

Effect of sun exposure on skin and hair

Submitted by

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(M.B.,B.Ch. – Faculty of Medicine – Ain Shams University, 1995

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APPROVAL SHEET

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ABSTRACT

Photoaging refers to the effects of long-term UV exposure and sun damage which appears as pigmentation, laxity, wrinkles, telangiectasia, a leathery appearance, and cutaneous malignancies. Hair photodamage leads to loss of mechanical strength, luster and an increase in surface roughness.

Aim: The aim of this study was to Compare the effect of sun exposure on the skin and hair among females wearing scarves and those did not, we intend to have more clues to understand if scarves have a role as a photoprotectant.

Methods: Our study included 150 females who are frequently exposed to the sun (4-6 hours/day). They are classified into 2 groups: First group included 50 females without scarves while the second group included 100 females with scarves which was subdivided into (70 females with ordinary scarves and 30 females with nekab.

Results: This study revealed a significant association between wearing scarves and traction alopecia,also, protection of hair luster but there was no significant association with diffuse hair loss. There was a significant association between hair loss and scarves multilayers but no association with scarves fabrics. On the other hand, we found a significant association between nekab and photoprotection of both wrinkles and pigmentation. **Conclusion:** We concluded that scarves may play a role as photoprotectant .Continued studies to evaluate role of scarves as a photoprotectant is needed.

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LIST OF ABBREVIATIONS

1,25(OH) ₂ -D	1,25-Dihydroxyvitamin D
25 (OH)-D	25-Hydroxyvitamin D
α MSH	Alpha Melanocytic Hormone
ACTH	Adrenocorticotrophic Hormone
AP-1	Activated Protein-1
CHS	Contact Hypersensitivity
CGRP	Calcitonin gene-related Peptide
CPD	Cyclobutane-Pyrimidine
DHT	Delayed Hypersensitivity
ICAM	Intracellular Adhesion Molecule
IF	Infrared
IFN-γ	Interferon Gamma
IL	Interleukin
IPD	Immediate Pigment Darkening
J	Joule
MC1R	Melanocortin 1 Receptor
MED	Minimal Erythema Dose
MPD	Minimal Pigmentation Dose
NFκB	Nuclear Factor Kappa B
Nm	Nanometer
NO	Nitric Oxide

$O_2^{\cdot -}$	Superoxide
$OH^{\cdot}$	Hydroxyl
PGE2	Prostaglandin E2
PPD	Persistent Pigment Darkening
RH	Reactive Humidity
ROS	Reactive Oxygen Species
SPF	Sun Protection Factor
TNF- α	Tumour Necrosis Factor Alpha
UCA	Urocanic Acid
UPF	Ultraviolet Protection Factor
UVR	Ultraviolet Ray

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Introduction

Ultraviolet radiation (UVR) from the sun is divided into UVC (270-290 nm), UVB (290-320 nm), and UVA, which is subdivided into UVA2 (320-340 nm) and UVA1 (340-400 nm). UVC emitted by the sun is filtered by ozone in the stratosphere therefore it does not reach the earth's surface **(Schaefer et al.,1988)**.

The amount of solar UVB and UVA reaching the earth's surface is affected by latitude, altitude, time of the day, cloudiness, and ozone layer. On the earth's surface, the ratio of UVA to UVB is 20 :1 **(Prisana and Henry ,2005)**.

UVR is strongest between 10 AM to 4 PM. UVA is of longer wavelength compared with UVB and can penetrate deeper through the skin, and is not filtered by window glass **(Prisana and Henry ,2005)**.

It is well known that ultraviolet and visible radiation damage hair. Sun radiation causes dryness , reduced strength ,rough surface texture, loss of color, decreased luster, stiffness , brittleness and an overall dull, unhealthy appearance of the hair **(Pande and Jachowicz,1988)**.

If the human hair is exposed to sun radiations over a period of time, it may be damaged in different ways, in most cases the amino acid of the cuticle are altered to a greater extent than those of the cortex. This exposure can cause rupture and detachment of the external layers resulting in splitting of the ends **(Robbins,2002)**

Clothing is an excellent photoprotectant.Ultraviolet protectiveness of fabrics is expressed as UV protection factor (UPF).Construction of fabrics is an important factor; those with tightly woven fibers have higher UPF than loosely woven ones. Wool and synthetic materials such as polyester

have high UPF whereas cotton, linen and rayon have less UPF(**Prisana Kullavan and Henry, 2005**).

There are also many factors that affect UPF value , which can affect choice of cloths ; hydration results in reduction of the UPF because of the presence of water in the interstices of the fabrics , which leads to an increase in the UV transmission , also dark color fabrics have greater UPF than light color ones (**Sinclair and Diffey, 1997**).

Aim of the work

To show the effect of sun exposure on the skin and hair among females wearing scarves and those who did not wear scarves, intending to have more clues to understand if scarf has a role as hair and skin photoprotectant.

Review

Basic Principles Of Cutaneous Photobiology:

Cutaneous photobiology is the study of the effects of ultraviolet (UV) and visible radiation on the skin. The UVR spectrum, 100–400 nm, comprises three wavebands: UVC (100–280), UVB (280–315 nm) and UVA (315–400 nm); visible light is 400–700 nm. and infrared radiation (IR >760 nm). UVA has been subdivided into UVA-I (340–400 nm) and UVA-II (320–340 nm) because, biologically speaking, the effects of UVA-II are more like those of UVB (**Haber et al., 1989**).

Sources of UVR:

UVR is emitted spontaneously in large amounts by the sun and other stars. Terrestrial sunlight, modified by the Earth's atmosphere, contains both UVB and UVA. At noon, when the sun is high in the sky, the UVB content is approximately 5% and UVA accounts for the remaining 95%. However, when the sun is lower, early or late in the day, the UVA content is even higher. UVR is also produced by artificial sources, the most common in dermatological photobiology being gas discharge lamps, glass or quartz columns containing molecules of mercury vapour or xenon gas (**Diffey, 1982**).

UVR interaction with skin

Approximately 5% of the UVR incident on skin is diffusely reflected, the remainder being transmitted, scattered and absorbed, or passed out of the medium. (**Fig.1**) Thus, transmitted radiation below approximately 300 nm is largely attenuated within the epidermis by chromophores such as urocanic acid, DNA, RNA, tryptophan, tyrosine and melanin, whereas dermal DNA, RNA and the amino acids in elastin and collagen presumably absorb any

radiation that passes through the epidermis. At approximately 300 nm and above, UVR is more readily transmitted to the dermis, after initial variable absorption by epidermal chromophores, followed by reflection back from dermal collagen bundles to the environment; in addition, minor absorption by intravascular haemoglobin, tissue bilirubin and β -carotene in fat is possible. DNA is almost certainly the most important skin chromophore (Sheehan et al., 2002).

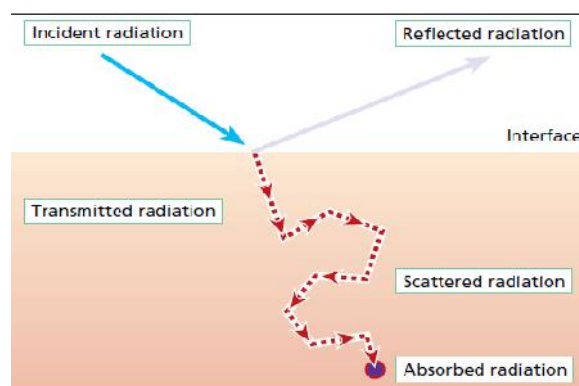


Fig.1 Interaction of UV radiation (UVR) with physical matter.
(Young , 2004)

It should be noted that because of the presence of atmosphere, UVC from sunlight does not reach the earth's surface, and therefore, it has no biologic significance. Exposure to UVC occurs only through exposure to artificial light sources, for example, germicidal lamps used in research and clinical laboratories. Ninety-five percent of the UV radiation reaching the earth's surface is UVA, and 5% is UVB (Rhodes and Lim, 2007).

UVB can be blocked by glass, but UVA can penetrate through glass (Tuchinda et al., 2006). Since UVB has the shorter wavelengths, it is mostly absorbed in the epidermis, with a small proportion reaching the upper dermis, whereas UVA penetrates deeper into the dermis.