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Adherence to American Cancer Society and American Institute of Cancer Research dietary guidelines in overweight African American breast cancer survivors

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Abstract

Purpose—The American Cancer Society (ACS) and the American Institute for Cancer Research (AICR) each created dietary and physical activity guidelines to improve cancer survivorship. Despite African American breast cancer survivors (AABCS) having the lowest survival rates of any racial or ethnic group, limited information exists on their adherence to cancer specific lifestyle

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Conflict of Interest

Sparkle Springfield, PhD, declares that she has no conflict of interest. Angela Odoms-Young, PhD, declares that she has no conflict of interest. Lisa Tussing-Humphreys, PhD, MS, RD, declares that she has no conflict of interest. Sally Freels, PhD, declares that she has no conflict of interest. Melinda Stolley, PhD, declares that she has no conflict of interest.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

recommendations. The study's purpose was to measure adherence to ACS/AICR dietary recommendations in AABCS.

Methods—210 AABCS enrolled in the Moving Forward intervention trial, a randomized, community-based, 6-month weight loss study, were assessed for sociodemographics, dietary intake (via food frequency questionnaire) and related health factors at baseline. We operationalized the dietary recommendations put forth by ACS/AICR and created component and total adherence index scores. Descriptive statistics were used to calculate the proportion of women who met recommendations. Student's t-test and $\chi 2$ tests were used to compare participant characteristics by median adherence scores.

Results—The mean total ACS/AICR score was 12.7 ± 2.5 out of 21 points (median: 13; range: 5 to 21). Over 90% were moderately or completely adherent to limiting alcohol and red and processed meat consumption, but the majority failed to meet the other recommendations to eat whole grains, legumes, fruits, vegetables, and avoid added sugars. Women with total scores below the median were younger, with higher BMI, had fewer years of education, and lower income levels.

Implications for Cancer Survivors—The present study extends the literature on AABCS adherence to cancer-survivor specific dietary guidelines. Findings will inform future dietary lifestyle interventions in this population.

Keywords

African American women; breast cancer survivors; racial-ethnic disparities; diet quality; diet adherence

Introduction

Breast cancer is the most common cancer and the second leading cause of cancer death among women in the United States (US) [1]. Due to advances in early detection and treatment, survival rates have improved over the last two decades [2]. However, African American (AA) women have not shared equally in the benefits of these advances and continue to suffer the highest breast cancer mortality and shortest survival rates of any racial or ethnic group [3]. Additionally, AA breast cancer survivors (AABCS) are more likely to die from comorbidities such as hypertension and diabetes compared to other women with breast cancer [4]. Although several factors contribute to these disparities, growing attention is being given to understanding the role of lifestyle behaviors, including diet [5–7].

Evidence supports a relationship between lifestyle behaviors and cancer-specific and overall mortality among cancer survivors [8–10]. Hence, the American Cancer Society (ACS) recommends that cancer survivors achieve and maintain a healthy body weight, be physically active, and eat a healthy diet [11]. Information on how diet in particular impacts breast cancer survival is evidenced by the American Institute for Cancer Research (AICR) Continuous Update Project (CUP) [12]. Data from their ongoing systematic review suggest that female breast cancer survivors who: 1) eat more fiber containing foods (e.g. vegetables, whole grains); 2) eat more soy containing foods (e.g. legumes); and 3) have a lower intake of total fat, and particularly saturated fat, may have overall longer survival [12]. Based on this,

the AICR put forth dietary guidelines similar to those put forth by ACS recommending that women: 1) eat a plant-based diet; 2) limit intake of red and processed meats; and 3) limit consumption of energy dense foods.

Research evaluating adherence to cancer-specific dietary guidelines among breast cancer survivors is limited [13–15]. Large cohort studies with predominantly white survivors report an inverse relationship between dietary adherence to the ACS/AICR cancer prevention guidelines (assessed by an index score which included the recommendations considered in this study) and risk of metabolic syndrome [13], all-cause mortality [16], and non-breast cancer related causes of mortality [15]. These studies also suggest that most breast cancer survivors are generally noncompliant with cancer-specific dietary guidelines. Only two studies have considered dietary intake of AABCS and adherence to cancer survivor-specific dietary recommendations. Parker and colleagues examined adherence to ACS dietary recommendations among a small sample of overweight and obese AABCS (n=31) enrolled in a lifestyle intervention [17]. They found that the majority of participants failed to adhere to several of the dietary component recommendations including total energy from fat, saturated fat, and added sugars. Paxton and colleagues completed a secondary analysis describing racial/ethnic differences in baseline dietary intake among participants in the Women's Healthy Eating and Living (WHEL) study (n=3088, 3.8% AA) [18]. Study results suggested AABCS have poorer dietary behaviors compared to white survivors [18], but they did not evaluate adherence to ACS/AICR cancer-specific dietary guidelines [19]. The present study aims to address this obvious research gap by providing information on dietary adherence of a large sample of AABCS. Such data will enhance the power of future lifestyle interventions targeting this high-risk survivor group.

Methods

Study Design

We used baseline interview data from Moving Forward, a randomized, community-based, six-month, weight management intervention trial for AABCS (NCT02482506). The study drew participants from cancer registries at three academic cancer centers and community-based recruitment efforts in the Chicago area. The University of Illinois at Chicago Institutional Review Board approved the study. Details about the study design are published elsewhere [20].

Study Population and Eligibility Criteria

Data were collected at baseline from 210 AABCS. Eligibility criteria included a previous diagnosis of stage I, II, or III breast cancer and completion of treatment (i.e., surgery, chemotherapy, radiation) at least 6 months before recruitment; ongoing treatment with Tamoxifen or aromatase inhibitors was allowed. Participants had to self-identify as AA; be 18 years or older; have a body mass index (BMI) > 25 kg/m2; have signed approval from a healthcare provider confirming it was safe to engage in moderate physical activity (obtained by study staff via faxed form to potential participant's primary care provider or oncologist); be available to attend intervention sessions twice per week for 6 months, and agree to be randomized to a guided or self-guided intervention program. Women were excluded if

planning to move from the Chicago area; pregnant or < 3 months postpartum; using an FDA-approved or over the counter weight loss medication; participating in another structured weight loss program; reporting a history of significant mental illness; or it was deemed unsafe by her healthcare provider to engage in moderate physical activity.

Study Procedures and Measures

All participants completed a 75-minute baseline interview consisting of in-person interviewer-administered questionnaires (including socio-demographic and lifestyle measures) and anthropometric assessments.

Anthropometric Assessment

Weight was assessed in duplicate using a Tanita digital scale (Arlington Heights, IL) with participants wearing light clothing and no shoes. Height was measured in duplicate using a seca portable stadiometer (Issaquah, WA). In cases of more than a 0.2 kg discrepancy in weight or a 0.5 cm discrepancy in height, a third measurement was taken. The two most closely aligned measurements of height and weight were averaged for each woman and used to calculate body mass index (BMI) $kg/(m)^2$.

Hip and waist circumference were measured on bare skin. Waist size was measured in duplicate at the level midway between the lower rib margin and the iliac crest, with the participant breathing out gently. Hip circumference was recorded in duplicate as the maximum circumference over the buttocks. A discrepancy of more than 1.0 cm for a given location resulted in a third measurement [20]. The mean of the two measurements most closely aligned was used for analysis. Average waist and hip circumference data were used to calculate a waist-to-hip ratio.

Physical Activity

The Modified Activity Questionnaire was used to assess self-reported physical activity as the number of hours per week the participant engaged in leisure time physical activity during a typical week [21]. This activity questionnaire has been used in many large studies with diverse samples, including breast cancer survivors [22] and has well-established reliability and validity [21].

Socio-demographic and Health Related Characteristics

Socio-demographic data obtained via questionnaire included self-reported age, years since diagnosis, years of education (high school diploma or less, some college with no degree, two-year college degree, four-year college degree, graduate/professional degree), and annual household income (<$20,000, $20,000-$39,999, $40,000-$59,999, $60,000-$79,999, ≥ $80,000).

Food Frequency Questionnaire

Study participants completed a semi-quantitative 110-item Block 2005 Food Frequency Questionnaire (FFQ). The FFQ was administered by a trained interviewer and included reference to a standardized portion guide. The questionnaire was designed to assess habitual dietary intake of foods, beverages, and supplements. We asked participants to report on the

past 6 months. Reliability and validity are established in a wide range of age, gender, income, and ethnic groups [23–28]. Only FFQs deemed reliable and plausible were used for the analysis. FFQs that (1) had more than ten questions unanswered (n=0), (2) reported intakes of more than 5,000 or less than 500 calories per day (n=6), or (3) reported consecutive repetitive answers throughout the questionnaire (n=0) were excluded from the analysis. Habitual intake of macro- and micronutrients, food groups, and the diet quality indices (Healthy Eating Index-2010 and Alternate Healthy Eating Index-2010, were reported in a separate paper [28] and calculated by NutritionQuest (Berkeley, CA).

ACS/AICR Dietary Recommendations for Cancer Survivorship Scoring Approach

The combined ACS/AICR dietary guidelines for cancer survivorship include six broad recommendations, each defined by one or two personal goals (see Table 1). We operationalized these recommendations resulting in 7 scoring components: 1) fruit and vegetable intake; 2) whole grain and legume intake; 3) red meat intake; 4) processed meat intake; 5) energy density; 6) added sugar intake; and 7) alcohol intake (see Table 1). Similar to previous studies [16, 29–31], we did not operationalize a recommendation for dietary supplement use because cancer survivors are recommended to obtain their needed nutrients through foods [11]. Additionally, considering that the FFQ has limited ability to accurately capture sodium intake both from foods and salt added at the table, we did not operationalize the AICR recommendation to limit the consumption of sodium to 2,400mg per day [24, 32].

Our quantitative scoring system is modeled after scoring systems operationalized by McCullough et al. (2011), Berdan et al. (2013), and Hastert et al. (2013) [30, 31, 33]. Adherence to each component is scored from 0 to 3 points: 3 points for meeting or exceeding the recommendation; 1–2 points for partially meeting the recommendation; and 0 points for not meeting the recommendation (see Table 1). Total scores could range from 0 – 21 points. In the case of sugar-sweetened beverage intake, where the ACS/AICR recommendations are non-specific and thus difficult to operationalize, we relied on the AHA recommendations for intake [34]. Detailed scoring information is provided in Table 1 and described below.

Fruits and Vegetables

Both ACS and AICR recommend consuming five servings, or 2.5 cups, of a variety of non-starchy fruits and vegetables daily. Intake of at least five servings of fruits and vegetables daily received 3 points; those consuming fewer fruits and vegetables received 0–2 points. To create this score, we summed six FFQ output variables: cups of deep yellow-orange vegetables; dark green leafy vegetables; other vegetables; tomatoes; citrus melon berries; and other solid fruit. Potatoes, yams, other starchy vegetables, and French fries were not counted as a vegetable [30].

Whole Grains and Legumes

ACS recommends whole grains instead of refined grain products; AICR recommends eating relatively unprocessed cereals (grains) and/or pulses (legumes) with every meal. Those consuming 50% or more of their grains as whole grains (sourced mostly from breads, cereals, and rice; respectively) and/or consuming at least one serving of legumes daily

received 3 points (i.e., daily intake of whole grains divided by daily intake of total whole grains). Fewer points (0–2) were given to those consuming less than 50% of their grains as whole grains (i.e., daily intake of whole grains divided by daily intake of total whole grains) and/or less than one serving daily of legumes (i.e., including soy-based foods) [35]. We used four variables from the FFQ: daily intake of total grains, daily intake of whole grains, servings of legumes, and soy foods.

Red and Processed Meats

Both ACS and AICR recommend limiting the consumption of red and processed meats. Based on evidence suggesting consumption of processed meat in particular leads to increased risk of all-cause mortality, the AICR specifically recommends to "avoid" processed meat indicating that the recommendation for processed meat is stricter than that for red meat [36]. Unlike previous investigators [14, 31], we provided separate scores for red and processed meats to acknowledge the difference in cancer-specific recommendations. While ACS guidelines do not provide a recommendation for specific amounts, AICR recommends a maximum of 18 ounces of red meat each week. Thus, those who consumed ≤18 ounces of red meat per week received 3 points, while those consuming over 30 ounces per day received 0 points. Those who consumed ≤one ounce of processed meat per day received 3 points; those consuming over 3 ounces daily received 0 points. For this component score, we summed responses from two FFQ variables specific to red and organ meat intake. AICR recommends avoiding processed meats altogether. The FFQ variables used to quantify processed meat intake included lunchmeats, hot dogs, and bacon.

Energy Density

ACS recommends limiting the consumption of energy dense foods, and AICR has a more specific recommendation indicating that the average energy density be lower than 125 calories per 100 grams of foods/beverages. Those at or below the AICR recommendation received 3 points, while those who consumed 225 per 100 grams of food received 0 points. Energy density was calculated using the FFQ variables for total grams of solid food, total grams of sugary drinks, and total daily calories.

Added sugars

Both ACS and AICR recommend avoiding added sugars in the form of sugary drinks, but neither recommend specific maximum daily amounts. Given that added sugars are an important contributor to obesity, we wanted to use a defined cutoff to guide adherence scoring, and thus relied on the AHA recommendation for women of no more than six teaspoons of added sugars per day [37]. Women consuming six teaspoons or less received 3 points; those consuming 6.01–10, 10.01–14, and >14.0 teaspoons received 2, 1, and 0 points, respectively. The FFQ variable for added sugar teaspoon equivalents served as a proxy for sugary drink intake.

Alcoholic Drinks

Both the ACS and AICR recommend no more than one alcoholic drink (or ~14 grams of ethanol) daily for women. Given our study population of cancer survivors, and alcohol's

positive relationship with cancer risk, non-drinkers received the highest score [30]. Those meeting the daily limit of one drink per day received two points. Those who reported drinking more than two drinks daily received 0 points. The alcoholic drink equivalents variable from the FFQ was used to determine alcoholic beverage intake.

Statistical Analysis

Standard descriptive statistics, including mean, median, standard deviation, and range, were calculated for ACS/AICR total and component scores. Participants were divided into low- and high dietary adherence groups based on the median ACS/AICR total score. Student's t test and $\chi 2$ tests were used to determine socio-demographic, health, and anthropometric differences among groups for continuous and categorical variables. Multiple logistic regression was conducted to examine the effect of each covariate on the ACS/AICR scores above the median after adjustment for total energy intake. Additionally, we used forward stepwise variable selection to determine independent covariate effects. See supplemental information. All analyses were conducted using IBM SPSS Statistics for Macintosh, Version 22.0 (Chicago, IL).

Results

Mean participant age was 57 (sd ± 10.1), with an average of 7 years (sd ± 5.2) since initial breast cancer diagnosis. Many of the participants reported having some college (77.5%), and private medical insurance (48.1 %). One quarter of women (24.8 %) reported annual household income less than $20,000, with 19% reporting $80,000 or more. Few participants reported current smoking (8.6 %); BMI ranged from 25.29 to 57.87 kg/m^2. The mean total ACS/AICR score was 12.7 (sd ± 2.5) out of 21, with scores ranging from 4 to 20 points. Study participants' socio-demographic, health-related, and anthropometrics characteristics are summarized in Table 2.

As shown in Table 3, most survivors were adherent to restricting alcohol intake, limiting red meat, and avoiding processed meats. Ninety percent of our participants met the ACS/AICR recommendation of 1 alcoholic drink or less per day, with 36.7% meeting our strict recommendation of not consuming any alcohol. About 88% of women were completely adherent to the recommendation to limit red meat to less than 18 oz. per week. Similarly, 78.1% of women were completely adherent to the recommendation to limit processed meat. Over 83% of participants were non- or only modestly adherent to eating whole grains and legumes, 60% were non- or modestly adherent with eating a variety of fruits and vegetables, and nearly 60% were non- or modestly adherent with avoiding added sugars. Only 25.7% of participants were completely adherent to limiting the consumption of energy-dense foods (see Table 3). Although we did not include sodium in our adherence algorithm, given that 54% of our sample reported a history of hypertension, we did a sub-analysis to examine sodium intake. Sixty percent reported consuming more than 2,400 mg of sodium per day with 88.1% consuming over 1,500 mg. AICR recommends limiting sodium intake to 2,400 mg per day and the American Heart Association (AHA) recommends of 1,500 mg per day for AAs, due to their increased risk for hypertension and other heart-related conditions [38].

On average, women with ACS/AICR adherence scores below the median had significantly different sociodemographic and anthropometric characteristics compared to women who scored above the median (see Table 4). The group with lower adherence scores were younger and had fewer years of education, lower annual household income, and increased BMI compared to women with higher scores. No additional significant differences were detected in years since diagnosis, marital status, insurance status, waist-hip ratio, or weekly hours of moderate physical activity. This finding was confirmed by forward stepwise selection resulting in total energy intake and years of education as the two significant predictors of adherence (see Supplemental Table E).

Discussion

Few studies have examined adherence to cancer-specific dietary guidelines in breast cancer survivors, with even fewer reporting data specific to AABCS. Based on others' work [30, 31, 33], we operationalized the ACS/AICR dietary recommendations for cancer survivors into a quantitative score and assessed AABCS adherence to these recommendations. Our sample scored approximately 13 of 21 points indicating only modest adherence with current survivor-specific dietary recommendations. The majority of our participants met the ACS/AICR recommendations related to the consumption of alcohol, red and processed meats. However, most were noncompliant with other recommendations, particularly those regarding whole grains and legumes, eating fruits and vegetables, and avoiding added sugars. Also, additional analyses revealed that the sodium intakes for our sample exceeded levels recommended by AICR and AHA to reduce risk of cancer and cardiovascular disease. This is particularly important considering that cardiovascular disease (CVD) is the leading cause of death in AA woman overall and among breast cancer survivors [39, 40]; furthermore, CVD is an independent predictor of disparities between AA and white breast cancer survivors [4, 41, 42].

Findings from our study of adherence to cancer specific dietary guidelines among AABCS are similar to previous studies and draws attention to the need for dietary interventions targeting this population [15, 43–45]. In one of the only published studies focused on dietary intake among AABCS, Parker and colleagues examined baseline dietary adherence to ACS recommendations in a sample of 31 AABCS participating in "Stepping Stone," a randomized clinical trial focused on exercise and healthy eating [17]. Unlike our study, they did not develop a dietary index to assess overall adherence to ACS dietary recommendations. However, they did examine individual components and, like our findings, Stepping Stone participants had high adherence to recommendations for red/processed meat and alcohol, and low adherence to recommendations for fiber, whole grains, and added sugars (i.e., sugary drinks) [17]. Differences were noted between our study and Parker et al. on fruit and vegetable adherence. Whereas 71% of Parker and colleagues' participants reported consuming the recommended five daily servings of fruit and vegetables, only 16.7 % of our study participants met this recommendation. In a study of AABCS (n=240) attending a breast cancer support group, Ramirez et al., also reported a majority meeting the guideline for red and processed meat (n=191, 83.4%), and similar to our results, the majority did not meet the guidelines for fruits and vegetables (n=189, 80.4%) [7]. Studies with Latina breast cancer survivors report similarly unhealthy dietary patterns [44]. For example,

Palacios et al. found Puerto Rican breast cancer survivors had very low mean intake of plant-based foods and very high intake of added sugars compared to the other groups [8]. At the same time, women exhibited high adherence to recommendations to limit red and processed meat and alcohol consumption [8].

Healthier patterns are often observed among non-minority breast cancer survivors. A cross-sectional study of adherence to the ACS/AICR cancer prevention dietary guidelines (assessed by a dietary adherence score*)* among 2,092 European breast cancer survivors (diagnosed within the previous 5 years) with and without metabolic syndrome reported overall low adherence to the recommendation to eat mostly plant-based foods [45]. However, adherence was higher than the percent of women adherent in our sample [45] with 39.4% of survivors without metabolic syndrome and 32% of survivors with metabolic syndrome adherent to the recommendation for eating more than five servings of fruits and vegetables, whole grains, and legumes. Additionally, over 80% of their sample met the recommendation to avoid sugary drinks, while only 15.7% of our participants were adherent to avoiding added sugars. Interestingly, however, nearly half of all participants in the study by Bruno and colleagues fell short of the recommendation for limiting red and processed meat, whereas the majority of our participants were adherent. Similar results were noted between studies for alcohol consumption with high adherence for both study populations.

The observation that the AABCS in our sample were limiting alcohol and red meat, as well as avoiding processed meats is encouraging. Furthermore, the consistency in findings between our results and those of Parker et al. regarding limiting red and processed meats and avoiding alcohol suggest these patterns may be common among AABCS [17]. Red and processed meats in particular are associated with increased cancer risk, heart disease, and all-cause mortality [36, 46, 47]. They also represent a substantial source of saturated fat, which in itself is linked to increased breast cancer mortality [48]. Our observation of low red and processed meat consumption was unexpected. NHANES data suggest that red meat is consumed more than fish or poultry, with healthy AA and white women consuming equal amounts of red meat per day (~70 grams per day)[49]. At the same time, data show that some AAs are aware of the association between meat consumption and increased health risks, and that there are negative social/cultural perceptions of red meat, which together may be contributing to high adherence in our sample [50, 51]. Qualitative data that informed the development of the Moving Forward intervention, indicated that urban AABCS reported decreasing meat intake as one of the most common dietary changes made following their breast cancer diagnosis [52]. In the absence of longitudinal studies tracking diet changes after breast cancer diagnosis among AA women, it is unclear if AABCS are more cautious about red meat consumption following diagnosis.

Although the majority of survivors in our sample reported low alcohol consumption (i.e., 90% reporting ≤1 drink/day), even consuming just one drink (~14 grams of ethanol) per day has demonstrated adverse effects on breast cancer outcomes [53–56], highlighting the need for strategies to further reduce alcohol consumption in AABCS. In the only study to date to examine alcohol consumption as a prognostic factor of breast cancer survival in AA women, McDonald et al. reported at least one drink per week was associated with 2.7-fold increase in mortality [53]. Additionally, in two studies with AABCS, light drinking before breast

cancer diagnosis was significantly associated with increased risk of mortality [57, 58]. Reduced alcohol consumption was expected in our sample as patterns of high abstinence, and low alcohol consumption is well documented in the AA general population [59]. Explanations for lower alcohol use among AAs compared to whites include differences in cultural norms, parental factors, religiosity, and biological response [60]. Considering AABCS may be particularly vulnerable to the harmful effects of even small amounts of alcohol, studies that elucidate and build on the cultural asset of light drinking (≤1 drink/day, ~14 grams of ethanol) patterns in the broader AA community are needed. That research could be leveraged to increase abstinence among high-risk subpopulations such as AABCS.

Low consumption of fiber containing foods such as fruits, vegetables, and whole grains, as well as high consumption of added sugars such as sugary drinks among study participants prompt concern. Moreover, we were particularly surprised by our sample's low legume consumption. Legumes are consistent with AA cultural dietary patterns (e.g., black-eyed peas) and are commonly more readily available in canned and dried form than fresh produce, especially in smaller food outlets [61–63]. In the Black Women's Health Study, an ongoing cohort study of nearly 60,000 AA women from across the US, lower fiber intake and higher sugary drink consumption were significantly associated with increased weight gain and risk of type II diabetes [64, 65]. High fiber consumption is established as a protective factor against heart disease, and a growing body of evidence connects sugary drink intake to metabolic syndrome in general [66–68]. Epidemiologic evidence strongly suggests that dietary fiber intake decreases the risk of obesity, while intake of sugar-sweetened beverages increases risk [69, 70]. Increased fiber intake also supports weight loss. In the ORBIT trial, an efficacy study of a weight loss intervention comparable to Moving Forward, obese AA woman (n=213) with similar characteristics to our sample (urban, 44% college graduates, median income $42,500), increased fiber intake was positively associated with greater weight loss [71, 72].

Notably, AABCS [52], like AA women in the general population [73] and white breast cancer survivors, are generally aware of the health benefits of consuming more fruits and vegetables. However, unlike Parker et al.'s [17] results, our sample averaged less than three servings daily. No intervention trials have specifically targeted fruit and vegetable consumption among AABCS. The WHEL trial, which targeted fruit and vegetable consumption in a sample of predominantly white breast cancer survivors (n=3088, 3.8% AA), documented a significant increase in fruit and vegetable consumption among all participants post-intervention [19]. However, AA participants were less likely to maintain improvements over time compared to the other racial/ethnic groups [18]. The WHEL trial investigators posited that increasing fruit and vegetable consumption might be challenging to some AABCS given environmental and economic barriers. Low-income and racially segregated neighborhoods have fewer supermarkets and a higher prevalence of food retail establishments with limited produce options [61, 74, 75].

Even apart from food access issues, disproportionate marketing of products with high amounts of added sugars such as sugary drinks and low-quality snack foods via multiple platforms (e.g., television, billboards, storefronts) to AA communities makes adherence to general population and cancer-specific dietary recommendations particularly difficult [76,

77]. AAs may receive a “double dose” of televised food and beverage advertisements, as they respond to those geared toward the general population, as well as those directly targeting AA consumers [76]. Interestingly, evidence suggests that AA women who consume more sugary “fruit” drinks also practice healthier behaviors (e.g., increased fiber intake, physical activity, and nonsmoking status) compared to those who consume more sugary sodas [64]. Marketing may mislead women to believe that sugary “fruit” drinks advertised as “all-natural” or “real” are healthy options, where in fact, fruit juices, fruit drinks, and sodas are sources of added sugars, a category linked to increased chronic disease risk in AA women including cancers [76].

Age, education, income, and BMI are established predictors of health and lifestyle factors, including dietary adherence [78, 79]. Younger participants with fewer years of education, lower annual household income, and higher BMI were more likely to be less adherent to ACS/AICR recommendations in our sample. These findings are consistent with previous findings [43] as well as evidence linking decreased income, education, and health literacy to increased consumption of low quality foods [80–82]. Increased health literacy and access to high-quality foods [61] may lead to increased adherence to cancer specific dietary guidelines in AABCS. More studies are needed to understand the effects of poor sociodemographic and health factors presumably rooted in racial segregation, on dietary adherence in this population. There were no additional differences in other health-related factors when comparing the low-adherence vs. higher-adherence groups. This result was unexpected, as lifestyle factors such as smoking status have been associated with dietary adherence in previous studies of female cancer survivors [16].

Although this study adds to the evidence that dietary quality is an important avenue to pursue in addressing disparities in survivorship, it is not without limitations. The FFQ as a dietary assessment tool is known to elicit high rates of under-reporting [83]. Reporting bias, which is especially prevalent in overweight and AA women, can compound this effect [84–86]. There is also the potential for selection bias [87]. Participants who self-selected into the Moving Forward weight loss study may not be representative of the wider population of AABCS. Survivors who do not enter RCTs may be less healthy overall. Still, strengths of our study include the focus on an underserved population, the large sample size, the quantification of diet adherence to cancer specific dietary guidelines, and inclusion of sociodemographic, health and anthropometric factors.

Examining adherence to cancer-specific dietary recommendations constitutes a critical step in the trajectory toward developing and implementing effective dietary interventions for AABCS to reduce breast cancer survivorship disparities. Our results suggest that increasing intake of fruits, vegetables, whole grains/fiber, plant-based meatless meals (e.g., dry beans), and avoiding added sugars (e.g., low sugar beverages) are important and promising intervention targets. Assessing the knowledge, attitudes, and beliefs around the ACS/AICR recommendations in AABCS will inform further tailoring of intervention messages, as will gaining a greater understanding of the unique barriers and facilitators AABCS face in meeting these recommendations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1.

AMERICAN CANCER SOCIETY (ACS) AND AMERICAN INSTUTITE FOR CANCER RESEARCH (AICR) NUTRITION RECOMMENDATIONS, PERSONAL GOALS, AND OPERATIONALIZED SCORING CRITERIA

ACS and AICR Recommendation	Associated ACS personal goal	Associated AICR personal goal	ACS/AICR Dietary Adherence Scoring Criteria			
			0=Non Adherent	1=Modestly Adherent	2=Moderately Adherent	3=Completely Adherent
Eat a healthy diet, with an emphasis on plant-based foods	Eat at least 2 1/2 cups of vegetables and fruits each day	Eat at least five portions/ servings (at least 400 g or 14 oz.) of a variety of non-starchy vegetables and fruits every day	Intake of ≤1 serving daily	Intake of 1–2.99 servings daily	Intake of 3–4.99 servings daily	Daily intake ≥5 servings daily
	Choose whole grains instead of refined grain products	Eat relatively unprocessed cereals (grains) and/or pulses (legumes) with every meal Limit refined starchy foods. People who consume starchy roots or tubers as staples also to ensure intake of sufficient non-starchy vegetables, fruits, and pulses (legumes)	<30% of grains are whole grains and/or <0.50 servings of legumes daily	30–39.99% of grains are whole grains and/or 0.50–0.74 servings of legumes daily	40–49.99% of grains are whole grains and/or or 0.75–0.99 servings of legumes daily	Less than 50% of grains are refined and/or 1+ servings of legumes daily
Limit intake of red meat and avoid processed meats	Limit how much red processed meat you eat	People who eat red meat should consume less than 500 g (18 oz.) per week. Consume very little, if any, processed meat	>30 oz. red meat weekly >3 oz. processed meat daily	24.01–30 oz. red meat weekly 2.01–3 oz. processed meat daily	18.01–24 oz. red meat weekly 1.01–2 oz. processed meat daily	≤18 oz. red meat weekly ≤1 oz. of processed meat daily points
Limit consumption of energy dense foods; avoid sugary drinks	Choose foods and drinks in the amounts that help you get to and maintain a healthy weight	Consume energy dense foods sparingly Avoid sugary drinks Consume 'fast foods' sparingly, if at all	≥225 kcals/100 grams of food daily >14 tsp. daily	176–225 kcals/100 grams of food daily 10.01–14 tsp. daily	126–175 kcals/100 grams of food daily 6.01–10 tsp. daily	≤125 kcals per 100 grams of food daily ≤6 tsp. daily
Salt-preserved foods: Limit consumption of salt	Choose foods and drinks in the amounts that help you get to and maintain a healthy weight	Avoid salt-preserved, salted, or salty foods; preserve foods without using salt Limit consumption of processed foods with added salt to ensure an intake of less than 6 g (2.4 g sodium) a day				Not operationalized
Limit alcoholic drinks	Drink no more than 1 drink per day (~14 grams of ethanol)	If alcoholic drinks are consumed, limit consumption to no more than two drinks a day for men and one drink a day for women	>2 drinks daily	1.01–2 drinks daily	0.01–1 drink daily	Non-drinkers
Aim to meet nutritional needs through diet alone	Dietary supplements are not recommended for cancer prevention	Dietary supplements are not recommended for cancer prevention				Not operationalized

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TABLE 2.

SOCIO-DEMOGRAPHIC, HEALTH, AND ANTHROPOMETRIC CHARACTERISTICS OF AFRICAN AMERICAN BREAST CANCER SURVIVORS (N=210)

Characteristics[a]	**210 AABCS**
Age[b], years, μ (sd)	57.6 (10.1)
Years since diagnosis[c], μ (sd)	7.1 (5.2)
Stage (self-reported, n (%))	
Stage I	69 (36.3)
Stage II	85 (44.7)
Stage III	36 (18.9)
Education, n (%)	
Less than HS, HS, or GED	47 (22.4)
Some College no degree	50 (23.8)
Two-year degree	33 (15.7)
College Graduate, 4-year degree	40 (19.0)
Graduate/Professional degree	40 (19.0)
Relationship Status, n (%)	81 (38.8)
Single, never married	57 (27.1)
Married	81 (38.6)
Single, married before	71 (33.8)
Annual family income, n (%)	
<$20,000	52 (24.8)
$20,000-$39,999	46 (21.9)
$40,000-$59,999	41 (19.5)
$60,000-$79,999	31 (14.8)
≥ $80,000	40 (19.0)
Insurance status, n (%)	
Public	44 (21.0)
Medicare	55 (26.2)
Private	101 (48.1)
None	8 (3.8)
Current Smoker, n (%)	18 (8.6)
BMI, kg/m^2, n (%)	
Overweight, 25< 30	25 (11.9)
Obese I, 30 – 35	83 (39.5)
Obese II, 35 – 40	55 (26.2)
Obese II, ≥ 40	47 (22.4)
Waist to Hip Ratio, cm, μ (sd)	0.9 (0.01)
Moderate Physical Activity, hrs. per week, μ (sd)	2.4 (3.2)

Characteristics[a]	**210 AABCS**
ACS/AICR Dietary Adherence Score, μ (sd)	12.7 (2.5)

[a] Data are displayed as Mean (SD) or N (%).

[b] Age n=209

[c] Time since diagnosis n=207

TABLE 3.

FREQUENCY AND PERCENTAGE OF AFRICAN AMERICAN BREAST CANCER SURVIVORS ADHERENT TO ACS/AICR DIETARY ADHERENCE SCORE (N=210)

ACS/AICR recommendation	Scoring Criteria			
	0=Non-Adherent	1=Modestly Adherent	2=Moderately Adherent	3=Completely Adherent
Eat a variety of fruits and vegetables	16 (7.6)	110 (52.4)	49 (23.3)	35 (16.7)
Eat whole grains and legumes	139 (66.2)	36 (17.1)	17 (8.1)	18 (8.6)
Limit consumption of red meats	6 (2.9)	5 (2.4)	13 (6.2)	186 (88.6)
Avoid processed meats	4 (1.9)	8 (3.8)	34 (16.2)	164 (78.1)
Limit consumption of energy dense foods	23 (11)	52 (24.8)	81 (38.6)	54 (25.7)
Avoid added sugars	94 (44.8)	31 (14.8)	52 (24.8)	33 (15.7)
Limit alcohol	7 (3.3)	14 (6.7)	112 (53.3)	77 (36.7)

TABLE 4.

COMPARISON OF THE MEAN SOCIO-DEMOGRAPHIC, HEALTH, AND ANTHROPOMETRIC CHARACTERISTICS BY MEDIAN ADHERENCE SCORES IN AFRICAN AMERICAN BREAST CANCER SURVIVORS

ACS/AICR Total Score N=210			
Characteristics	**Below median score <13 (n=96)**	**Above median score ≥13 (n=114)**	**P-value**
Age[a], years, μ (sd)	56.0 (10.3)	59.1 (9.8)	**0.03**
Years since diagnosis[b], μ (sd)	6.5 (4.3)	7.7 (5.9)	0.12
Education, years, μ (sd)	13.9 (2.4)	14.7 (2.3)	**0.02**
Current Smoker, n (%)	12 (66.7)	6 (33.3)	0.06
Current Non-Smoker, n (%)	84 (43.8)	108 (56.3)	
Married, n (%)	35 (43.2)	46 (56.8)	0.53
Not married, n (%)	61 (47.7)	67 (52.3)	
Annual family income, $, μ (sd)	41458.3 (29126.9)	50350.88 (28282.1)	**0.03**
Insured, n (%)	90 (44.6)	112 (55.4)	0.09
Not Insured, n (%)	6 (75.0)	2 (25.0)	
BMI, kg/m^2, μ (sd)	37.3 (6.6)	35.3 (6.0)	**0.02**
Waist-Hip Ratio, cm, μ (sd)	0.9 (1.0)	0.9 (0.7)	0.66
Moderate Physical Activity, hrs. per week, μ (sd)	2.1 (3.1)	2.7 (3.2)	0.16

Student's t-test and $\chi 2$ tests were used to determine differences between groups for continuous and categorical variables.

[a]Age n=209

[b]Time since diagnosis n=207