JURNAL Healthsains
Printed ISSN: 2722-7782
Electronic ISSN:2722-5356
jurnal.healthsains.co.id

EFFECT OF CLOTHING FABRIC COLOR ON UV ABSORPTION OF SKIN PROTECTION EFFORTS

Purwito Soegeng asetijono[1], Andhika Dwi Anggara[2], Nila Prasetya Aryani[3]
Fakultas Kedokteran, Universitas Islam Sultan Agung Semarang, Jawa Tengah, Indonesia[1,2]
Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Semarang, Jawa Tengah, Indonesia[3]
Email: purwitofis@gmail.com, andhika.d.anggara@gmail.com, nilaprasetya@mail.unnes.ac.id

Keywords:
Ultraviolet (UV); Fabric Color; Radiation.

ABSTRACT
Despite the many benefits of sunlight, it can also have negative impacts on our health, particularly from Ultraviolet (UV) radiation. To reduce the risks, one can protect themselves by wearing appropriate clothing, avoiding prolonged exposure to sunlight, especially Ultraviolet (UV) radiation. It is necessary to pay attention to the choice of clothing colors considering that each color actually absorbs sunlight with different abilities. Therefore it is very important for us to know the color selection of clothes to wear in reducing exposure to UV rays on our skin. The objective of this study is to determine the difference in the effect of clothing fabric color on UV ray absorption. The UV intensity data obtained is the intensity of UV that has passed through a cloth filter with a certain color and the intensity without a filter. Data collection was conducted with 10 different cloth color variations. The results will be compared between the UV intensity with various colored cloth filters and the intensity without a filter. It was found that different colors on fabric also affect the intensity of UV rays that are absorbed or transmitted. Relatively bright colors will cause a dominant amount of UV rays to pass through compared to dark-colored fabrics. The fabric colors that allow more UV radiation to pass through are those that are predominantly light, in this study, the colors Purple and White.

Info Artikel: Artikel masuk, Direvisi, Diterima

INTRODUCTION

The benefits of sunlight for life are many, but it turns out that it can also have negative effects on our health. One of these negative effects comes from exposure to ultraviolet (UV) rays from the sun. In some ways, UV rays are beneficial to humans, including synthesizing Vitamin D and killing bacteria (Wright & Weller, 2015). However, in addition to the above benefits, UV rays can be harmful to humans if exposed to human skin for too long (Young et al., 2017). Negative effects of UV exposure can

How to cite: Purwito Soegeng asetijono, Andhika Dwi Anggara, Nila Prasetya Aryani (2023) Effect of Clothing Fabric Color on UV Absorption of Skin Protection Efforts, *Journal Health Sains*, *4*(5). https://doi.org/
E-ISSN: 2722-5356
Published by: Ridwan Institute

include skin redness, erythema, skin cell destruction, and even skin cancer (Serrano et al., 2013).

The Meteorology and Climatology Agency (BMKG) has stated on its official Instagram account that extreme UV rays from the sun will hit Indonesia, particularly the Eastern and Central regions, starting from Tuesday (25/4/2023). To reduce the risk of UV radiation exposure, one can wear appropriate clothing, use sunscreen, avoid exposure to sunlight as much as possible, be cautious with photosensitive treatments, and increase awareness of the harmful effects of exposure (Arjun et al., 2013). In hot climates, clothing serves to protect the body from sunlight or other impacts (Bennett et al., 2020). Additionally, clothing acts as a barrier that impedes evaporation and reduces heat loss by decreasing air circulation near the skin (Jannah et al., 2019).

Understanding the function of clothing is important in protecting the body from exposure to sunlight, especially UV rays, and as a barrier to prevent the evaporation of body heat. Therefore, the choice of clothing material is crucial. Cotton is a widely used and preferred material for day-to-day activities due to its comfort. In addition to the fabric material, the color of the fabric also needs to be considered because different colors absorb different intensities of sunlight (Liana & Nurbaiti, 2021). It is therefore important to know the level of protection of clothing fabric of different colors in resisting and absorbing UV rays.

METHOD

The clothing material used in this study is cotton fabric with 10 color variations. The colors used are black, gray, white, purple, pink, blue, green, yellow, orange, and red. Each fabric has the same specifications in terms of thickness and gram weight. The tool used is a set of ultraviolet (UV) meters, Tenmars TM-213 type, with a grab range of wavelengths of 290-390 nm and a measurement range of intensity of 4000 µW/cm2 and 20 mW/cm2 along with a computer with adequate specifications.

Figure 1 Color Variety of Cotton Fabrics Used in This Study

Data collection was done by comparing the intensity readings captured by a UV meter with a colored fabric filter against the intensity readings without a filter. Data collection was carried out between 11:00-13:00 because this time period has high sunlight intensity (Anas et al., 2022). Data collection was not limited to one day only, but carried out over multiple days to obtain more optimal measurement data. From the ten collected

data sets, a Kruskal-Wallis Test was conducted to compare the average percentage of UV intensity.

RESULTS AND DISCUSSION

The intensity of UV radiation measured four times resulted in an average intensity of 4.267 mW/m2. The data collected was the intensity of UV radiation from direct sunlight, without any cloud cover or other obstructions.

Two UV meters were used to measure the intensity of UV rays from direct sunlight and from sunlight passing through fabric of various colors. Both intensities were obtained at the same time and were compared to determine the percentage of UV intensity that could pass through the fabric. The percentage of UV intensity that passed through indicates the clothing's ability to protect our skin from UV exposure. The higher the percentage, the lower the clothing's ability to protect against UV rays (Sastrawati & Jumain, 2023).

The data collected from ten different colored fabrics had a range of percentage values from 0.77% to 4.1%. The Kruskal-Wallis test was conducted to determine the difference in the average percentage of UV intensity for each fabric. The result showed a p-value of 0.005 ($p<0.05$), indicating that there was a significant difference in the average percentage of UV intensity among the ten different colored fabrics used in this study.

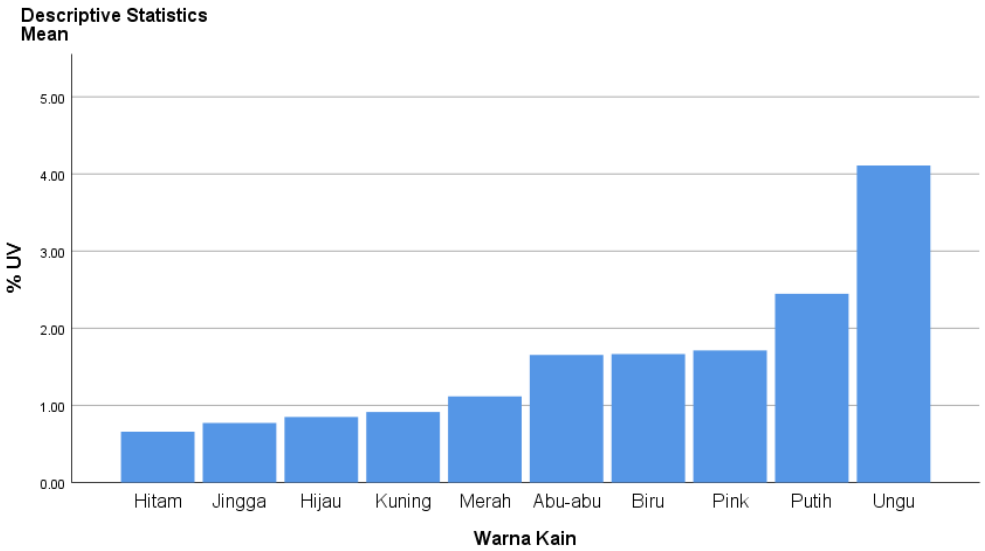

Figure 2 Graph of the percentage of UV intensity that passed through the fabric

From Figure 2, it can be seen that purple is a color that tends to transmit a lot of UV radiation, at a rate of 4.11%. This is because purple is the highest frequency light that moves towards UV rays on the spectrum (Camelia et al., 2020). This is followed by white, which has a relatively high percentage value compared to the others, at around 2.45% (Sastrawati & Jumain, 2023). White is the brightest color among the others. Meanwhile, the color with the lowest percentage of UV intensity is black, with a percentage value of 0.66% (Indana & Lailiyah, 2018). From these percentage values, it can be concluded that

black is the color that has the best UV protection ability among the other colors. Black is the darkest color and tends to absorb more UV radiation energy (Bandara et al., 2022). Warna hitam adalah warna tergelap dari warna yang ada dan cenderung lebih banyak menyerap energi radiasi sinar UV yang diterimanya (Liana & Nurbaiti, 2021). However, all of the percentage values obtained for all fabrics used in this study are considered good according to Table 1 (Hughes et al., 2021).

Table 1. Factors Of UV Ray Protection

Average % of UV Rays Transmition	Category of Protection
<2,5	Maximum Protection
3,3 – 2,5	Very High Protection
5,0 – 3,3	High Protection

The effectiveness of textiles in reducing UV exposure to the skin is determined by several factors in the fabric processing as well as the presence or absence of UV absorbers (Kocić et al., 2019). Color is a part of electromagnetic wave energy that has a frequency range and wavelength. Each color has a different frequency range and wavelength (Khery et al., 2022). This can possibly be a factor that affects the absorption of energy from UV rays received. Because they have different frequency values, the transmission of UV rays between colors varies (Ray et al., 2022).

Many experts have stated that clothing is a primary and simple way of protection against direct sunlight exposure (Anas et al., 2022). The fabric used in this study is a good material for protection against UV rays and the results show that the color difference also has different protection capabilities even with the same fabric type (ALIFIYA, 2022). Therefore, it is very important to choose fabrics and clothing colors that have low risk of irritation and sensitivity to UV radiation.

CONCLUSION

In the variation of fabric colors used, it was found that the color of the fabric affects the intensity of UV rays that will be transmitted through the fabric to the skin. Out of the ten colors of fabric used, purple tends to allow the most UV rays to pass through, resulting in a higher intensity of UV rays reaching the skin. In addition to purple, white fabric also has a relatively high rate of allowing UV rays to pass through, while black fabric is the best color for protecting the skin from UV sun exposure.

BIBLIOGRAFI

Alifiya, M. (2022). *Formulasi Dan Uji Stabilitas Fisik Sediaan Krim Tabir Surya Berbahan Aktif Kombinasi Ekstrak Bunga Telang (Clitoria Ternatea) Dan Lidah Buaya (Aloe Vera)*. Uin Raden Intan Lampung.

Anas, M. S., Abbas, A., Azam, Z., Tariq, Z., Gul, Z., & Sarwar, M. E. (2022). *Ultraviolet Protection Factor Evaluation Of Comfort Oriented Two-Yarn Fleece Fabrics*. Https://Doi.Org/10.1177/15589250221125461

Arjun, D., Kavitha, A., & Hiranmayee, J. (2013). Textile Materials Used For Uv Protection. *International Journal Of Advanced Research In Engineering And Technology*, *4*(7), 53–59.

Bandara, T. M. W. J., Hansadi, J. M. C., & Bella, F. (2022). A Review Of Textile Dye-Sensitized Solar Cells For Wearable Electronics. *Ionics*, *28*(6), 2563–2583.

Bennett, B. L., Hew-Butler, T., Rosner, M. H., Myers, T., & Lipman, G. S. (2020). Wilderness Medical Society Clinical Practice Guidelines For The Management Of Exercise-Associated Hyponatremia : 2019 Update. *Wilderness & Environmental Medicine*, *31*(1), 50–62. Https://Doi.Org/10.1016/J.Wem.2019.11.003

Camelia, S. T., Zahro, R. D., Meithasari, Y., & Tauhidah, D. (2020). Pemahaman Mahasiswa Pendidikan Biologi Terhadap Pentingnya Penggunaan Tabir Surya. *Biosel (Biology Science And Education): Jurnal Penelitian Science Dan Pendidikan*, *9*(2), 132–138.

Hughes, S. N. G., Lowe, N. J., Gross, K., Mark, L., Goffe, B., Hughes, H., & Cole, C. (2021). Assessment Of Natural Sunlight Protection Provided By 10 High-Spf Broad-Spectrum Sunscreens And Sun-Protective Fabrics. In *Challenges In Sun Protection* (Vol. 55, Pp. 157–169). Karger Publishers.

Indana, N., & Lailiyah, N. (2018). *Meningkatkan Keterampilan Motorik Halus Anak Melalui Kegiatan Bermain Kreatif Dengan Pasir Kinetik Pada Anak Kelompok B Tk Aisyiyah Bustanul Athfal V Kediri Tahun Pelajaran 2017/2018*.

Jannah, R., Iskandarhasaduddin, I., & Mohdiqbal, M. (2019). Pengaruh Jenis Bahan Pakaian Terhadap Respon Psikologi Manusia Pada Saat Berolahraga Di Lingkungan Panas. *Jurnal Unitek*, *12*(1), 17–29.

Khery, Y., Sarjan, M., Nufida, B. A., & Efendi, I. (2022). Etnosains Tumbuhan Nyamplung (Chalophyllum Inophillum L.) Dalam Tradisi Masyarakat Sasak. *Biocaster: Jurnal Kajian Biologi*, *2*(4), 176–188.

Kocić, A., Bizjak, M., Popović, D., Poparić, G. B., & Stanković, S. B. (2019). Uv Protection Afforded By Textile Fabrics Made Of Natural And Regenerated Cellulose Fibres. *Journal Of Cleaner Production*, *228*, 1229–1237.

Liana, Y. R., & Nurbaiti, U. (2021). *Research Article Study Of Sun Protection Factor (Spf) Batik Textile Fabric On Solar Radiation In Pekalongan*. *11*(01), 39–49. Https://Doi.Org/10.26740/Jpfa.V11n1.P39-49

Ray, A., Bhowmick, N., & Ghosh, S. (2022). Designing Of Woven Textile Fabrics For Greenhouse Covering Material. *Journal Of The Institution Of Engineers (India): Series E*, 1–10.

Sastrawati, A. N., & Jumain, J. (2023). Formulation Of Herbal Toothpaste Combination Of Anna Apple Peel And Kaffir Lime Peel With Variation Of Sodium Lauryl

Sulfate Concentration. *Indonesian Health Journal*, *2*(1), 30–37.

Serrano, M.-A., Cañada, J., & Moreno, J. C. (2013). Solar Uv Exposure In Construction Workers In Valencia, Spain. *Journal Of Exposure Science & Environmental Epidemiology*, *23*(5), 525–530.

Wright, F., & Weller, R. B. (2015). Risks And Benefits Of Uv Radiation In Older People: More Of A Friend Than A Foe? *Maturitas*, *81*(4), 425–431.

Young, A. R., Claveau, J., & Rossi, A. B. (2017). Ultraviolet Radiation And The Skin: Photobiology And Sunscreen Photoprotection. *Journal Of The American Academy Of Dermatology*, *76*(3), S100–S109.