

Introduction

- As contemporary research unfolds, it underscores the profound influence of dietary patterns like the Mediterranean diet on skin cancer prevalence, attributing this to the nuanced interplay of nutrients and their synergistic interactions
- Research shows diets, such as the Mediterranean diet, that are high in antioxidants, vitamins, and nutrients, help fight off free radicals and prevent the DNA damage contributing to skin cancer
- UV exposure's effect on skin cancer has been studied and found to cause damage at least partly by depleting antioxidants within the body. Replacing antioxidants with a nutritious diet is imperative to bolstering the body's weakened immune defenses after UV exposure
- Poor diet correlates with higher cancer rates, including higher skin cancer rates
- Research has shown diets rich in antioxidants and omega-3 fatty acids help protect from skin cancer¹
- Foods including olive oil, yogurt, fish, and a wide variety of fruits and vegetables assist with fighting the oxidizing effects of the sun
- Vitamins C, E, and A, zinc, carotenoids, selenium, lycopene, and polyphenols found in Mediterranean-rich diets have been studied to help prevent skin cancer. In essence, the Mediterranean diet is a cornucopia of health, proffering an array of nutrients pivotal for holistic skin cancer prevention

Discussion

The Mediterranean diet is based in the rich culture of the region; it consists of many foods and contains a wide variety of nutritious compounds. This dietary pattern is based on a high intake of olive oil, fresh fruit, legumes, nuts, and vegetables, a moderate intake of fish, dairy products, ethanol (in the form of red wine), and a low consumption of red meats with overall moderate quantities of processed foods.^{2,3,4,5} Herbs such as sage, basil, oregano, and rosemary are also incorporated into the foods of the Mediterranean diet for further flavoring and nutrients.³ These aspects of the Mediterranean diet make it unique in today's food culture, where many foods are highly processed and a high intake of fruits and vegetables is not commonplace. The Mediterranean diet has proved to be a well-varied diet with many nutritional benefits and may increase overall health and longevity.⁶ Many of these foods are rich in antioxidants, a diet which may protect against the free radicals produced when exposed to UV radiation, and thus aid in the prevention of skin cancer.⁶

A hospital-based case-control study by Fortes, et al. in Rome, Italy evaluated the protective role of the Mediterranean diet for cutaneous melanoma through a food frequency questionnaire (FFQ) and a skin examination, with significant findings.⁷ There were protective effects of vegetable consumption five or more times a week (especially for cruciferous, leafy green, carrots), fruit consumption once or more a day (especially for citrus fruits), fresh herbs (especially for rosemary), nuts, omega-3 fatty acid rich fish, fish, shellfish, and tea.^{3,4,7} Rosemary is rich in carnosol, an inflammatory compound that blocks protein kinase C signaling and reduces proinflammatory leukotrienes.³ In this study, tomatoes had no association with a decreased risk of melanoma, while foods such as meat, dairy, eggs, and liver had no association with an increased risk of melanoma.⁷ These findings are consistent with the literature that foods found in the Mediterranean diet are protective for the development of melanoma.

In a large prospective cohort study of French women, Mahamat-Saleh, et al. evaluated the role of the Mediterranean diet via questionnaires of reported skin cancer events and a food questionnaire scored to adherence of a Mediterranean diet. This study found a significant

decrease in skin cancer for participants who had a high score of adherence to the Mediterranean diet and an inverse and linearly associated score of the Mediterranean diet to the risk of melanoma and basal cell carcinoma (BCC).⁶ When evaluating single dietary items within the Mediterranean diet, there was a decreased risk of skin cancer with increased intake of vegetables.⁶ Sources of monounsaturated fat in the typical Mediterranean diet are largely olive oil, while in France the main source of this compound is from poultry and pork and the scoring was adjusted accordingly.⁶ This can be extrapolated to mean that the compound consumed, even from a different source than is typically included in the Mediterranean diet, can still be beneficial and play a protective role in the development of skin cancer.

Lipids

- Omega-3 polyunsaturated fatty acids (PUFA) are essential fatty acids found in abundance in the Mediterranean diet in both animal and plant sources and are typically associated with their anti-inflammatory effects
- Fatty fish (such as sardines and mackerel) and nuts (such as almonds and walnuts) are rich sources of this nutrient; they reduce inflammation within the body and slow the progression of cancer.^{2,5,6}
- UV damage to the skin is in part through immune suppression. A randomized controlled trial by Pilkington et al. confirmed the protective effects that omega-3 PUFAs have on photo-immunosuppression to further confirm the role this nutrient has in the protective effects of developing skin cancer.⁹ However, many modern Western diets are lacking in this essential fatty acid and are instead diets rich in inflammatory compounds, such as omega-6 PUFAs
- Omega-6 is an essential PUFA found in abundance in Western diets and has been shown to reduce the risk of skin cancer with limited consumption and increase the risk of skin cancer when consumed in abundance, which is possibly through its metabolism into PGE2 (a tumor promoter) through the cyclooxygenase pathway.^{9,10}
- PGE2 has been implicated in BCC and squamous cell carcinoma (SCC).¹⁰ While both omega-3 and omega-6 PUFAs are necessary for proper metabolic function and are both part of a well-balanced diet, consuming a diet with an optimized ratio of omega-6 to omega-3 PUFAs is ideal
- It has been suggested that the ratio of omega-6 to omega-3 PUFAs in Western diets is around 15:1, which leads to many chronic diseases.¹¹ In contrast, humans evolved with a ratio of omega-6 to omega-3 of 1:1 to 2:1¹¹
- Lowering this ratio to include more favorable omega-3 PUFAs can not only help protect against skin cancer but many other inflammatory conditions, such as heart disease
- Olive oil is rich in phenolic compounds including polyphenols, secoiridoids, lignans, and squalenes which are rich antioxidants and have been shown to protect against cancer.^{2,12} These antioxidant properties play a role in decreasing inflammatory processes and are associated with a lower risk of chronic diseases such as diabetes, cancer, skin disease, and heart disease⁵
- It is estimated that the average yearly intake of olive oil in the region ranges from a few kilograms per person in countries such as France to fifteen kilograms per person in Greece (where olive oil is the main monounsaturated food source); in areas with higher intake of olive oil there is a lower incidence of cancer.^{6,12} Olive oil is 70% of the lipid source in the Mediterranean diet⁵
- Squalene, which can be found in olive oil, is thought to play a role in the prevention of skin cancer, because it is largely transferred to the skin where it is found in large amounts in sebum^{12,13}
- In an in vitro and in vivo study by Ekanayake Mudiyansele et al., the chemoprotective properties of human sebum were evaluated after irradiation with UVA and UVB. It was found that squalene was depleted when exposed to UVA and photo-oxidation products were produced and there was an increased amount of squalene isomers, which may be a photo-oxidative stress marker¹³

Wine and Wine-making Byproducts

- Grapes are rich in many phytochemicals. Wine is consumed in moderate amounts as part of the Mediterranean diet and contains many of the polyphenols and antioxidants once found in the grapes.^{2,4}
- White wine has less phytochemicals than red wine; in comparison spirits consumed in other countries and dietary patterns have next to no phytochemicals⁴
- Phytochemicals in wine and grapes include resveratrol, tannins, anthocyanins, and catechins.⁴ While consumed in moderation, the wine as part of the Mediterranean diet may confer protective benefits towards health and skin cancer prevention through these phytochemicals
- Skin cancer may also benefit from wine-making byproducts. Specifically, the polyphenol resveratrol found in grapes and wine has been shown to play a role in skin cancer⁵
- An in vitro study by Grace Nirmala, et al. evaluated the role of grape peel and seed extracts by incubating A431 cells (human epidermoid carcinoma) with these compounds and found significant apoptosis and necrotic cells when compared to the control via the production of reactive oxygen species and induced cytotoxicity^{5,15}



Areas for Future Research

- The beneficial implications of the Mediterranean diet (MD) for overall health and its potential chemoprotective properties against skin cancer have been elucidated. However, there are several areas within the Mediterranean diet that warrant further exploration
- While the Mediterranean diet's constituents, like olive oil and omega-3, have shown individual benefits, a comprehensive understanding of their combined effect and potential synergistic roles is needed
- Additionally, while wine-making byproducts have shown potential in preliminary studies, their exact role, dosage, and application in skin cancer prevention remain largely uncharted. The challenge of effectively integrating these byproducts into everyday diets, without optimal effects, presents another research opportunity
- Moreover, the effectiveness of the Mediterranean diet when combined with traditional sun protection measures and its potential in reducing pre-existing skin cancer risks needs to be further elucidated
- Furthermore, while current studies predominantly involve in vitro tests, there remains a pressing need for comprehensive in vivo trials, population-based cohort studies, and clinical evaluations to validate findings and ensure they are translatable to real-world scenarios

Conclusion

Foods studied within the Mediterranean diet are found to be protective against skin cancer with high levels of nutrients, vitamins, protein, omega-3 fatty acids, antioxidants, and anti-inflammatory compounds. The diversity of healthy foods and numerous nutritional benefits maximizes chemoprotection with a variety of protective substances. Previous research studies have found phytochemicals in the Mediterranean diet contain antioxidant properties that prevent DNA damage, extra virgin olive oil lowers the incidence of dermatological diseases, and omega-3 fatty acids slow down cancer development, cancer cell proliferation, angiogenesis, survival, inflammation, and metastasis. This review addresses the chemoprotective properties of how a Mediterranean diet pertains specifically to skin cancer and the need for additional research with larger clinical trials to show the significance of the impact of certain nutritive substances and the interaction between specific nutrients on cancer prevention. The impact of chemoprotection from a Mediterranean diet continues to show significance through recent research studies and suggests development of a nutritional approach as a substantial lifestyle change to minimize skin cancer.

References



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