Chapter 28

Diet, Wellness, and Prevention

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Introduction

Although telomere biology disorders (TBDs) such as Dyskeratosis Congenita (DC) are clearly inherited, it is natural for patients and caregivers to inquire about whether lifestyle factors such as diet can influence the progression or expression of telomere disorders. When any person is confronted with a diagnosis over which they have very little control, it is an expected and natural response to want to take as much control over the situation as possible. Because lifestyle is a potentially modifiable factor in many diseases, it is common for individuals to inquire about how integrative practices such as diet, supplements, or physical activity might impact their disease. Unfortunately, predatory marketers (such as “wellness” and dietary supplement companies) can use this time of vulnerability to prey on the fears and hopes of patients, oftentimes promoting un-proven and expensive telomere lengthening supplements or diets. Conversely, if a patient is motivated by their diagnosis to make positive lifestyle changes that may impact their overall health in a positive way, we want to encourage and support them using the best available evidence.

Telomeres and Lifestyle

To date, there are a small but growing number of studies examining the role of diet and physical activity on telomeres. Because telomere shortening has been associated with inflammation and oxidative stress, lifestyle factors known to mediate these factors have been the primary focus of study so far [1-4]. Results have been mixed, with some studies showing no benefit and others showing modest benefit on either telomere length or telomerase activity. Several recent meta-analyses have been helpful in summarizing these studies of diet and/or physical activity on telomeres [1-3]. Most studies are of very small sample sizes of healthy subjects (without known TBDs), they are primarily cross-sectional or cohort studies, and comparatively few are randomized controlled trials [1-3]. It is important to put the subject type, study size and quality of these studies in context when speaking with patients and caregivers about the impact of lifestyle directly on telomere length or activity.

There is a much larger body of evidence that relates to modifiable lifestyle factors and prevention of cancer. Because individuals with TBDs have a higher risk of developing cancers, it is advisable to review the known links between dietary and physical activity patterns and cancer prevention. Many of the known, well-studied lifestyle changes to promote cancer prevention overlap significantly with the emerging telomere diet research [5, 6]. For these reasons, helping patients to adopt lifestyles that promote cancer prevention may have the most impact in terms of modifiable disease factors and overall health.

Telomere-Specific Diet and Physical Activity Research

In recent years there have been several published reviews or meta-analyses of the literature related to diet and/or physical activity and telomere length or telomerase activity. The range of studies included in these reviews include dietary patterns known to be anti- or pro-inflammatory as well as specific nutrients such as vitamin D or fish oil. Please refer to the individual reviews for a summary of their study inclusion criteria and

tables of summary findings [1-4]. Again, it is important to remember that the overall size and type of studies can only suggest risk or protective associations and not causality of telomere changes.

The most recent review from Navarro-Ibarra and colleagues published in 2020 includes fifty studies published through 2018 [1]. Contrary to a previously published review by Perez and colleagues in 2017 which showed no overall effect of diet on telomere length, the updated Navarro-Ibarra review showed some correlations with diet, activity and telomere length or telomerase activity. The mechanisms of such an effect are not fully understood in the context of telomeres, but the assumption is that pro-inflammatory diet components are associated with telomere shortening whereas anti-inflammatory diet components are associated with maintaining telomere length and telomerase activity. Of note, some studies showed that increased serum concentrations of vitamin D or antioxidants had positive correlations with telomere length, but the impact of increased consumption of these nutrients through food or supplements was not independently evaluated.

In general, dietary patterns that included a higher consumption of plant foods were associated with an increase in telomere length. Most studies showed that dietary patterns such as the Mediterranean Diet and those that include more antioxidant components such as those found in vegetables and fruits, whole grains, seeds, and walnuts were associated with longer telomeres. Conversely, diets that included more pro-inflammatory components such as sugary beverages and processed meats were associated with telomere shortening.

Of the twenty studies in the Navarro-Ibarra review that evaluated some aspect of physical activity and telomere length, all studies showed a positive association between moderate physical activity and telomere length.

Cancer Prevention Diet and Physical Activity Research

Individuals with TBDs have higher frequencies and develop cancers at younger ages than would be expected and are considered “cancer-prone” (see Chapter 9, Solid Tumors). Therefore, encouraging modifiable lifestyle factors that are known to be protective against cancer development and recurrence may be even more important for those with TBDs than for the general population. Not surprisingly, emerging findings from the small amount of published lifestyle and telomere research also aligns closely with the much larger body of evidence related to lifestyle factors and cancer prevention. For this reason, it may be most practical for providers and patients to look to the large amount of resources developed for promoting cancer prevention through modifiable lifestyle changes.

The most recent Guidelines for Diet and Physical Activity for Cancer Prevention were published by the American Cancer Society (ACS) in 2020 and include a variety of specific recommendations for the prevention of cancer [5]. While the published guidelines are written for the physician and public health audience, the information contained in the guidelines becomes the scaffolding on which most evidence-based guidelines and patient resources are built.

The American Institute for Cancer Research (aicr.org) also integrates cancer prevention research globally into guidelines, and in 2018 published their most recent *Third Expert Report* [6] and includes similar and expanded information as compared to the ACS. The mission of the AICR is to “*…champion the latest and most authoritative scientific research from around the world on cancer prevention and survival through diet, weight, and physical activity, so that we can help people make informed lifestyle choices to reduce their cancer risk.*” A result of this mission includes a breadth of educational materials online to help individuals put these research derived evidence-based guidelines into practice every day.

American Institute for Cancer Research (AICR)

How to Prevent Cancer: 10 Recommendations

1. Be a healthy weight
2. Be physically active
3. Eat a diet rich in whole grains, fruits, vegetables and beans
4. Limit consumption of fast foods and other processed foods that are high in fat, starches, or sugars
5. Limit consumption of red and processed meat
6. Limit consumption of sugar-sweetened drinks
7. Limit alcohol consumption
8. Do not use supplements for cancer prevention
9. For mothers: breastfeed your baby if you can
10. After a cancer diagnosis, follow these recommendations if you can

Messages and Resources for Patients

A significant diagnosis such as a telomere biology disorder can be an overwhelming time for patients and their loved ones. It is expected that patients will have questions about their role in the development, progression, or expression of their disease. These questions may very likely include questions about diet and lifestyle. Although it is sometimes uncomfortable for medical professionals to discuss topics that do not have clear evidence, it is important that we provide patients with *what we do know* – otherwise bad actors with less good intentions may attempt to fill that information void - and not always in the patient's best interest.

Some talking points to consider:

- **Validate the importance of patient locus of control concerns:** *"This is big and unexpected news, and it's natural for you to wonder how your actions might have*

contributed to this diagnosis. It's important to know that developing a TBD is related to your genetics, and we don't have any evidence that how you have lived your life contributed to this diagnosis."

- **Put the number and quality of research studies related to telomeres and lifestyle into context:** *"There are more studies about the role of nutrition and lifestyle being published every year. In fact, you may read about single studies in the popular news media because telomeres are a hot topic in science and medicine. These studies are done in people who have normally-aging telomeres, and not TBDs. It's important to understand that compared to what we know about the biology of telomeres, the amount of information that we know about lifestyle and telomeres is much smaller and less clear. There are some small studies done on healthy subjects (persons without TBDs) that may start to give us some insight into whether or not lifestyle modifications can alter telomeres in patients like yourself – but so far there is no evidence that diet, supplements or lifestyle will definitively change the length of your telomeres. Our group is interested in every way that we can help you and we will continually be re-evaluating the research as it is studied and published."*
- **Give the patient broader context for adopting healthy lifestyle changes:** *"One of the things we know about patients with TBDs is that you have a higher likelihood of developing cancer. There are several lifestyle changes that all of us can make to help prevent cancer. The good news is that these are things that can benefit you and everyone around you – whether or not they have a TBD. Also, the same recommendations that we know can help prevent cancer are many of the same things that some of those smaller studies about telomeres and lifestyle have found – so it's possible it may be even more beneficial for you, and there are no health risks to following a cancer preventative diet."*

Online Resources

Online evidence-based resources related to diet, lifestyle, and cancer prevention:

- American Institute for Cancer Research (AICR): https://www.aicr.org/cancer-prevention Provides information for providers and consumers, including detailed information about diet, foods that fight cancer, food facts, recipes, and information on supplements.
- Consumer-facing summary of ACS 2020 Guidelines on Diet and Physical Activity for Cancer Prevention: https://www.cancer.org/healthy/eat-healthy-get-active/acs-guidelines-nutrition-physical-activity-cancer-prevention/guidelines.html
- *Eat Right to Fight Cancer* information from the Academy of Nutrition & Dietetics Oncology Nutrition Dietetic Practice Group includes, FAQs, recipes, menus and links to more resources: https://www.oncologynutrition.org/erfc
- Food and Cancer Risk information from the American Society of Clinical Oncology (ASCO): https://www.cancer.net/navigating-cancer-care/prevention-and-healthy-living/food-and-cancer-risk
- National Center for Complimentary and Integrative Health (NIH) provides great information on evaluating evidence of complimentary and integrative health to become a better informed consumer: https://www.nccih.nih.gov
- Mediterranean diet ideas and recipes from Mayo Clinic:
    - https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/mediterranean-diet-recipes/art-20046682
    - https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/multimedia/mediterranean-diet/sls-20077104

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