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Investigation of Ultraviolet Radiation (UVR) in Benue State University, Makurdi, Benue State

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Abstract
The study investigated the level of ultraviolet (UV) radiation in Benue State University, Makurdi. Since the greatest source of UV radiation reaching the earth surface is from the sun, we have investigated in detail the solar UV intensity in Benue State University. This was done through measurement of UV indices with the use of a broad band UV checker which infers the intensity of UV radiation. Typical values of ultraviolet indices between 7 and 13 were observed during clear sky hours in the solar noon hours of the day, meaning the UV radiation intensity was high. However,it was observed to be low/moderate between UVI of 1 and 6 when overcast occurred in the sky. But the intensities of UV radiation were observed to be constantly low/moderate from 6:00am-10:00am and 4:00pm-5:00pm times of the day.

Key words: Ultraviolet indices; Radiation; Sun; Makurdi

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INTRODUCTION
The prevalence of skin cancers and some eye defects among people have been traced to their exposure to ultraviolet (UV) rays. This harm accumulates during one's life time. Research indicate that some exposure to sunlight can be enjoyable; however too much could be dangerous. Over-exposure to the sun's UV rays can cause immediate effects, such as sunburn, and long-term problems, such as skin cancer and cataracts (Wanda, 2008).

Ultraviolet (UV) rays are a Non-Ionizing Radiation which form that portion of the electromagnetic spectrum between X-rays and visible light, i.e., between 40 nm and 40nm (Betsy, 1997). It can also be defined as the electromagnetic radiation with a wavelength shorter than that of visible light but longer than X-rays, in the range 10nm to 400 nm, and energies from 3 eV to 124 eV (Black and Gauvin, 2006). Three types of UV light have been identified and the spectrum can be subdivided in a number of ways. The Draft ISO standard on determining solar irradiances (ISO-DIS-21948) describes the following ranges.

Name	Abbreviation	Wave length range(nm)	Energy per photon(eV)
Ultraviolet A, long wave or black light.	UAV	400-315	3.10-3.94
Near	NUV	400-300	3.10-4.13
Ultraviolet B or medium wave	UVB	315-280	3.94-4.43
Middle	MUV	300-200	4.13-6.20
Ultraviolet C, short wave or germicidal	UVC	280-100	4.43-12.4
Far	FUV	200-122	6.20-10.2
Vacuum	VUV	200-100	6.20-12.4
Low	LUV	100-88	12.4-141
Super	SUV	150-10	8.28-124
Extreme	EUV	121-10	10.2-124

(WHO, 2002)

UVC is almost never observed in nature because it is absorbed completely in the atmosphere, as are far UV and vacuum UV. Germicidal lamps are designed to emit UVC radiation because of its ability to kill bacteria. In humans, UVC is absorbed in the outer dead layers of the epidermis. Accidental over-exposure to UVC can cause corneal burns, commonly termed welder's flash, and snow blindness, a severe sunburn to the face. While UVC injury usually clears up in a day or two, it can be extremely painful (Agnir, 2002).

UVB is typically the most destructive form of UV radiation because it has enough energy to cause photochemical damage to cellular DNA, yet not enough to be completely absorbed by the atmosphere. UVB is needed by humans for synthesis of vitamin D; however, harmful effects can include erythema (sunburn), cataracts, and development of skin cancer. Individuals working out doors are at the greatest risk of UVB effects. Most solar UVB is blocked by ozone in the atmosphere, and there is concern that reduction in atmospheric ozone could increase the prevalence of skin cancer (Agnir, 2002).

UVA is the most commonly encountered types of UV light. Atmospheric ozone absorbs very little of this part of the UV spectrum. It is needed by humans for synthesis of vitamin D; however over-exposure toughens the skin, causes immune system suppression and cataract formation. UVA light is often called black light. Most phototherapy and tanning booths use UVA lamps (Agnir, 2002).

The strength of the UV radiation reaching the earth surface at a particular place is determined by the UV index of that place at a given time.The UV index is a number linearly related to the intensity of UV radiation reaching the surface of the earth at a given point. This is an International standard measurement of the strength of the ultraviolet (UV) rays from the sun at a particular place on a particular day. It is a scale primarily used in daily forecasts aimed at the general public (Young, 2000).Its purpose is to help people to effectively protect themselves from UV light, of which excessive exposure causes sunburns, eye defect such as cataracts, skin aging and skin cancer (Wanda, 2008).Most people do not use sunscreen and sunglasses.The few ones who are interested in the usage are still misinformed about the products with standard specifications. As such they are faced with the entire hazard caused by over-exposure to UV rays. Over-exposure to the ultraviolet component of sunlight may be associated with an increased risk for certain skin cancers. The rise in skin cancer which some experts are calling an epidermis is a source of controversy. Cumulative damage from repeated UV exposure may also contribute greatly to chronic eye disease.A saying goes, "prevention is better than cure". No doubt, this is true. The depletion of the ozone layer (giant sunshade) has become a source of worry to human beings. For it is likely to aggravate existing health effects caused by exposure to UV radiation, as stratospheric ozone is a particularly effective UV radiation absorber. As the ozone layer gets thinner, the protective filter provided by the atmosphere is progressively reduced. Consequently, human beings and the environment are exposed to higher UV B levels that have the greatest impact on human health, animals, marine organisms and plant life. As such there is a continuing need to maintain health promotion campaigns to limit personal exposure to damaging UV radiation. Clearer advise is also needed on how the public can maintain adequate vitamin D status and at the same time avoid the adverse consequences of exposure to sunlight.

This research was carried out at the Benue state University where the UV index and the power density of the UVR in the university is measured at the frontage of the vice chancellor's office.This work is aimed at predicting the UV index and subsequently the UV intensity in Benue State University. This will enhance the establishment of an UV alert statement based on the UV index predicted.

1. MATERIALS AND METHODS

The instrument used in the measurement of the UVI and UV irradiance (W/m^2) level was the portable, digital UV checker—the educator. The educator UV checker is broadband, detects both UVA and UVB and then calculates the UVI and UV irradiance through averaging the reading of the various wavelengths according to the Erythemal Action Spectrum.

The special features of the Educator UV checker include: One button, easy to use, with a lanyard for easy carrying, the UV sensor is embedded inside the transparent knob,when pointed toward the sun a more precise measurement of UVI and UV irradiance (W/m^2) is obtained. The daily measurement of UVI and UV irradiance level around the vice chancellor's office frontage, Benue state University were carried out with the educator UV checker held at 1.8m above the ground level. The measurement were done at every hour of the day during the day-light time only i.e. from 6:00am to 6:00pm. A maximum of thirteen (13) readings each for UVI and the UV irradiance were recorded in a day. However during rainy hours measurements were not taken, because when it is raining there is a total overcast in the sky and readings are assumed to be zero.

Procedure

We pressed and held the ON/TEST/OFF key for two seconds to turn on the device. The UV irradiance functions were noted, then the device was allowed to return to its standby mode. It was then held approximately 1.8m above the ground level with its sensor pointed toward the sunlight.In the standby mode, the ON/TEST/OFF key was pressed once, and then the measurements were taken in

one second.The UVI and UV irradiance were displayed for about 15 seconds. Then the metre returned to it's standby mode again.

2. RESULTS AND DISCUSSION

Graphical Representation of Data

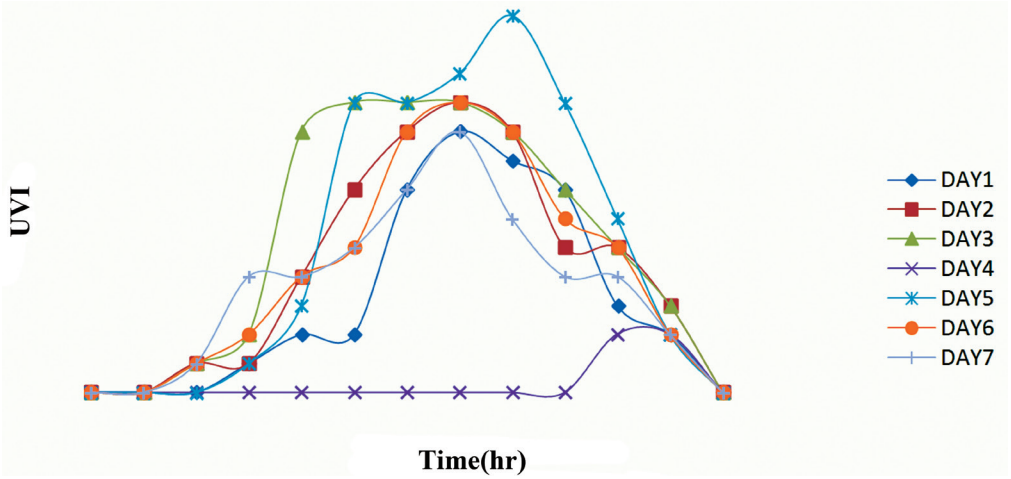

Figure 1
Week 1

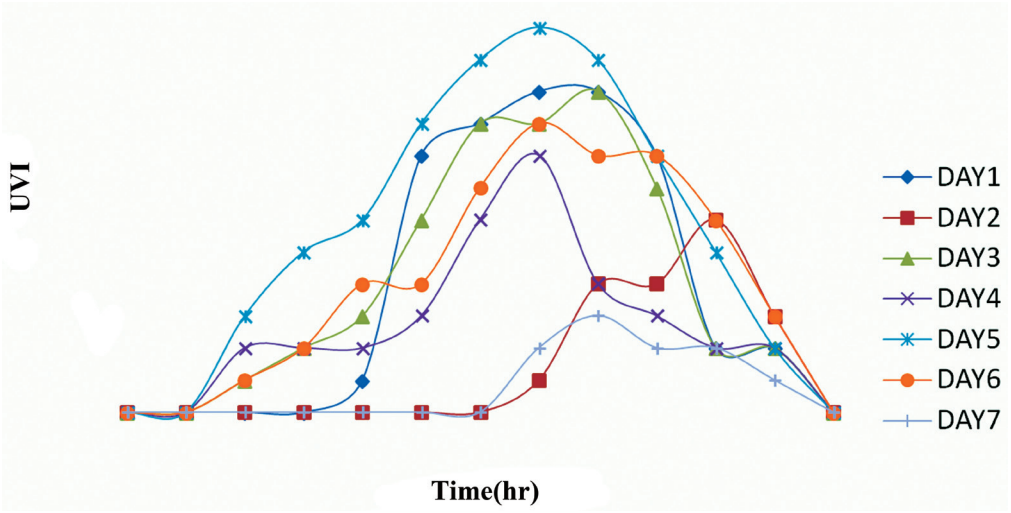

Figure 2
Week 2

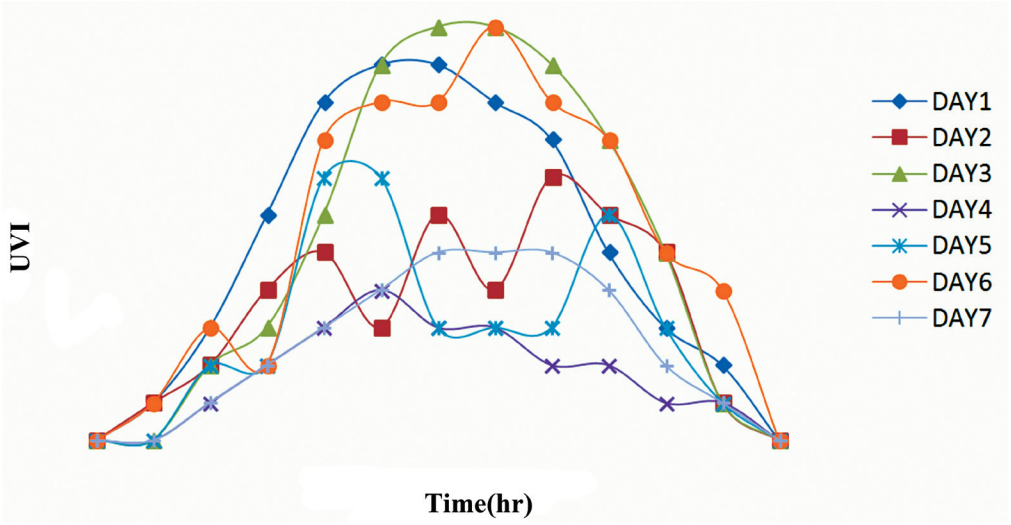

Figure 3
Week 3

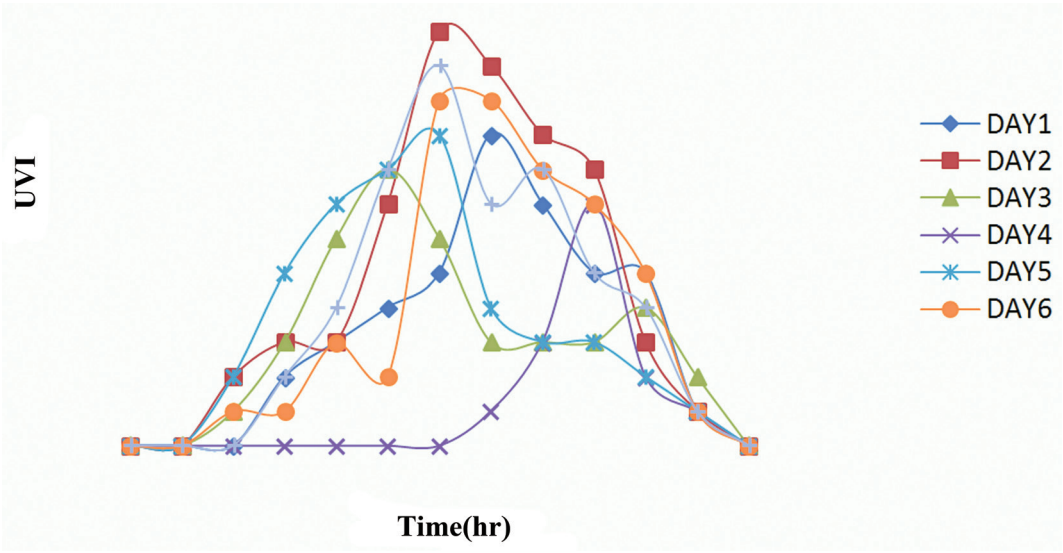

Figure 4
Week 4

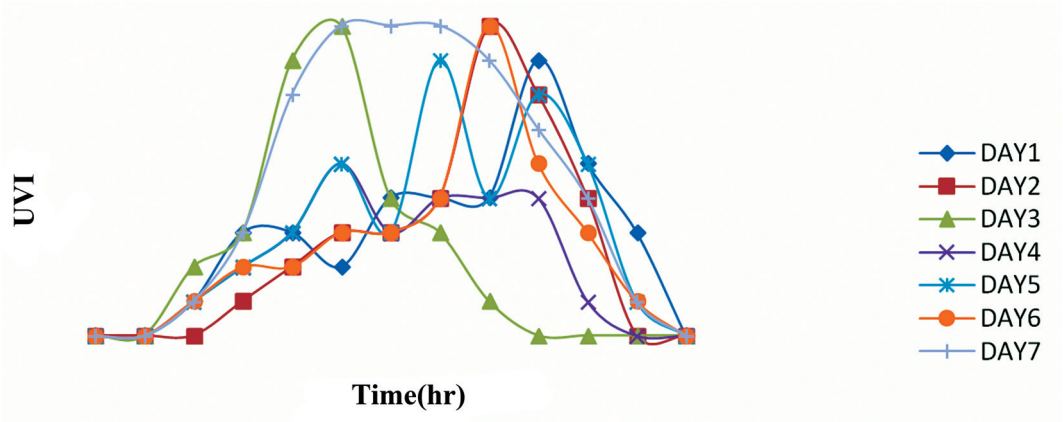

Figure 5
Week 5

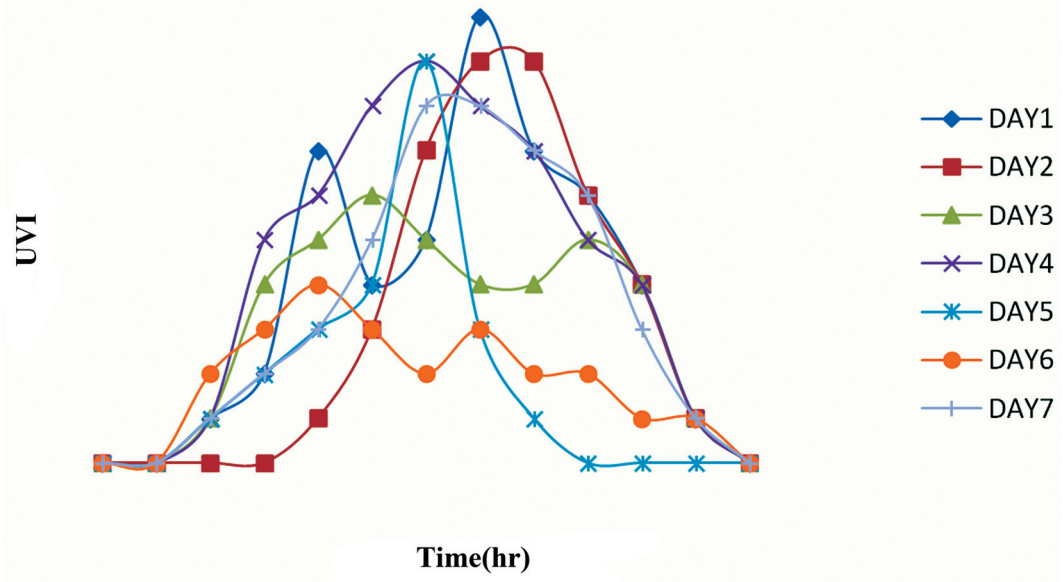

Figure 6
Week 6

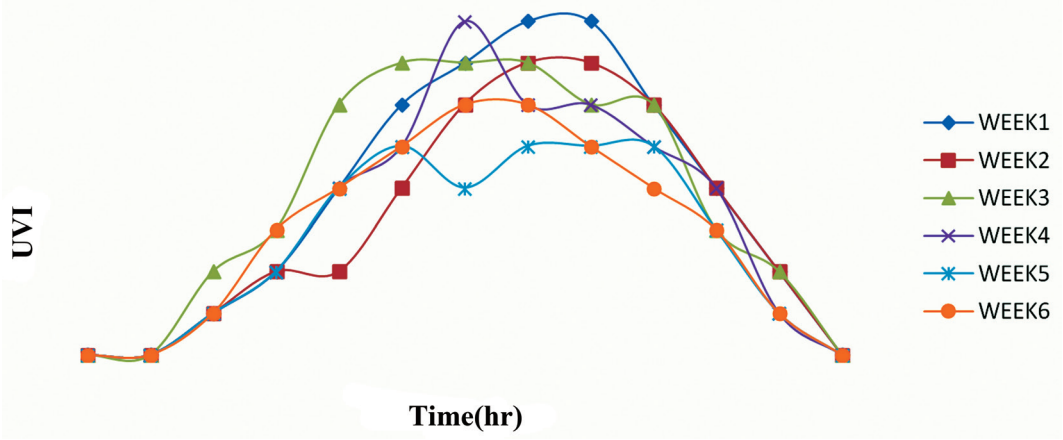

Figure 7
Weekly Averages

The UV radiation levels are normally from natural (sun, star R16ac etc.) and artificial (Black light, UV fluorescent lamps, UV LEDs etc.) sources. Research has shown that, UV intensity is strongest when the sun is at its highest point in the day, which typically occurs during the four how period surrounding solar noon (EPA, 2003).

Around the world, UV indices greater than 11(eleven) are quite common in the countries (Australia, New Zealand, South America, chile etc.) located at the southern hemisphere where the Ozone layer is depleted (Diffey, 2004). In Benue State University (BSU), Makurdi from the research carried out, consequent measurements show that UV indices were mostly observed to be high in the environment between 11:00am and 3:00pm in clear sky solar days. Indices of 7 to 13 were observed during the cause of this study. This implied that, the environment was highly exposed to UV radiation during these hours.

The study results have also shown that Benue State University case is synonymous to that of southern hemisphere environment where ozone layer is depleted. It can also be assume roughly that, Benue state University neighboring communities will also receive approximately the same UV intensities as observed in the Benue State University since their locational co-ordinates might differ only by some few seconds.

CONCLUSION

The UV intensity in Benue State University was observed to be very high (i.e. UV indices between 7 and 13 were recorded) between 11:00am and 3:00pm in clear sky hours, but was low/moderate (i.e. UV indices between 1 and 6) when an overcast occurred in the skies. However the UV intensity was observed to be constantly low/moderate from 6:00am to 10:00am and 4:00pm to 6:00pm times of the day.

RECOMMENDATION

We recommend that, more research should be carried out on this work using other types of monitors in different sites and the results can be compared. Also, the measurement of the UV indices should cover both the wet and dry season after which the result obtained in both seasons are compared so as to advice the public appropriately.

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