

At a glance— Fabric characteristics and UVR protection



When choosing a fabric for clothing to be worn in the sun, consider:

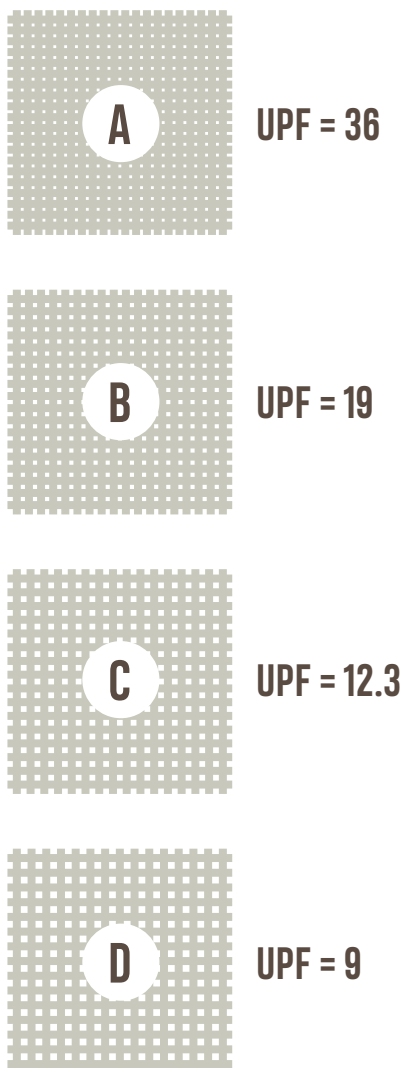
- **Construction**
 - Weave/knit
 - Stretch
 - Fibre type
 - Weight
- **Treatments**
 - Colour
 - Finishing processes
 - Additives
 - Washing
 - Wet versus dry.
- **UPF (Ultraviolet Protection Factor)**

Fabric construction

Weave

- Weave is a major factor that affects how much ultraviolet radiation (UVR) can pass through a fabric.
- Closely woven fabrics allow less UVR to pass through than loosely woven fabrics.
- In tightly woven fabrics, the space between the yarns is smaller, so only very small amounts of UVR can pass through (see Figure 1).

FIGURE 1.
THE VARIATION OF ULTRAVIOLET PROTECTION
FACTOR (UPF) WITH WEAVE DENSITY



Source: Gies, Roy, McLennan, & Toomey (1998). Clothing and protection against UVR: Current status. *Journal of the Home Economics Institute of Australia*, 5[2], S9.

Stretch

- When fabrics are stretched, the spaces between the yarns open up and the UVR can pass through more easily.
- The Ultraviolet Protection Factor (UPF) of fabrics such as lycra and elastane change considerably with stretch.
- Tightly woven fabrics stretch less than knitted fabrics.

Fibre type

- The type of fibre used can influence its UPF.
- Some fibres such as unbleached cotton have natural pigments and lignins that improve their UPF.
- Cotton, linen and viscose offer little protection.
- Nylon, acrylic and acetate are also poor inhibitors.
- Polyester is more effective against UVB (the radiation most responsible for skin cancer).

Weight

- Heavier fabrics allow less UVR to pass through than lighter fabrics.
- This effect is minor when compared to other factors such as weave and colour.



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FACT
FILE

Treatments

Colour

- Dark colours provide higher protection than lighter colours (see Table 1). Dark colours absorb more UVR than lighter colours and, therefore, allow less UVR to pass through to the skin.
- Light-coloured fabrics also reflect more UVR than darker-coloured fabrics and this UVR may be reflected onto the skin e.g. on the face.

Table 1. The effect of colour on the Ultraviolet Protection factor (UPF) of samples with identical weaves and weights

Cotton	
Colour	UPF
White	12
Azure	18
Royal	27
Black	32
Navy	37

Source: Gies, Roy, McLennan, & Toomey (1998). Clothing and protection against UVR: Current status. Journal of the Home Economics Institute of Australia, 5(2), S10.

Finishing processes

- When fabrics are being manufactured, some processes—for example, shrinking and sanforising (a preshrinking process)—move the fibres and yarns closer together. This reduces the amount of UVR that can pass through the fabric.
- Bleaching decreases UVR protection, for example, bleached calico is less sun protective than unbleached calico.

Washing

- Washing can increase the UPF of cotton and polyester/cotton fabrics.
 - After a garment's first wash it may shrink. The spaces between the fibres become smaller, so less UVR is able to pass through. This increase in UPF lasts for the lifetime of the garment.
- Testing for a UPF rating is done before the garment is washed. This means that the UPF rating may be somewhat higher after the garment is washed.

Wet versus dry

- UPF reduces when fabrics are wet.
- Cotton fabrics absorb more water than those made from nylon or polyester and hence, when wet, have a reduced UPF compared to less absorbent fabrics.

Additives

- UVR-absorbing additives increase the UPF of fabrics.
- UVR absorbers are added to lightweight fabrics so that cool and comfortable clothing can provide high protection from the sun's UVR.
- If possible it is important to check with the manufacturer that the effect of the additive will last with washing and sun exposure and over time.

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FACT
FILE

UPF

The Ultraviolet Protection Factor (UPF) rating system was devised to give an indication of how well fabrics protect against Ultraviolet Radiation (UVR). Australia was the first country in the world to develop a standard for testing and labelling of sun-protective clothing (AS/NZS 4399: 1996). UPF ratings on clothing range from 15–50+. The table below outlines the UPF ratings assigned to various protection categories.

Ultraviolet Protection (UPF) categories in Australian Standard (AS/NZS 4399: 1996)

Protection category	Rating	UPF Range
Excellent protection	40, 45, 50, 50+	40–50, 50+
Very good protection	25, 30, 35	25–39
Good protection	15, 20	15–24

A UPF rating of 15, for example, will reduce the amount of UVR passing through a fabric by a factor of 15. Another way of putting this is that only one-fifteenth (1/15 or 7%) of UVR can pass through a fabric and onto the skin. A UPF of 50 means only one fiftieth (1/50 or 2%) of UVR can pass through.

The Australian and New Zealand Standard (AS/NZS 4399: 1996 Sun-protective clothing—Evaluation and classification) specifies claims that clothing manufacturers can and cannot make about the level of sun protection offered by their products.

Clothing that has undergone a number of scientific tests and has been found to provide significant protection against solar UVR may be labelled with a swing tag from the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA, previously the Australian Radiation Laboratory) showing the garment's UPF rating. The highest UPF rating for clothing is 50+.

Visit the ARPANSA website (www.arpansa.gov.au) for further information about the UPF rating.



UPF - What does it mean?

Overexposure to ultraviolet radiation over many years causes serious health problems such as skin cancers. Clothing that is sensibly designed for sun protection reduces your exposure. Materials with **Ultraviolet Protection Factor (UPF)** ratings of 40 and higher provide all-day protection for the fairest skin. A garment only protects the skin it covers. Protect your head and exposed skin by wearing a hat, sunglasses and sunscreen and use shaded outdoor areas.

AS/NZS4399 Australian Standard for sun protective clothing

This UPF rating is for the fabric and does not address the amount of protection which is afforded by the design of the article. The manipulations involved in garment manufacture such as stretching and sewing may lower the UPF of the material. Articles which have been designed to cover the maximum area of the body are recommended. The protection offered by this item may be lessened--

- (i) at points where the fabric is in close contact with the skin such as across the shoulders;
- (ii) if the fabric is stretched;
- (iii) if the fabric is wet; and
- (iv) with time, due to the effects of normal wear.

Headwear & shade products:
This item does not provide protection against reflected or scattered solar ultraviolet radiation (UVR).

Sun protection information:
www.cancer.org.au/sunsmart
www.cancernz.org.nz



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For more information about UPF and UV radiation visit
www.arpansa.gov.au/uv

Example of an ARPANZA UPF Rating swingtag