

Ultraviolet - A Protection in Nonprescription Sunglasses

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Abstract

Purpose: Sunglasses have become common over-the-counter ophthalmic devices worn by most people in Ghana for the purported protection against harmful ultraviolet radiation from sunlight. The purposes of this study were to determine whether the level of protection against ultraviolet - A (UVA) in sampled non-prescription sunglasses met the American Optometric Association (AOA) standard and to ascertain some purchasing decisions made by wearers when buying these non-prescription sunglasses.

Methods: We investigated the UVA transmissivity of the right eye of 81 pair of glasses under a D-903 auto lensmeter with an inbuilt UVA meter to determine their level of protection against UVA using the AOA UVA - protection standard as our reference. To ascertain some of the purchasing decisions made by sunglass-wearers, we conducted a cross-sectional study among 400 sunglass wearers aged between 15 and 65 years in a Ghanaian metropolis, using an interviewer administered questionnaire.

Results: Overall, 53% of the sunglasses acquired from roadside vendors failed to meet the AOA UVA -protection standard while all of the sunglasses from optical shops met the standard. Mean UVA was 100% in optical shop sunglasses and 77.23% in roadside vendor sunglasses. Most common purchase locations were from roadside vendors (65.5%) and fashion stores/boutique (21.3%). Participants' main reasons for wearing sunglasses included glare reduction (38.3%) and fashion (30.8%). Price (41.5%) was the most important factor considered when buying sunglasses while 1.25% indicated amount of UV protection as the most important factor.

Conclusion: More than half of sunglasses sold by roadside vendors did not meet the AOA standard. Most of our study respondents did not consider UV protection when buying sunglasses.

Keywords: Low vision; Retinitis Pigmentosa; Telescope; Spectacle Magnifier

Introduction

Ultraviolet (UV) radiation has insidious effects on the human eye [1]. UV - induced damage and related diseases can occur in a number of tissues within the eye, ranging from the corneal surface to the retina [2-4]. Ultraviolet radiation is of a continuum of wavelengths from 100 -400 nm. There is Ultraviolet A (UVA) of 315-400 nm, Ultraviolet B (UVB) of 280-315 nm and Ultraviolet C (UVC) of 100-280 nm. The UVA rays constitute 90-95% of the ultraviolet light reaching the earth [5].

Even though UVB is far more dangerous than UVA, similar ocular effect has been documented as a result of cumulative accumulation of UVA in tissues [6-9]. Ophthalmic experts suggest a myriad of protective gears that could help shield the eyes from deleterious effects of UV radiation. These include but not limited to wearing appropriate head wears, sunglasses, photochromic lenses and sunscreens [10,11]. While these forms of protective gears are useful, the AOA recommends that choice sunglasses or protective contact lenses should block at least 99% of UVA and UVB.

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Some reports show that in spite of the widespread implication of UV radiation in eye conditions such as age-related macular degeneration, cancer of the eye, cataract and pterygium formation, many people are still not aware of the hazardous UV-related ocular effects [12,13]. Studies conducted show that countries like Ghana also have high prevalence of UV-related eye diseases [14-16]. Many people in the country resort to the use of sunglasses to shield their eyes from the gross effect of radiation from the sun and other artificial sources. They acquire these sunglasses from the optical shops and or very often, from roadside (street) vendors. What draws the attention of the local ophthalmic community is that, some of these sunglasses may not have the level of protection claimed by manufacturers. This is similar to concerns raised in other studies; sunglasses with inferior protection are even thought to enhance transmittance of UV radiation into the eye because their darker tints cause pupillary dilatation allowing much more than less of harmful radiation to enter the eyes [4,17,18].

This study was an attempt to determine whether or not UVA protection in some nonprescription sunglasses on the Ghanaian market met AOA standard and to explore some decisions made by wearers when buying nonprescription sunglasses.

Methods

Study Design and Sampling

We conducted a cross-sectional study in a Ghanaian metropolis in which we measured UVA protection in a sample of sunglasses and obtained information on some decisions made by wearers when buying the sunglasses via an interviewer – administered questionnaire pretested in a pilot study.

A total of 81 pairs of nonprescription sunglasses were conveniently acquired for this study: 66 pairs were acquired from 10 different roadside vendors and 15 pairs from 2 optical shops located in different areas of the metropolis. We obtained a sample size of 385 respondents (all aged between 15-65 years), estimated using Epi Info software version 7 (at Confidence Interval of 95%) based on the total of 353,662 people living in the metropolis at the time of the study.

Data Collection Technique

Evaluation of sunglasses for their UVA protection

The UVA (380nm) transmissivity of the right lens of each sampled sunglass was determined with a D-903 auto lensmeter with an in-built UVA meter. The measured values were then compared with the AOA standard which is set at a minimum of 99% of UVA.

The UVA protection of the sunglasses studied was computed as follows:

% protection = 100 – % transmittance

For example, if a given lens allowed 10% UV transmittance, it was considered to afford 90% protection against UV: 100 – 10% transmittance = 90% protection.

Decision made by respondents when buying sunglasses

The interviewer – administered questionnaire sought for information relevant to the study. Participants were asked to willingly provide information on where they acquired their sunglasses, why they bought the sunglasses and on what factors they considered when buying the sunglasses.

Data Analysis

Data collected was analyzed using Epi Info software (version7). Continuous variables are expressed as mean ± standard deviations and p- < 0.05 was considered significant.

Ethical Considerations

Informed consent was sought from all study participants; terms of anonymity was assured and sources of acquired lens were agreed to be kept confidential. Our study adhered to the Declaration of Helsinki.

Results

Assessment of UVA protection

A total of 81 pairs of sunglasses comprising 66 pairs from roadside vendors (81.48%) and 15 pairs from optical shops (18.52%) were measured. Their UVA protections ranged from 26% to 100% with a mean UVA protection of 81.44% ± 24.43%. The mean UVA protection for sunglasses acquired from the roadside was significantly lower than those acquired from the optical shops vendors (P < 0.0001). All the sunglasses from optical shops met the AOA standard on UVA protection, while only 47% of sunglasses from the roadside vendors met the AOA standard. Table 1 summarizes these findings.

AOA standard			
Purchase locations	Failed	Passed	Total
Optical / Eyecare centre	0	15 (100%)	15
Roadside vendor	35 (53%)	31 (47%)	66
Total	35	46	81

Table 1: Distribution of Purchase location and AOA Standard.

Gender and age distribution of sunglass users

A total of 400 sunglass users (82% males and 18% females) participated in the study. Table 2 shows the age and gender distribution of the respondents sampled for the study. The ages of the participants ranged from 15 to 65 years. In all instances males were found to be the majority across all age groups.

Age	Female	Male	Total
15-29 years	43	125	168 (42%)
30-44years	20	120	140 (35%)
45-65 years	9	83	92 (23%)
Total	72(18.0%)	328 (82.0%)	400 (100%)

Table 2: Distribution of age and gender.

Purchase locations of recent sunglasses

Figure 1 shows the various common purchase locations where studied participants acquired or purchased their sunglasses.

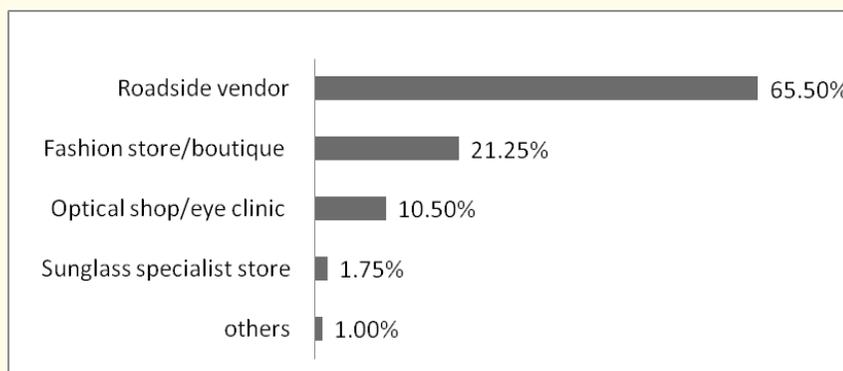


Figure 1: Purchase location of sunglasses.

Main reason for sunglass wear

Participants offered various reasons for why they wore sunglasses. This is summarized in figure 2.

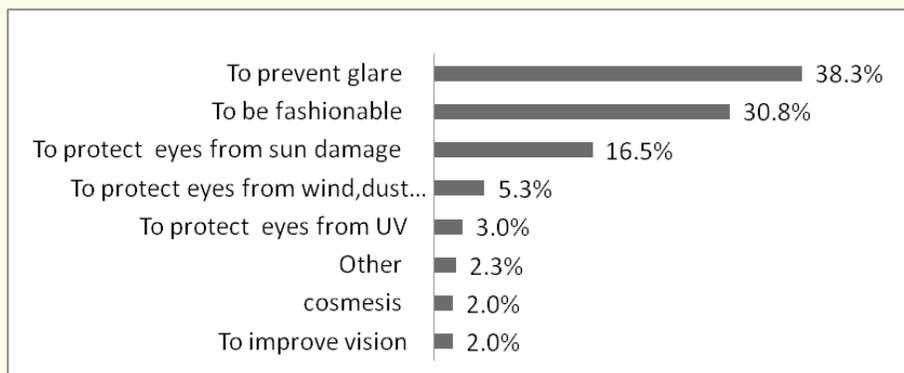


Figure 2: Main reason for wearing sunglasses.

Most important factor in purchase decision making

The studied participants also reported in the study that they considered various factors whenever they wanted to purchase a pair of sunglasses. The factors included varied from prevention of glare to protection against ultraviolet radiation. A summary of the factors is shown in figure 3.

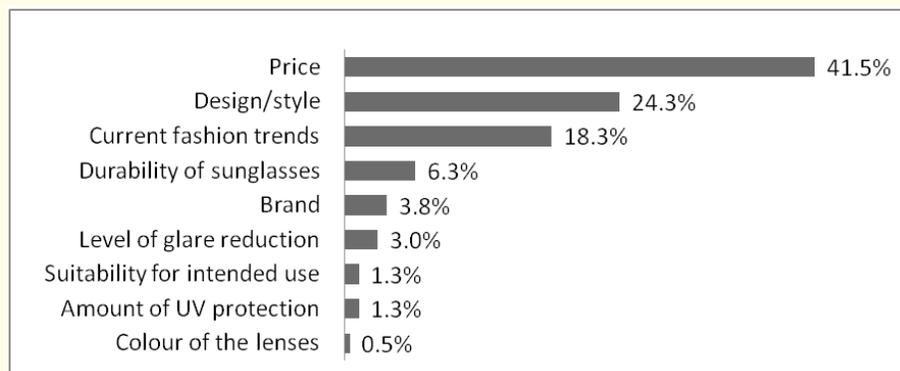


Figure 3: Important factors in purchase decision making.

Discussion

Several other studies have reported different values for UVA protection in prescription and non – prescription sunglasses. Our studies recorded values which were close to what had been reported in two different other studies. The slight differences in values could be due to differences in sample size and type of measuring instrument – a spectrophotometer was used in these other studies whereas a lensmeter was used in our study [18-20].

Further, we recorded consistent findings with one study [19]. On how sunglasses obtained from optical shops met the AOA standard as compared to those purchased from roadside vendors. In our study, all of the sunglasses acquired from optical shops met the AOA standard – they provided at least 99% protection against UVA .On one hand, only 47% of the sunglasses acquired from roadside vendors

met the AOA requirement ($p = 0.002$). The discrepancy observed between these two groups of sunglasses might be due to differences in the manufacturing and regulatory standards observed by different manufacturers. The tints on most of sunglasses acquired from the roadside were likely to fade easily because the sunglasses were made of inferior plastics which were prone to scratching effects and thus unable to firmly hold tint material.

For the many possible above and perhaps differences in sample size, other studies have also reported 75% failure rate of a sample of sunglasses studied for UVA protection [21]. In this study, only 25% of the sunglasses could provide UVA protection of 95% and above. A different study recorded a lower failure rate of 1.5% where they applied an inclusion criteria of only lenses carrying the European Certification (CE) mark [16]. While some challenges to our study design did not allow for us to discuss optical quality of the sunglasses sampled for the study, other studies have discussed this an important element in the study of sunglasses [20].

Regarding the numbers of study participants who wore sunglasses, males were significantly higher than females ($p < 0.0001$). Overall, there were 82% male study respondents and the mere higher number of males could have been a confounder to this finding. Other studies have not detected a significant association between gender and sunglass wear [22,23]. Some plausible explanations to our findings are that there is higher literacy among males than females in the Ghanaian population [24]. Males are thus much more aware of how sunglasses may offer protection against UVA. Additionally, more males were enthused about partaking in the study than females. We would also like readers to consider our findings in the light of certain limitations to our study design. We chose a convenient sampling method which might not have allowed sunglass wearers equal opportunity to partake in the study.

The age of majority (77%) of the respondents was from 15 – 44 years. This finding is similar to what has been reported in another study – where the participants 67% of the participants were aged from 18 – 44 years [25]. While the only single meaningful explanation to the age profile of the respondents could be the relatively youthful nature of the Ghanaian population, another possible reason could be love for fashion. Some of the country's youth may wear sunglasses for no reason than cosmetic.

In the looking at the different places where study respondents acquired their sunglasses we noticed roadside vending stands (65.5%) formed the majority. This was followed by boutiques/fashion centers (21.3%). Optical shops/eye clinics formed the least (10.5%). While this we found, a different study [25] revealed that the most common sunglass-purchase locations were specialist sunglass shops and boutiques. In our study, some respondents explained that sunglasses acquired from the roadside are relatively cheaper and were readily available to buy. On one hand, they explained that acquiring sunglasses from specialist shops and or eye clinics were expensive and came with some extra requirements. Potential sunglass buyers often need to undergo eye tests (eye examination) in these places before buying them.

Out of the total number of sunglass wearers interviewed, 77.25% of them replaced their sunglasses at least once a year. Exactly 40% of them confirmed they replaced their sunglasses at least once every six months. In a comparable study [25] 77% of the subjects replaced their glasses at least once every two years. Several reasons might account for the difference in the frequency of sunglass replacements. Replacements of sunglasses may become necessary when existing ones become old, weak or break. Some people might also change their existing wears when the tints fade and or when they wish to change their older designs to keep up to date with fashion.

The duration of sunglass wear per day differed from respondent to respondent; 66.6% wore their sunglasses for a (an unspecified) greater part of the day irrespective of their location or weather conditions. On the contrary, 22.5% wore them on sunny days and when they were outdoors. It suffices to say, the Ghana's climate could influence how and when people wear sunglasses.

The average UV irradiance in Ghana is relatively high. This is perhaps due to the low naturally occurring low total ozone columns and higher solar elevations [26]. In a similar but rather different survey conducted by the Vision Council on protection against the sun, 27% of the participants reported wearing their sunglasses anytime outdoors and 46% wore their sunglasses on sunny days. The differences in percentages recorded may be due to varying climate characteristics in these places of study.

The reasons given for why the study participants wore sunglasses were diverse. Some 38.3% of them wore sunglasses to prevent glare, 30.8% wore sunglasses to look fashionable and 16.5% mentioned protection against UV radiation as their reason for wearing sunglasses. On one hand, the Australian study revealed that 34% of the study respondents wore sunglasses to prevent glare while 28% reported protection against UV radiation as the main reason [25]. Compared to our study, the Australian study had a higher percentage of people stating protection against UV as a reason for sunglass wear. While we do not know what accounts for this major difference, we do not doubt that the participants of that study are better informed about the harm UV could cause to their eyes. It is also worth mentioning that Australia may have well advanced health campaign structures and better regulatory systems regarding the use of sunglasses. Other possible explanation might be due differences in the overall number in study participants.

In focusing on what factors sunglass wearers considered before making a purchase, 41.5% of the participants stated that they considered price of the sunglasses. A few of them (1.3%) considered the level of UV protection stated on sunglass labels. Other studies have offered several different factors considered by sunglass wearers [20]. One study recorded 33% for protection against UV as a major factor considered by sunglass users. Comfort (26%), price (18%), style (15%), and lens colour (3%) were some other reasons recorded in that same study [12]. Glare prevention (14%), price (14%) and protection against UV (20%) were also reported in the Australian study [25]. The factors vary from study to study. That price is a major factor in our study is reasonable; Ghana is a developing country and majority of the people have minimal earnings that makes it challenging in acquiring different goods and services-sunglasses being an extreme example [27].

Conclusion

While more than half (53%) of sunglasses from roadside vendors failed to meet the AOA standard, all the sunglasses from optical shops in the Sekondi-Takoradi metropolis provided maximum UVA protection. Participants wore sunglasses for different reasons and protection ultraviolet radiation was one of such reasons. Price was a major factor or influence in deciding to purchase sunglasses. Participants also acquired their sunglasses from different places-mainly from roadside, optical centers and fashion centers.

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