

Implementation of a Rapid Dietary Assessment Tool in Breast Cancer Care

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Abstract

Purpose

Healthy dietary patterns are associated with improved breast cancer outcomes, yet dietary assessment is rarely integrated into survivorship care due to the burden of traditional assessment methods. Diet ID™ is a brief, image-based dietary assessment tool with validity comparable to established dietary assessment measures while substantially reducing participant burden. This study piloted the feasibility of implementing Diet ID™ among patients with breast cancer in a large integrated health care system.

Methods

Patients were invited by email to complete the Diet ID™ assessment after breast cancer diagnosis, either before, during, or after treatment. Electronic health record (EHR) and dietary assessment data were analyzed.

Results

Forty-four percent of patients contacted enrolled, and the mean completion time was 3.6 minutes. Seventeen percent of participants reported that Diet ID™ did not accurately reflect their usual diet. Participation rates were comparable across treatment stages.

Conclusions

The high participation rate and short completion time supports the feasibility of Diet ID™ as a dietary screening tool in clinical care. Similar participation across treatment stages suggests that it may be suitable for low-burden dietary assessment throughout the breast cancer survivorship continuum.

Implications for Cancer Survivors:

Diet ID™ may help identify patients who could benefit from dietary counseling and nutrition recommendations across all stages of treatment and survivorship.

INTRODUCTION

Breast cancer has one of the highest five-year relative survival rates among cancers, with over four million breast cancer survivors in the United States [1]. Recent studies suggest that adherence to a healthy diet may reduce morbidity and mortality risk in this population [2–4]. Studies have shown that patients with breast cancer are highly motivated to make lifestyle changes, and desire more evidence-

based information from health professionals [5, 6]. However, while essential health markers such as blood pressure, lipid profiles, and glucose levels are routinely collected for breast cancer patients, dietary assessments that could support evidence-based and individualized lifestyle recommendations are often overlooked due to limitations in existing dietary assessment tools [7]. Traditional methods including 24-hour dietary recalls, food frequency questionnaires, or food diaries are often too tedious, time-consuming, and labor-intensive for routine clinical use [8, 9]. They also impose substantial burden on patients, particularly those experiencing the overwhelming stress of a breast cancer diagnosis [10].

The need for low-burden, scalable, and more accurate dietary assessment tools for better clinical integration has been widely recognized across funding initiatives and research [11, 12]. While emerging technologies, including dietary tracking apps, artificial intelligence, and photo recognition algorithms are being explored as potential solutions to the challenges of traditional dietary assessment methods [11–14].

Diet ID™ is an online, image-based dietary assessment tool that uses Diet Quality Photo Navigation, a patented image-based pattern recognition algorithm, to characterize an individual's typical dietary pattern over the previous month [15]. Based on the established dietary pattern, the platform generates a comprehensive nutritional profile and a Healthy Eating Index (HEI) score [15, 16]. Reported completion times are approximately five-times shorter compared with traditional food frequency questionnaires while maintaining comparable validity for diet quality assessment [17, 18]. Cross-sectional validation studies comparing Diet ID™ with traditional methods such as food records, food frequency questionnaires, and the Automated Self-Administered 24-Hour Recall have demonstrated consistent correlations with HEI scores, biomarkers, and several macro- and micronutrients [17, 18].

This study piloted the Diet ID™ platform in patients diagnosed with breast cancer to evaluate its feasibility and usability within a large integrated healthcare system. Given Diet ID™'s demonstrated validity and potential to reduce burden for both patients and healthcare professionals, this effort represents the first step to exploring the integration of a dietary assessment tool in routine oncology care.

METHODS

Study Design and Recruitment

Our pilot study was conducted between March 2025 and October 2025 to evaluate the feasibility, usability, and patient acceptability of the Diet ID™ platform for dietary assessment. The platform was piloted among 1,270 female patients diagnosed with ductal carcinoma in situ (DCIS) or invasive breast cancer (any stage) at the San Francisco and Oakland medical centers of Kaiser Permanente Northern California (KPNC), a large integrated healthcare system.

Recruitment occurred in three waves over a six-month period. Wave 1 included patients diagnosed up to 24 months prior to study launch. Waves 2 and 3 took place at three- and six-months after study launch,

recruiting newly diagnosed patients during those time periods. This wave-based approach allowed recruitment at different stages of the cancer care continuum (pre-treatment, during treatment, and post-treatment) and was intended to increase enrollment of patients who were more recently diagnosed.

Dietary Assessment

At the time of initial contact, eligible patients were sent a standardized email invitation containing a unique, patient-specific weblink to the Diet ID™ platform (www.dietid.com). Informed consent was obtained from all participants included in this study. Depending on responses, participants completed between two and eight brief screening questions regarding food preferences, allergies, and ethnic dietary influences. Participants were then presented with pairs of composite images representing established dietary patterns and asked to select the image that most closely aligned with their diet over the prior month (Fig. 1). Through repeated comparisons, the algorithm identified the dietary pattern most closely aligned with each participant's diet. Participants were then asked if they believed that Diet ID™ accurately captured their usual diet.

Patients who did not complete the assessment received reminder emails one and two weeks after the initial invitation and non-responders were also invited to participate in subsequent waves. A study staff member was available to participants via email contact to answer questions and address any technical difficulties.

Eligibility and Exclusion Criteria

A Virtual Data Warehouse (VDW)-based Cancer Data Mart was used to identify patients at KPNC San Francisco and Oakland Medical Centers with a diagnosis of DCIS or invasive breast cancer [19]. Breast cancer diagnosis was determined from the patient biopsy in the VDW, which was updated daily with a one-week delay. Eligible participants for each wave were extracted approximately one week prior to sending invitation emails. Across all three waves between April 2023 and October 2025, there were 1,675 potentially eligible female patients aged 18 years or older identified with invasive breast cancer or DCIS. Of those identified, 328 patients were classified as having DCIS based on combined pathological and clinical staging data. Patients were excluded if they: lacked a recorded email address in the KPNC electronic health record (EHR) (n = 29, 1.7%), were deceased or listed on a KPNC no-contact registry record (n = 28, 1.7%), indicated a preferred written language other than English (n = 196, 11.7%), had a documented history of cognitive impairment as determined by relevant ICD codes [3] (n = 87, 5.2%), or were no longer KPNC members (n = 37, 2.2%) (see Online Resource 1). Patients with DCIS or an invasive breast cancer diagnosis, but without a corresponding scheduled surgery date, underwent clinical review by a collaborating physician to ensure patient contact was appropriate. An additional 1.7% (n = 28) were determined inappropriate for contact based on clinical chart review. Of 1,675 patients identified, 1,270 were determined eligible for contact.

All protocols and procedures for this study were approved by the KPNC Institutional Review Board for Protection of Human Rights.

Demographic and Clinical Variables

For each participant, captured Diet ID™ data were linked to their KPNC EHR to identify demographic and clinical covariates including age at diagnosis, race and ethnicity, cancer stage, body mass index (BMI), time from diagnosis, and treatment status. BMI was calculated using the closest clinical record of height and weight from the time of dietary assessment for enrolled participants and first invite date for those unenrolled. If no recorded BMI was available within +/- 30 days of assessment completion, BMI for enrolled participants was estimated using self-reported height and weight from Diet ID™ (39.0%). Treatment status was determined using EHR-derived data and categorized as pre-treatment, during treatment, or post-treatment. Pre-treatment was defined as the period before the initiation of surgery, radiation, or chemotherapy, or when no treatment was recorded. During treatment was defined as the period of active treatment, including intervals between treatment episodes, until 30 days after the last end date of all treatments. Chemotherapy end date was defined by the last recorded infusion date, while radiation end date was estimated as 35 days after radiation initiation. Post-treatment was defined as more than 30 days after completion of all treatments (surgery, chemotherapy, and radiation). Endocrine therapy was not included in treatment status because it is typically administered over several years and would not meaningfully distinguish acute treatment from survivorship phases.

Dietary Assessment Outputs

Based on each participant's identified dietary pattern, Diet ID™ generated estimates of energy intake, macronutrients, micronutrients, food group composition, and a 2020 HEI score, providing a comprehensive nutritional profile. HEI scores ranged from 0 to 100, with lower scores indicating poorer diet quality and were categorized into tertiles: <51 (low diet quality), 51 – 80 (medium diet quality), and > 80 (high diet quality). The nutrient output included estimates for 62 nutrients and 33 food subgroups.

Statistical Analysis

Descriptive statistics were used to summarize participant demographic and clinical characteristics, Diet ID™ outputs, and outcomes across recruitment waves. Feasibility was evaluated by comparing enrollment across participant demographic and clinical characteristics including BMI, cancer stage, treatment status, and time from diagnosis to assessment. Response to outreach was evaluated using median time to assessment completion and number of email contacts required. Usability was evaluated by comparing HEI score tertiles across demographic and clinical characteristics, including BMI, cancer stage, treatment status, and time from diagnosis. Participants' perceived accuracy of the Diet ID™ assessment was evaluated in relation to their HEI score to further assess usefulness. To demonstrate

the platform’s nutritional profiling capacity, means were calculated for total energy (kcal), as well as the seven food groups, and four macronutrients that are typically used to derive the HEI score.

Categorical variables were compared using chi-square tests, with likelihood ratio tests used when expected cell counts were less than 5. For continuous variables, differences were evaluated using tests for trend. Statistical significance was assessed using two-sided tests with a significance threshold of $p < .05$. All analyses were performed using SAS version 9 [20].

RESULTS

Table 1 presents measures of the feasibility and usability of Diet ID™ across the three recruitment waves (n = 1,270 total contacted individuals). Overall, 557 of those contacted (43.9%) enrolled in the study. There were 12 individuals (0.9%) who actively refused participation, 15 (1.2%) whose email bounced back, and 686 (54.0%) who never responded. Of the 557 individuals who enrolled, 184 (33.0%) responded after the first email contact, 160 (28.7%) responded after two email contacts, and 213 individuals (38.2%) responded after 3 or more emails. Of these, 136 participants (24.4%) responded after additional contacts received through subsequent recruitment waves. Excluding these participants did not materially change the study findings. The median time from the first email contact to assessment completion was 8 days (range = 20–189) and the median assessment completion time was 3.6 minutes (range = 2.8–4.9).

Table 1
Feasibility and acceptability of Diet ID assessments across recruitment waves

	Wave 1	Wave 2	Wave 3	Total
	n (%)	n (%)	n (%)	n (%)
Response to outreach (newly invited participants)				
Eligibility lookback window	Prior 24 months	Prior 3 months	Prior 3 months	Prior 30 months
Invited to participate	1021 (100.0)	132 (100.0)	117 (100.0)	1270 (100.0)
Enrolled (consented)	456 (44.7)	55 (41.7)	46 (39.3)	557 (43.9)
Refused to participate	12 (1.2)	0 (0.0)	0 (0.0)	12 (0.9)
Unable to contact (email bounced back)	12 (1.2)	3 (2.3)	0 (0.0)	15 (1.2)
No response	541 (53.0)	74 (56.1)	71 (60.7)	686 (54.0)
Responded after 1 email	137 (30.0)	25 (45.5)	22 (47.8)	184 (14.5)
Responded after 2 emails	130 (28.5)	14 (25.5)	16 (34.8)	160 (12.6)
Responded after 3 or more emails	189 (41.4)	16 (29.1)	8 (17.4)	213 (16.8)
Assessment completion (all participants)				
Median time from first email invitation to enrollment, days ^a	8 (2–91)	7 (0–15)	7 (1–8)	8 (1–36)
Median time of assessment completion, minutes ^a	3.5 (2.7–4.8)	4.1 (2.7–5.2)	4.1 (2.9–6.1)	3.6 (2.8–4.9)
^a Interquartile range				

Table 2 summarizes the demographic and clinical characteristics comparing the enrolled with the unenrolled participants. The distributions of medical center location, cancer stage, treatment status and time from diagnosis were generally similar between the two groups. Enrolled participants were more likely to be younger (< 50 years; 30.5%), White (59.3%), and have normal BMI (≤ 25 kg/m²; 42.4%) compared with the unenrolled. Moderate differences were observed by treatment status, whereby participants who were post-treatment at the time of contact (68.9%) were also more likely to enroll. However, this difference was not statistically significant.

Table 2
Demographic and clinical characteristics for unenrolled and enrolled patients

Age at Diagnosis, yrs	Unenrolled n = 713 (56.1)	Enrolled n = 557 (43.9)	Total n = 1,270 (100.0)	P-chisq
				0.02
<50	172 (24.1)	170 (30.5)	342 (26.9)	
50–59	138 (19.4)	107 (19.2)	245 (19.3)	
60–69	179 (25.1)	142 (25.5)	321 (25.3)	
≥70	224 (31.4)	138 (24.8)	362 (28.5)	
Race and Ethnicity				< 0.01
Black/African American	137 (19.2)	44 (7.9)	181 (14.3)	
Hispanic	64 (9.0)	37 (6.6)	101 (8.0)	
Asian/PI	199 (27.9)	111 (19.9)	310 (24.4)	
White	256 (35.9)	330 (59.3)	586 (46.1)	
Other	52 (7.3)	30 (5.4)	82 (6.5)	
Unknown	5 (0.7)	5 (0.9)	10 (0.8)	
Facility of Record				0.57
San Francisco Medical Center	245 (34.4)	200 (35.9)	445 (35.0)	
Oakland Medical Center	468 (65.6)	357 (64.1)	825 (65.0)	
Cancer Stage Group				0.44
0	147 (20.6)	118 (21.2)	265 (20.9)	
I	400 (56.1)	329 (59.1)	729 (57.4)	
II	53 (7.4)	39 (7.0)	92 (7.2)	
III	37 (5.2)	21 (3.8)	58 (4.6)	
IV	26 (3.7)	13 (2.3)	39 (3.1)	
Invasive, unknown	50 (7.0)	37 (6.6)	87 (6.9)	
Body Mass Index, kg/m ²				< 0.01
Under (< 18.5)	18 (2.5)	10 (1.8)	28 (2.2)	
^a At date of completed assessment for enrolled and first contact for unenrolled.				

Age at Diagnosis, yrs	Unenrolled n = 713 (56.1)	Enrolled n = 557 (43.9)	Total n = 1,270 (100.0)	P-chisq
				0.02
Normal (18.5–24.9)	194 (27.2)	236 (42.4)	430 (33.9)	
Overweight (25.0-29.9)	160 (22.4)	162 (29.1)	322 (25.4)	
Obese (> = 30.0)	188 (26.4)	116 (20.8)	304 (23.9)	
Unknown	153 (21.5)	33 (5.9)	186 (14.7)	
Treatment Status ^a				0.11
Pre-Treatment	88 (12.3)	62 (11.1)	150 (11.8)	
In Treatment	173 (24.3)	111 (19.9)	284 (22.4)	
Post-Treatment	452 (63.4)	384 (68.9)	836 (65.8)	
Time from Dx ^a				0.63
0–1 month	22 (3.1)	23 (4.1)	45 (3.5)	
1–3 months	125 (17.5)	84 (15.1)	209 (16.5)	
3–6 months	100 (14.0)	76 (13.6)	176 (13.9)	
6–12 months	141 (19.8)	103 (18.5)	244 (19.2)	
12–18 months	148 (20.8)	116 (20.8)	264 (20.8)	
18–24 months	177 (24.8)	155 (27.8)	332 (26.1)	
^a At date of completed assessment for enrolled and first contact for unenrolled.				

Table 3 summarizes demographic, clinical and dietary perception characteristics of participants across tertiles of the HEI. Participants in the low diet quality tertile tended to be younger (36.9% were < 50), Black/African American (13.1%), and overweight (36.9%) or obese (26.8%). Participants in the higher diet quality tertile tended to be White (63.3%), mid-aged (22.6% were 50–59), and have normal BMI (49.7%). Participants with low diet quality were also more likely to be undergoing active treatment at the time of assessment (23.2%), while participants with high diet quality were more likely to be post-treatment (72.3%). We did not observe any notable differences in diet quality across time from diagnosis to time of dietary assessment. Overall, 17.4% of participants disagreed or strongly disagreed with Diet ID™ accurately capturing their diet. Participants with low diet quality were more likely to disagree (22.0%) or strongly disagree (4.8%), while participants with high diet quality were more likely to agree (55.9%) or strongly agree (2.3%) that the Diet ID™ tool accurately captured their diet.

Table 3
Patient characteristics by tertiles of the Healthy Eating Index score

	Healthy Eating Index score				P- chisq
	T1 n = 168 (32.6)	T2 n = 171 (33.1)	T3 n = 177 (34.3)	Total n = 516 (100.0)	
Age at Diagnosis, years					0.58
<50	62 (36.9)	49 (28.7)	50 (28.3)	161 (31.2)	
50–59	28 (16.7)	35 (20.5)	40 (22.6)	103 (20.0)	
60–69	39 (23.2)	42 (24.6)	45 (25.4)	126 (24.4)	
≥70	39 (23.2)	45 (26.3)	42 (23.7)	126 (24.4)	
Race and Ethnicity					0.07
Black/African American	22 (13.1)	11 (6.4)	10 (5.7)	43 (8.3)	
Hispanic	11 (6.6)	9 (5.3)	12 (6.8)	32 (6.2)	
Asian/PI	36 (21.4)	38 (22.2)	27 (15.3)	101 (19.6)	
White	91 (54.2)	104 (60.8)	112 (63.3)	307 (59.5)	
Other	6 (3.6)	8 (4.7)	14 (7.9)	28 (5.4)	
Unknown	2 (1.2)	1 (0.6)	2 (1.1)	5 (1.0)	
Facility of Record					0.78
San Francisco Medical Center	61 (36.3)	66 (38.6)	62 (35.0)	189 (36.6)	
Oakland Medical Center	107 (63.7)	105 (61.4)	115 (65.0)	327 (63.4)	
Cancer Stage Group					0.87
0	38 (22.6)	34 (19.9)	35 (19.8)	107 (20.7)	
I	92 (54.8)	106 (62.0)	105 (59.3)	303 (58.7)	
II	14 (8.3)	9 (5.3)	15 (8.5)	38 (7.4)	
III	8 (4.8)	7 (4.1)	5 (2.8)	20 (3.9)	
IV	4 (2.4)	5 (2.9)	4 (2.3)	13 (2.5)	
Invasive, unknown	12 (7.1)	10 (5.9)	13 (7.3)	35 (6.8)	
^a At date of completed assessment for enrolled and first contact for unenrolled.					

	Healthy Eating Index score				P-chisq
	T1 n = 168 (32.6)	T2 n = 171 (33.1)	T3 n = 177 (34.3)	Total n = 516 (100.0)	
Body Mass Index, kg/m ²					< 0.01
Under (< 18.5)	1 (0.6)	5 (2.9)	4 (2.3)	10 (1.9)	
Normal (18.5–24.9)	58 (34.5)	81 (47.4)	88 (49.7)	227 (44.0)	
Overweight (25.0-29.9)	62 (36.9)	42 (24.6)	53 (29.9)	157 (30.4)	
Obese (> = 30.0)	45 (26.8)	41 (24.0)	27 (15.3)	113 (21.9)	
Unknown	2 (1.2)	2 (1.2)	5 (2.8)	9 (1.7)	
Treatment Status ^a					0.06
Pre-Treatment	19 (11.3)	16 (9.4)	25 (14.1)	60 (11.6)	
In Treatment	39 (23.2)	43 (25.2)	24 (13.6)	106 (20.5)	
Post-Treatment	110 (65.5)	112 (65.5)	128 (72.3)	350 (67.8)	
Time from Dx					0.66
0–1 month	4 (2.4)	12 (7.0)	6 (3.4)	22 (4.3)	
1–3 months	24 (14.3)	28 (16.4)	28 (15.8)	80 (15.5)	
3–6 months	25 (14.9)	24 (14.0)	21 (11.9)	70 (13.6)	
6–12 months	35 (20.8)	26 (15.2)	33 (18.6)	94 (18.2)	
12–18 months	34 (20.2)	37 (21.6)	37 (20.9)	108 (20.9)	
18–24 months	46 (27.4)	44 (25.7)	52 (29.4)	142 (27.5)	
Perceived diet captured accurately					< 0.01
Strongly agree	1 (0.6)	5 (2.9)	4 (2.3)	10 (1.9)	
Agree	57 (33.9)	80 (46.8)	99 (55.9)	236 (45.7)	
Neutral	64 (38.1)	61 (35.7)	53 (29.9)	178 (34.5)	
Disagree	37 (22.0)	22 (12.9)	15 (8.5)	74 (14.3)	
Strongly disagree	8 (4.8)	2 (1.2)	6 (3.4)	16 (3.1)	

^aAt date of completed assessment for enrolled and first contact for unenrolled.

	Healthy Eating Index score				P- chisq
	T1 n = 168 (32.6)	T2 n = 171 (33.1)	T3 n = 177 (34.3)	Total n = 516 (100.0)	
Refused	1 (0.6)	1 (0.6)	0 (0.0)	2 (0.4)	
Abbreviations: T (tertile); kg (kilograms); m (meters);					
^a At date of completed assessment for enrolled and first contact for unenrolled.					

Table 4 outlines dietary characteristics and diet components across tertiles of the HEI. The distribution of participants across quartiles of total energy intake (kcal) differed by HEI tertiles, with participants with high diet quality more likely to be represented in the second (29.4%) and third (28.3%) quartiles and participants with low diet quality more likely to be represented in the fourth quartile (31.6%). Aligned with HEI guidelines, mean daily dietary intake amounts of whole and total fruits, whole grains, seafoods & plant protein, greens & beans, total vegetables, fatty acids increased with higher diet quality. For example, the mean intake of whole fruits was 0.7 ½ cup equivalents (eq) among participants with low diet quality, compared with 2.2 ½ cup eq among those with high diet quality. Similarly, the mean score for seafood and plant protein was 1.3-ounce (oz) eq in the low diet quality group and 3.7 oz eq in the high diet quality group. Also aligned with HEI guidelines, dietary intake amounts of refined grains, sodium, added sugars, and saturated fats decreased with higher diet quality [16]. In contrast to the HEI guidelines, total protein and dairy intakes tended to increase with lower diet quality. Examination of contributing food groups suggested these patterns were largely driven by greater consumption of eggs, poultry, red and processed meats, full-fat dairy products and dairy desserts. These foods generally contain high concentrations of saturated fat, which is also discouraged by the HEI guidelines [16].

Table 4
Dietary characteristics by tertiles of the Healthy Eating Index score

	Healthy Eating Index Score				P- chisq ^b
	T1 n = 168 (32.6)	T2 n = 171 (33.1)	T3 n = 177 (34.3)	Total n = 516 (100.0)	
Total energy, kcals, n (%)					0.04
Q1 (1,207-1,722)	41 (24.4)	54 (31.6)	34 (19.2)	129 (25.0)	
Q2 (1,730-1,920)	37 (22.0)	40 (23.4)	52 (29.4)	129 (25.0)	
Q3 (1,920-2,132)	37 (22.0)	42 (24.6)	50 (28.3)	129 (25.0)	
Q4 (2,133-3,099)	53 (31.6)	35 (20.5)	41 (23.2)	129 (25.0)	
HEI adequacy components, mean (sd)					
Whole fruits, oz eq	0.7 (0.5)	1.7 (0.5)	2.2 (0.6)	1.5 (0.8)	< 0.01
Total fruits, 1/2 cup eq	0.8 (0.5)	1.8 (0.4)	2.2 (0.6)	1.6 (0.8)	< 0.01
Whole grains, oz eq	0.7 (0.7)	1.8 (1.2)	2.0 (0.4)	1.5 (1.0)	< 0.01
Dairy, cup eq	0.8 (0.3)	0.4 (0.2)	0.6 (0.4)	0.6 (0.4)	< 0.01
Total protein foods, oz eq	3.3 (1.9)	3.2 (1.9)	1.9 (0.8)	2.8 (1.7)	< 0.01
Seafood & plant protein, oz eq	1.3 (0.8)	4.1 (1.4)	3.7 (0.7)	3.0 (1.6)	< 0.01
Greens & beans, 1/2 cup eq	0.0 (0.1)	0.5 (0.3)	0.6 (0.1)	0.4 (0.3)	< 0.01
Total vegetables, 1/2 cup eq	2.2 (1.0)	5.5 (1.5)	6.6 (0.5)	4.8 (2.2)	< 0.01
Fatty acids ^a	2.3 (0.6)	4.6 (1.2)	5.3 (0.7)	4.1 (1.5)	< 0.01
HEI moderation components, mean (sd)					
Refined grains, oz eq	2.3 (1.3)	0.7 (0.8)	0.8 (0.4)	1.2 (1.2)	< 0.01
Sodium, oz eq	1.5 (1.3)	0.4 (0.3)	0.3 (0.1)	0.7 (0.9)	< 0.01
Added sugars, oz eq	3.5 (2.4)	0.6 (0.7)	0.3 (0.1)	1.4 (2.0)	< 0.01
Saturated fats, oz eq	1.1 (0.6)	0.2 (0.4)	0.0 (0.0)	0.4 (0.6)	< 0.01
Abbreviations: T (tertile); Q (quartile); oz eq (ounce equivalents); sd (standard deviation).					
^a Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs) in grams.					

Healthy Eating Index Score				
T1	T2	T3	Total	P- chisq ^b
n = 168 (32.6)	n = 171 (33.1)	n = 177 (34.3)	n = 516 (100.0)	
^b P-trend values were calculated treating all dietary variables as continuous variables.				

DISCUSSION

This study is among the first to evaluate the feasibility and usability of Diet ID™, a rapid image-based dietary assessment tool, within a large integrated healthcare system among women diagnosed with invasive breast cancer or DCIS. Overall, findings suggest that Diet ID™ is a feasible and useful method for collecting dietary data in this population. Almost half (44%) of eligible participants completed the dietary assessment with comparable enrollment rates across treatment status. The median completion time was 3.6 minutes. Aligned with prior studies, participants with lower diet quality were more likely to be overweight or obese while participants with higher diet quality were more likely to have normal BMI [21]. The majority of participants reported that Diet ID™ accurately reflected their dietary intake, with the minority of participants who disagreed being more likely to report lower diet quality. Overall findings support the potential utility of Diet ID™ as a low-burden dietary assessment to provide clinically meaningful information in women diagnosed with breast cancer.

Our findings expand upon previous Diet ID™ validation and usability studies conducted in smaller limited populations, including college students and African American women living in the southern United States [17, 18]. These studies found that Diet ID™ had reasonable alignment with biomarkers of carotenoid status and nutrient intake when compared to self- and interview-administered recalls [17, 18]. One study mentioned higher estimates of calorie and nutrient intake scores with Diet ID™ compared with 24- hour recalls. However, it was still concluded that Diet ID™ may be a useful tool in nutrition research as it is a less time-intensive and minimally burdensome dietary data collection method for both participants and researchers [18]. The present study demonstrated a similar feasibility within a more clinically complex population of patients: those who are before, during, and after treatment for invasive breast cancer or DCIS.

Previous evidence has shown that breast cancer survivors with higher diet quality scores have a 21–27% lower risk of all-cause mortality and morbidity [3]. Studies have also suggested that dietary interventions during primary breast cancer treatment may help mitigate treatment-related weight gain, preserve or improve body composition, and improve aspects of quality of life [22, 23]. Yet, women with breast cancer who are actively undergoing treatment are a particularly vulnerable and understudied population in regard to diet, due to substantial concurrent symptom burden, including fatigue, pain, sleep disturbance, anxiety, and depression, which may affect dietary behaviors and ability to withstand imposed burden of

traditional diet assessments [10]. Given comparable enrollment rates across treatment status in the present study, Diet ID™ has potential to serve as a low-burden screening tool to increase dietary recommendations for patients across all treatment stages.

Building on these findings, Diet ID™ could serve as a practical screening tool to integrate nutrition assessment into routine oncology care. Implementing Diet ID™ near diagnosis could support a shift from a reactive model, in which dietary counseling is provided during the post-treatment period or in response to patient questions, to a more proactive, system-level approach. Earlier dietary screening and stratification may identify patients with lower diet quality who could benefit from tailored educational resources, referral to a registered dietitian or other nutritional support. Proactively providing nutrition resources may also reduce the burden on oncology providers by addressing common dietary concerns outside of clinical encounters and help ensure that patients receive evidence-based dietary guidance throughout treatment and survivorship. While Diet ID™ was feasible across all treatment stages, the transition from active treatment to early survivorship may represent a particularly opportune time to support dietary behavior change. Future studies should evaluate the use of Diet ID™ as a risk stratification tool to facilitate referrals to lifestyle medicine programs or dietitian services and determine whether tailored nutrition support improves diet quality and other patient-centered outcomes over time.

Unsolicited qualitative feedback from participants received via email identified areas for potential improvement of Diet ID™. Participants noted that although pre-screening questions allowed selection of a primary cultural influence and corresponding adjustment of dietary composite images, the assessment may not fully capture complex or multi-cultural dietary patterns. Some respondents also indicated that the image-based response options were not always sufficiently specific to reflect individual dietary preferences, which may affect precision in self-reported intake. In addition, participants noted that alcohol consumption was not assessed in Diet ID™, suggesting a potential limitation in the comprehensiveness of dietary assessment.

This study has several strengths, including implementation within a large integrated healthcare system and inclusion of participants across multiple stages of breast cancer treatment and survivorship. Other strengths include the relatively large sample size, racially and ethnically diverse participant population, and evaluation of Diet ID™ under real-world conditions. This study also has limitations. Participation was voluntary and recruitment was conducted by email only, which may have favored individuals with greater interest in nutrition or higher digital literacy. In addition, the survey was limited to English speaking participants, which may have limited participation among non-English-speaking individuals. Nevertheless, integration of a similar tool into routine clinical care through recommendations from primary care physicians or oncologists may support broader engagement and utilization among more diverse patient populations. Further studies may also consider presenting this tool in other languages, as its image-based design may facilitate adaptation across diverse language groups. It should also be noted that Diet ID™ is a patented instrument and therefore the methods to calculate nutrient data and HEI score from the photos is proprietary.

CONCLUSION

Overall, this pilot study suggests that Diet ID™ is a feasible and useful dietary assessment tool among women with breast cancer. The platform's rapid administration, moderate participation rate and general acceptability support its potential clinical and research use. The influence of treatment status and cancer stage on the participation rate was minimal, suggesting Diet ID™ may be useable at all stages of the survivorship trajectory without significant burden to the patient. Further studies should expand recruitment to more diverse populations and investigate how image-based dietary assessment tools may support personalized nutrition interventions.

Declarations

The authors would like to thank the study participants for their contribution to this research. There are no conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Carissa G. Mindemann: Data curation, writing – original draft, writing – review & editing.

Lia D'Addario: Data curation and analysis, methodology, writing – review & editing.

Janise M. Roh: Project administration, writing – review & editing.

Raymond Liu: Investigation, writing – review & editing.

Samantha Siegel: Investigation, writing – review & editing.

Robin Zwerling Baltrushes: Investigation, writing – review & editing.

Marilyn L. Kwan: Supervision, writing – review & editing.

Lawrence H. Kushi: Supervision, writing – review & editing.

Isaac J. Ergas: Conceptualization, funding acquisition, supervision, methodology, writing – review & editing.

All authors reviewed the manuscript, provided critical feedback, and approved the final manuscript.

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Data Availability

The data underlying this article will be made available and shared for research purposes in accordance with institutional review boards on reasonable requests to the corresponding author.

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Figures

