to tan, and almost half spend more than 30 minutes a day under the sun. Only 16.4% of the children said they prefer a tanned skin and thinks that it makes them more beautiful. 69.6% or (272) of the children declared that they take at least one sun protection product with them during the vacations (sun cream, hat, sunglasses...) 72.2% of children reported using sunscreen during vacations, while only 27.7% reapply sunscreen every two hours. On the regularity of sunscreen application, 17% of the students apply it regularly (throughout the year) while most (82.4%) apply it only during the summer. 35% of children often wear a T-shirt at the beach. Of the 44% who reported often wearing a hat, 82.2% wear caps versus 17.8% who wear a wide-brimmed hat. 36.3% often wear sunglasses. 40% of children do outdoor activities between 10 am and 4 pm compared to 43.4% between 8 am and 10 am and 15% between 4 pm and 8 pm (Table 2).

At school

72.6% of students reported seeking shade during recess. 31% wear a hat during school sports, only 10% apply sunscreen and 14.6% wear covered clothing.

Table 2: distribution of children according to the application of the different methods of photo protection

answers concerning the application of the different methods of photoprotection	Absolute number (%)
Application of sun cream during your vacations	
Yes	282 (72,2%)
No	109 (27,8%)
Frequency of reapplication of sunscreen	
Never, one application is enough	192 (64,9%)
Every 2 hours	81 (27,4%)
Others	23 (7,2%)
Type of sunscreen application	
Regular (all year round)	54 (17,6%)
Seasonal (summer only)	253 (82,4%)
wearing of clothes and accessories	
T-shirt	137 (35%)
Hat	170 (43,7%)
Sunglasses	142 (36,3%)
Schedule of outdoor activities during the vacations	
8 H and 10 H	169 (43,4%)
10 H and 16 H	158 (40,6%)
16 H and 20 H	62 (15,9%)

Table 3: distribution of children according to the global knowledge score

Global knowledge score	Absolute number (%)
Good	80 (20,5%)
Average	203 (51,9%)
Low	108 (27,6%)

Assessment of Children's Knowledge

More than half of our children had an average level of knowledge, 27.6% were low level while only 20% had a high level of knowledge (Table 3).

Among the effects of the sun, 55, 8% of children think it can be dangerous, 44.2% know that there is a relationship between the sun and skin cancer, and 52% think that the sun can cause burning and 37% skin aging. While 93% ticked that the sun is good for morale and 65% the intake of vitamin D as a benefit of the sun. The main sources of children's information on sun and photo protection were the family in 65% of cases, the school in 46.4% of cases, followed by the media in 27.4%. Parents, teachers and doctors play a major role in educating our children. To assess this role regarding the dangers of the sun and photo protection, we asked children if they had ever been informed by their parents, teachers or doctors that they should protect themselves from the sun. Concerning the parents, 276 children (71%) declared that they had already been informed by one of the parents that they should protect themselves from the sun; 41.5% were advised by their teachers and only 31% by a doctor. Regarding their knowledge about skin cancer, only 43% of our children had ever heard of skin cancer and almost half of these children know that it can be caused by the sun, while 34% checked off tobacco as the cause of skin cancer about their knowledge of the different means of photoprotection, 266 children (68.2%) stated that sunscreen is used to protect the skin against 25% who think it is used to tan and 6.4% who apply sunscreen to please their parents, 60% of the children answered that there are several types of sunscreen and only 10.3% know that it is necessary to apply a sunscreen with SPF 50+. Only 35.4% (138 children) responded that sunscreen should be reapplied every 2 hours. Concerning the different means of clothing that allow us to protect ourselves from the sun, 78.2% (305 children) answered that we should wear a wide-brimmed hat, 62% sunglasses, 32.6% covered clothes while only 13.3% (52 children) think that we should wear a dark color on sunny days. Finally 208 children (53.3%) responded that the sun is stronger between noon and 4 pm.

Statistical analysis using the Chi 2 test showed The existence of a significant difference in the desire to tan according to age, school level and phototype, which is more marked in primary school children between 11 and 13 years of age with light phototypes. and also that female children with fair skin are the ones who apply

Table 4: Analytical study concerning the application of different methods of photoprotection during the vacations

Characteristics	Sunscreen N(%)	P-value	T-shirt N(%)	P-value	Hat N(%)	P-value	tanning desire N(%)	P-value
Age (years)								
8-10	35 (18,7)		29 (21,2)		40 (23,5)		23 (19,7)	0,000
11-13	124 (43,8)	0,079	45 (32,8)	0,079	60 (35,3)	0,273	66 (56,4)	
≥14	106 (37,5)		63 (46,0)		70 (41,2)		28 (23,9)	
Sexe								
Female	132 (39,9)	0,034	72 (47,4)	0,062	79 (46,5)	0,395	49 (41,9)	0,253
Male	161 (60,1)		65 (47,4)		91 (53,5)		68 (58,1)	
Area								
Urban	230 (81,3)	0,636	116 (84,7)	0,021	141 (82,9)	0,609	100 (85,5)	0,224
Rural	53 (18,7)		21 (15,3)		29 (17,1)		17 (14,5)	
Scholarship level								
Primary	169 (59,7)	0,999	80 (58,4)	0,166	66 (38,3)	0,685	82 (70,1)	0,050
Collège	114 (40,3)		57 (41,6)		104 (61,2)		35 (29,9)	
Sector								
Private	76 (26,9)	0,363	87 (63,5)	0,021	57 (33,5)	0,114	29 (24,8)	0,336
Public	209 (73,1)		50 (36,5)		113 (66,5)		88 (75,2)	
Phototype								
Light skin	90 (68,7)	0,044	36 (26,5)	0,25	48 (28,2)	0,085	91 (69,5)	0,041
Medium pigmented skin	62 (57,4)		97 (70,8)		117 (68,8)		77 (96,5)	
Dark skin	7 (2,5)		4 (2,9)		5 (2,9)		0 (0,00)	
Parent's educational level								
Level 1	28 (9,8)	0,87	19 (13,9)	0,071	24 (14,1)	0,25	8 (6,8)	0,45
Level 2	93 (32,9)		51 (37,2)		61 (35,5)		40 (34,2)	
Level 3	162 (57,2)		67 (48,9)		113 (66,5)		69 (59)	
History of sunburn								
0	158 (55,8)		77 (56,2)		100 (58,8)		71 (60,7)	
1-2	89 (31,4)	0,228	38 (27,7)	0,157	47 (27,6)	0,21	35 (29,9)	0,472
>2	36 (12,7)		22 (16,1)		23 (13,5)		11 (9,4)	

Table 5 : comparative table of the application of different methods of photoprotection during the vacations and at school

Studied variables	sunscreen	p-value	HAT	P value	Covred clothing	P value
Vacations	249 (88,0)		96 (56,5)		122 (85,1)	
school	34 (12,0)	0,029	74 (43,5)	0,000	15 (14,9)	0,0249

sunscreen the most. We also noted the existence of a significant difference in relation to the application of sunscreen and the wearing of hats during the vacations and during a sports session at school, which are higher during the vacations.

Regarding the level of knowledge, We note a significant difference between the level of knowledge in relation to: Age: it is higher in the middle age group between 11 and 13 compared to the youngest (8-10 years), and the oldest (> 14 years), sector: it is higher among children in the private sector than in the public sector, The level of education: the level of knowledge is higher among children in primary school. environment: it is higher among urban children.

DISCUSSION

In the general population, children should be a specific target because it is now widely accepted that children spend more time outdoors than adults, it has

been estimated that 50-80% of a person's exposure to ultraviolet (UV) radiation occurs before the age of 18 [6]. Also, they are more susceptible to the carcinogenic effects of UV radiation. Specific strategies to protect the child population should be encouraged to reduce the future incidence of skin cancers [7].

For a long time, white skin was the standard of beauty in Eastern and Western cultures. This all changed at the beginning of the 20th century, when tanning began to be accepted and then highly valued. Nowadays a dark tanned skin has become the indisputable reference of beauty, while most individuals are aware of the dangers of tanning, both from the sun and from artificial tanning [8]. We wanted to study this preference for tanned skin in our children. In our study 30.5% of the children answered that they like to stay under the sun/tan with a significantly higher percentage in children between 11 and 13 years ($p=0,000$); (Table 4). Only 16.4% of our children answered that tanning makes them more beautiful. A more recent Swiss study showed that 55% of children reported a favorable attitude

towards tanning [9], 55% of Italian children responded that they liked the sun because they could get a tan especially those aged 11-14 years [10]. We have noted that the percentage of children wishing to tan is slightly lower than the results found in the literature, this difference can be explained by the phototype of the children in our study which is represented in 60% of the cases by children with moderately pigmented skin (phototype III and IV).

concerning the application of sunscreen, We have noted that most of the children are aware of the application of sunscreen but not on the regularity of its application These results are similar to those in the literature, In a similar study, 79.6% of elementary school children reported using sunscreen on sunny days compared to 63.4% for middle schoolers [11].

Since school is the place where children spend the most time during the day, we wanted to study children's sun exposure behavior at school. Compared to the behavior of children during vacations, we found that children are less protected at school, with a significant difference in relation to the application of sunscreen and the wearing of hats (Table 5). It has been shown in Florida that Students protect themselves more outdoors than at school, for sunscreen application 69% of children in a French study applied it at the beach while only 4% of children used sunscreen at school [12].

Parents serve as role models for their children, and their knowledge about ultraviolet radiation exposure and protective behavior has a lasting effect on their children [13]. They can provide personalized and effective prevention messages to their children and initiate outdoor sun protection habits early in life. In our study 276 children (71%) reported that they had already been informed by a parent to protect themselves from the sun. In Switzerland 52.5% of secondary school students reported that sun protection was a topic of conversation at home and that they are continuously asked by their parents to protect themselves from the sun especially in families with higher education [14].

The school, being a place of living and learning, would be a very good place to structure educational actions. The World Health Organization (WHO) has recognized the school as an effective setting for skin cancer prevention efforts [15,16]. In a study conducted in 2017, 44% of students reported that they learned about the sun and sun protection at school [11], Thus, implementing sun protection modules as part of a school-based health

education program may be an effective measure to increase parents' and children's knowledge about sun exposure [17]. Several randomized intervention trials (RITs) of school-based interventions promoting sun-protective behaviors are reported in the international literature. Among the published trials, a wide variety of actions and methods have been used, but almost all have the same ultimate goal of increasing sun-protective behavior [13,19-21]. Most studies report an overall improvement in knowledge as a result of their intervention, but very few report a persistent change in sun exposure attitudes and behaviors [15,22]. A Spanish study judged the role of schools as insufficient with an imminent need to improve sun protection policies and practices in schools to help children adopt sun protection habits at an early age [23].

Medical personnel (dermatologists, pediatricians, general practitioners, and school nurses) should be involved in disseminating appropriate prevention messages about the sun and its harms. In Thailand, children who reported dermatologists or general practitioners as their source of information tended to have better sun protection behaviors [24].

Finally, concerning the knowledge of our children, most of the children had an average level of knowledge with a significantly high percentage among children between 11 and 13 years old, those from the private sector and living in urban areas. In Switzerland, the knowledge related to the sun was high in only one third of the respondents, and depended mainly on the age of the student, with the oldest students achieving the highest knowledge scores. The knowledge status also depended on the education level of the parents, the better the education of the parents the higher the sun-related knowledge of the students [14].

These results encourage us to reflect on the measures to be taken to improve the behavior and knowledge of children regarding the sun and the prevention of skin cancers in our country. For this we propose: To think about extending the study to other regions of Morocco, in order to have global results on the behavior and knowledge of Moroccan children, organize awareness campaigns against the harmful effects of the sun and the means of photoprotection for parents and children, and to focus on the rural environment and take into consideration the different constraints in which the children live., Conducting education sessions on sun protection measures for children and their parents at school.

Introduce information on the sun and photo protection in the school curriculum, and finally Introduce the media in the prevention of skin cancer.

CONCLUSION

The prevention of sun exposure among our children could reduce the incidence of skin cancers in the future, this justifies the implementation of prevention and information campaigns to try to modify the erroneous behavior of children with regard to sun exposure and to think of rehabilitating the information on the risks of photo exposure in our school programs.

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Statement of Human and Animal Rights

All the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the 2008 revision of the Declaration of Helsinki of 1975.

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