Diet and Lifestyle in Survivors of Colorectal Cancer

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KEYWORDS

• Colorectal cancer • Cancer survival • Lifestyle factors • Epigenetics

KEY POINTS

- Lifestyle factors that include obesity, physical activity, and diet are emerging as potential critical elements in improving survival outcomes for colorectal cancer.
- Changes in individual health behaviors both before and after a diagnosis of colorectal cancer may improve outcomes of survivors.
- Studies have indicated that maintaining a normal weight, participating in regular physical activity, and eating a healthy diet may be important preventive steps leading to improved survival outcomes.
- Epigenetic studies have demonstrated, at the cellular level, the possible mechanisms of colorectal cancer that can be positively influenced by changing lifestyle.

INTRODUCTION

The American Cancer Society estimates that there are more than 1.1 million survivors of colorectal cancer in the United States.[1] Survivors of colorectal cancer constitute 10% of the total number of cancer survivors, and the number is increasing.[2] Both genetic and lifestyle factors contribute to cancer development and the prognosis of colorectal cancer. Because lifestyle factors such as obesity, physical inactivity, diet, smoking, and alcohol consumption are potentially modifiable[3,4] while genetic factors are not, much attention has been paid to the impact of lifestyle factors on the incidence and prognosis of colorectal cancer.

Changing these modifiable factors toward practice of a healthy lifestyle may be crucial components of cancer treatment in addition to standard treatments in preventing recurrence and improving survival of patients with colorectal cancer. Although an increasing number of studies have examined the association of diet and lifestyle

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factors with cancer recurrence and survival outcome in patients with locally advanced colorectal cancer,[5–9] it is important to distinguish whether these exposures were measured before or after cancer diagnosis. For example, adiposity before diagnosis and after diagnosis may have a different impact on survival outcomes of patients with colorectal cancer. Exposures after diagnosis associated with prognosis of cancer may provide important implications on directing recommendations to cancer survivors. However, if an association exists only between prediagnosis adiposity and prognosis of colorectal cancer, it is less certain how to guide a patient, although such data may be important in understanding the biology of colorectal cancer.

This review summarizes the associations of modifiable lifestyle factors, including prediagnosis and postdiagnosis adiposity, physical activity, and diet, on the prognosis of patients with colorectal cancer. Given that most published data to date are from patients without metastatic disease, the focus here is on associations of these factors in survivors of stage I to III colorectal cancer. This article also summarizes the possible mechanisms for the association between modifiable lifestyle factors and the prognosis of patients with colorectal cancer.

ASSOCIATION BETWEEN THE PREDIAGNOSIS LIFESTYLE FACTORS AND RISK OF MORTALITY IN SURVIVORS OF COLORECTAL CANCER

Adiposity

Several studies have examined the association between prediagnosis adiposity and the prognosis of colorectal cancer (**Table 1**).[6,10–13] These studies used a variety of metrics for adiposity, including body mass index (BMI; calculated as weight in kilograms divided by height in meters squared, ie, kg/m^2), waist-hip ratio (WHR), and waist circumference (WC). Campbell and colleagues[6] examined 2303 men and women with stage I to III colorectal cancer and reported that those with BMI higher than 25 had worse colorectal cancer–specific mortality and all-cause mortality. Similarly, Doria-Rose and colleagues[10] studied 633 postmenopausal women with colorectal cancer and reported that obese patients (BMI $\geq$30) had a 2.1-fold higher risk of colorectal cancer–specific mortality and all-cause mortality compared with patients of normal weight.

Other studies have reported similar findings when using alternative measurements for adiposity such as percent body fat, WC, and WHR. Haydon and colleagues[14] reported that patients with colorectal cancer with increasing WC per 10 cm had a 1.33-times higher risk of disease-specific death. The investigators concluded that prediagnosis abdominal obesity might be a critical risk factor for mortality in patients with all-cause mortality, and made the recommendation for maintaining a normal weight and WC. In a study that compared BMI, weight, WHR, and WC, Prizment and colleagues[11] reported that whereas higher BMI ($\geq$25) and weight ($\geq$63.5 kg) were not significantly associated with colon cancer mortality, higher WHR ($\geq$0.81) and WC ($\geq$82.5 cm) were significantly associated with mortality. This study suggested that WHR and WC, which reflect abdominal adiposity, might be better predictors of colon cancer mortality than BMI and weight.

Physical Activity

Reports on association between the level of physical activity before cancer diagnosis and the risk of mortality in patients with colorectal cancer have been mixed (**Table 2**).[12,14–17] Some studies found significant associations between level of prediagnosis physical activity levels[12,14] and the risk of mortality, whereas others have found no association.[15] Meyerhardt and colleagues[15] studied female patients with