Healthy behaviors are associated with outcomes for cancer survivors with ostomies: A cross-sectional study

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ABSTRACT

Background: Cancer survivors (CS) with ostomies may face challenges in sustaining physical activity (PA) levels and maintaining healthy diets. This analysis describes lifestyle behaviors and their relationships with health-related quality of life (HRQOL) in CS with ostomies.

Methods: This is a cross-sectional, secondary analysis of a multisite randomized self-management education trial for CS with ostomies. Baseline self-reported measures were queried on aerobic PA and diet using the City of Hope Quality of Life Ostomy measure, and the Self-Efficacy to Perform Self-Management Behaviors questionnaire (SE). PA was compared against the American Cancer Society PA guidelines for CS. Relationships between PA and HRQOL were evaluated using multiple linear regression, stratified by BMI.

Results: Among 200 responders, fewer than 20% met or exceeded the PA guideline for cancer survivors; overall, confidence in the ability to perform gentle or aerobic PA was moderate (6/10 on the SE). Overall HRQOL ($p=0.038$), psychological well-being ($p=0.017$), and physical strength ($p=0.025$) were associated with increased PA. Almost half of CS reported a special diet (48.7%). CS with urostomies were less likely to report diet adjustments after their ostomy surgeries (OR: 0.16, 95% CI [0.08-0.38]) than CS with fecal ostomies.

Conclusions: Better HRQOL is associated with PA guideline achievement among CS with ostomies. Additionally, diet adjustments were reported more frequently in CS with fecal ostomies. Our findings bear clinical relevance for designing ostomy self-management and lifestyle recommendations for CS with ostomies.

Implications for Cancer Survivors: Evaluation of lifestyle behaviors may be an especially important focus for CS with ostomies.

INTRODUCTION

Regular physical activity (PA) and a healthy diet are crucial for cancer survivors' (CS) health and longevity [1]. These lifestyle behaviors can help slow functional decline and reduce risks of disease progression and comorbidities [1, 2]. The American Cancer Society (ACS) diet and PA recommendations for CS include achieving a diet that is rich in fruits and vegetables and performing at least 150 minutes per week of moderate PA or 75 minutes per week of vigorous PA, or an equivalent combination of moderate and vigorous PA [3]. However, CS' adherence to the ACS guidelines is moderate at best, even for motivated individuals [4-6]. While many barriers to PA and diet adherence have been described for CS, only recently has attention been given to the role of ostomies in adherence to lifestyle behavior. An ostomy is a surgically-created artificial opening created on the abdomen that serves as an outlet for stool (colostomy or ileostomy) or urine (urostomy). An estimated 18-35% of patients diagnosed with colorectal, gynecologic or urologic cancers will experience a temporary or permanent ostomy as part of their treatments [7-9]. CS with ostomies face unique challenges and restrictions that may act as additional barriers to achieving healthy lifestyle recommendations.

An ostomy imposes substantial challenges to an individual's bowel function, body image, and self-efficacy, a measure of perceived competence [10-12]. As such, ostomies can alter health-related quality of life (HRQOL). Individuals employ a broad range of coping and self-care mechanisms to adjust to life with an ostomy. Current literature suggests that CS with ostomies may avoid social and sexual activities due to insecurity and feelings of shame [13-15] and/or to circumvent odor or stomal leakage accidents [16, 17]. In a cross-sectional mail survey study, we previously found that colorectal CS with colostomies make considerable dietary and behavioral changes after their surgery [18], and that higher levels of PA may improve their health-related quality of life (HRQOL) [19]. CS with fecal ostomies (colostomy and ileostomy) commonly report restricting intake of fruits and vegetables to prevent bowel obstruction or diarrhea [20, 21]. To the best of our knowledge, no research has been conducted to compare CS' lifestyle behaviors across ostomy types –

colostomy, ileostomy, and urostomy. Further, attainment of dietary guidelines among CS with ostomies may influence HRQOL; yet, literature is lacking in this area.

A thorough understanding of the dietary and PA behaviors employed by CS with ostomies, including any variance by ostomy type, may inform the development, testing, and implementation of robust, evidence-based ostomy management and lifestyle recommendations for these survivors. Therefore, we performed a secondary analysis of baseline survey responses from a randomized trial of a telehealth-based Ostomy Self-Management Training program (OSMT). We sought to answer the following questions: (1) What percentage of CS with ostomies meet the ACS guidelines for PA? (2) What percentage of CS adjust their diets after their ostomy surgeries? (3) Are differences observed in PA or dietary behaviors by ostomy types (fecal versus urinary)? (4) Are there relationships between HRQOL and PA and dietary behavior in CS with ostomies?

We hypothesized that CS with ostomies would report a lower likelihood of meeting PA recommendations for survivorship compared to evidence reported in the current colorectal survivorship literature, and that there will be differences in PA and dietary behaviors by ostomy type. Further, we hypothesized that higher HRQOL and self-efficacy for PA would be associated with higher levels of self-reported PA.

MATERIALS AND METHODS

This cross-sectional, secondary analysis analyzes data from a randomized controlled trial among CS with ostomies. The design of the OSMT program is detailed elsewhere [22]. In short, CS with ostomies were recruited from three sites: The Hospital of the University of Pennsylvania (Philadelphia, PA), Yale-New Haven Medical Center (New Haven, CT), and City of Hope National Medical Center (Duarte, CA). All studies were approved by the Institutional Review Boards of the University of Pennsylvania, Yale University, and City of Hope. CS with any type of cancer or ostomy who were at least six weeks after ostomy surgery were eligible for the study. Time since surgery was not an exclusion criteria. CS randomized to the intervention arm participated in a self-management training program delivered via telehealth. Outcome measures included a multidimensional survey constructed using several validated instruments, including the City of Hope Quality of Life Ostomy (COH-QOL-O) [23], which has non-scaled questions related to diet, and food intake and 43 scaled HRQOL questions; the Self-Efficacy to Perform Self-Management Behaviors measures [24]; and a three-part non-scaled PA question obtained from a modified version of the Godin Leisure-Time Exercise Questionnaire, a validated self-reported measure [25]. Baseline (pre-intervention) measures were administered after informed consent and randomization. Ostomy type was self-reported by participants and verified via electronic medical record review, and current weight, height and co-morbidities were collected via a study form that each participant completed along with the multidimensional survey at baseline.

Physical Activity

PA data was collected from the responses to a three-part question on different intensities of PA. Participants were asked to report for a typical week in the past month the frequency and average amount of time spent in PA of light (minimal effort, no sweating), moderate (not exhausting, light sweating), and vigorous (heart beats rapidly, heavy sweating) PA. Average PA time for each exertion category was calculated as the frequency of the activity multiplied by the average session duration. To evaluate whether participants' self-reported PA met ACS guidelines, a weighted index (hereafter referred to as "weighted PA-minutes) [19] was calculated as moderate PA time plus 2 times vigorous PA time. Subject weighted PA-minutes were then compared against the ACS recommendation of 150 minutes/week of weighted PA-minutes, which is consistent with more current recommendations from the American College of Sports Medicine.[26]

Diet and Intake

Diet was assessed using three non-scaled questions from the COH-QOL-O survey on current diet type, time to comfort with diet, and dietary adjustments following the ostomy surgery.[23] Participants were given eight diet categories to describe their overall diet: high protein, low carbohydrate; fast foods; diabetic; vegetarian; vegan; heart healthy; no special diet; and other. Participants were also encouraged to provide comments on the specifics of their diets, especially if they selected "other." The diet categories and comments were then collapsed into broader diet categories according to a hierarchy (Figure 1) so that each participant was matched to one broad diet category that best described his/her diet. The broader diet categories were: Therapeutic/Health promoting; GI symptom modulating; Fast food; Vegetarian/Vegan; and No special diet. Participants who reported limited oral intake or total parenteral nutrition were excluded from the analysis (N=3).

Intake data were also collected from the COH-QOL-O responses on average number of meals and snacks, and ounces of liquid and standard servings of alcohol consumed per day. For example, a participant reports consuming three meals on average and drinks four standard servings (8 fluid ounces) of non-alcoholic beverages. Ingestion of liquids was also assessed by dividing the ostomy groups into two cohorts: those who matched or exceeded the average fluid intake for American adults in their age group versus those who did not (90.1 fluid ounces for age 51-70 and 57.2 fluid ounces for age ≥71) [27]. For the alcohol intake analysis, participants were divided into non-drinkers and those who reported at least some quantified alcohol consumption. Only numerically reported servings consumption was included in the analysis. Responses such as "few" and "a couple" were excluded.

Self-efficacy was measured by the Self-Efficacy to Perform Self-Management Behaviors questionnaire, which our program adapted for ostomy subjects [28] from a self-efficacy measure developed by Lorig and colleagues [24]. Two scaled questions were analyzed: (1) "How confident are you that you can do gentle exercises for muscle strength and flexibility three to four times per week (range of motion, using weights, etc.)?" and, (2) "How confident are you that you can do aerobic exercise such as walking, swimming, or bicycling three to four times a week?." Participants rated their confidence on a ten-point scale, with "1" signifying "Not at all confident" and "10" representing "Totally confident". Reported Cronbach's alpha for the original subscale for self-efficacy to exercise regularly is 0.83 [24].

Health-related quality of life (HRQOL) was collected from the COH-QOL-O scaled tool, which contained 43 scaled questions related to quality of life and ostomy-related symptoms. The scored scale ranged from 0 to 10, with 10 indicating better HRQOL. The scores were derived by arithmetic mean of non-missing items for overall HRQOL and sub-scales (physical, psychological, social, and spiritual well-being).

Statistical Analysis

Data were entered and cleaned in Microsoft Excel®. Analyses were performed using R 3.5.0 (R Core Team, 2018). Baseline survey responses were collected from 216 CS with ostomies. Patients with multiple ostomies (N=7) and those who dropped out before completing any baseline surveys (N=9) were excluded from all analyses. After exclusion, the final analysis sample was 200 participants.

To examine PA, since there is evidence that higher PA-related self-efficacy is associated with increased PA participation in CS, [25, 29] interaction between self-efficacy (both gentle and aerobic) and PA were evaluated, and only aerobic PA had significant interaction with PA. Mean PA times were then compared using two-way ANOVA with aerobic PA self-efficacy rating and ostomy type as independent variables. We reported means adjusted for body mass index (BMI) and standard error of HRQOL outcomes by weighted PA-minute category, as well as significant mean differences and 95% confidence intervals from the not active group. HRQOL and individual domain trends were evaluated across weighted PA-minute categories using two two-tailed unpaired t-tests: one test compared the not active group with the insufficiently active group, and the other test compared the not active group with the meeting or exceeding PA guidelines group. The p-values for these tests were Bonferroni-corrected for two comparisons. To evaluate clinical importance, we used the empirical rule effect size (ERES) method [30], which defines minimally important difference (MID) as 8% of the theoretical range of the QOL item. The MID for the COH-QOL-O scales and individual items was 0.88.

Dietary intake data were compared by ostomy type using one-way ANOVA tests for continuous measures and Fisher's exact test for categorical measures. The relationship between diet category and ostomy type (fecal vs. urinary) was evaluated using a multivariable logistic regression model, adjusting for self-reported co-morbidities (diabetes, heart disease, arthritis and mobility issues). We tested the relationship between ostomy type and time-to-comfort with diet by dichotomizing the sample by time-since-surgery and using the Student's unpaired t-test. The effect of HRQOL on diet could not be analyzed due to small sample size; instead, the data were summarized descriptively.

RESULTS

Of the 200 participants in this analysis, the mean age was 64 years, 54% were male, and the majority of the participants were Caucasian (81%). Eighty-seven (43.5%) CS had colostomies, 67 (33.5%) had urostomies or urinary diversions, and 46 (23.0%) had ileostomies. The most common cancer for the fecal ostomies (colostomy and ileostomy) was colorectal cancer (64/87 and 34/46, respectively), and the most common cancer for the urostomy cohort was bladder cancer (62/67).

Physical Activity by Ostomy Type

Table 1 compares level of PA by each ostomy type (colostomy, ileostomy and urostomy). Thirty-three (16.5%) CS met or exceeded ACS PA guidelines: 18/87 (20.7%) with colostomies, 6/46 (13.0%) with ileostomies, and 9/66 (13.6%) with urostomies. We did not observe statistically significant differences in PA by ostomy type, even after controlling for interaction between self-efficacy and PA. In a separate analysis combining moderate and vigorous PA without weighting, results were consistent with those of the weighted PA-minutes, indicating that participant subjective distinction between vigorous and moderate PA was not a determining factor ($p=0.06$). Self-efficacy for aerobic exercise accounted for more of the variance (4.9%) in weighted PA-minutes than did ostomy type (2.5%). CS with urostomies who met ACS PA guidelines had significantly higher self-efficacy scores for the ability to engage in aerobic exercise ($p=0.02$); levels of self-efficacy for PA were not significant for other ostomy types (results not shown). Overall, on average, CS who met ACS PA guidelines had higher self-efficacy scores for both gentle (8.1 on a 10-point scale) and aerobic (8.7 on a 10-point scale) exercise when compared to the cohort that did not meet the guidelines. However, the latter group of CS reported moderate self-efficacy regarding the ability to engage in either gentle (6.7) or aerobic (6.1) PA.

Adjusted QOL scores are reported in Table 2. Overall, average outcomes rose across the three weighted PA-minute categories, although this trend was not statistically significant. Participants who met or exceeded ACS guidelines reported significantly higher (better) average psychological well-being (mean difference 1.03, 95% CI 0.19-1.9), overall QOL (0.74, 0.04-1.4) and physical strength (1.29, 0.17-2.4) compared to the not active category. The met or exceeded ACS PA guidelines group had significantly better psychological well-being and physical strength scores that exceeded the MID compared to the not active group.

Intake by Ostomy Type

Average number of meals consumed, and ounces of liquids ingested per day did not vary among the colostomy (N=79), ileostomy (N=39) and urostomy (N=66) groups. Differences among number of snacks consumed per day were observed, with the ileostomy group reporting an average of 2.28 snacks per day versus 1.97 snacks per day for the colostomy group and 1.83 snacks per day for the urostomy group, but these differences were not statistically significant. CS with ileostomies ingested statistically significantly more fluid ounces of liquid (60.7 fl. oz.) than CS with colostomies (50.1 fluid ounces) and CS with urostomies (51.8 fluid ounces). However, more CS with urostomies met or exceeded the average liquid intake for American adults (24.2%) than did CS with colostomies (7.6%) or CS with ileostomies (17.9%) ($p=0.02$). A significant portion of the ileostomy group (85.0%) were non-drinkers, as compared to the 72.2% non-drinkers in the colostomy group and the 59.1% non-drinkers in the urostomy group. Alcohol consumption varied by ostomy type: CS with colostomies consumed on average 0.23 alcoholic beverages per day; CS with ileostomies drank 0.11 alcoholic beverages per day; and CS with urostomies ingested an average of 0.52 alcoholic beverages per day.

Diet Adjustments by Ostomy Type

No significant differences in diet type were observed between the fecal (N=123) and urinary (N=66) ostomy groups (Table 3). A significant association was observed between ostomy type (fecal vs. urinary) and diet adjustment due to the ostomy or surgery ($p < 0.001$), suggesting that fecal ostomies (colostomy and ileostomy) may be associated with a greater likelihood to report adjustment of diet after ostomy surgery. CS with a vegetarian or vegan diet reported higher average QOL scores compared to the other four diet categories, and CS with a fast food diet on average reported worse gas and diarrhea than the other diet categories. Due to our small sample size, we could not evaluate statistical significance. As diet categories were created from a new diet categorization hierarchy and analysis is therefore exploratory, we did not control for multiple comparisons for this analysis.

When comparing the fecal (N=90) and urinary (N=41) groups that had relatively recent (<13 month) ostomy surgeries, no significant differences were observed for time-to-comfort with diet. For CS who had ostomies for more than 13 months, a significant difference was observed between the fecal (N=34) and urinary (N=25) groups with regard to time-to-comfort with diet, in that the fecal group reported a longer time-to-comfort with diet. Overall, CS with urostomies reported taking less time than CS with fecal ostomies to be comfortable with their diets. More CS with fecal ostomies reported changing their diet due to the ostomy regardless of time-since-surgery.

DISCUSSION

To our knowledge, this study is the first to specifically evaluate the differences in PA and diet among CS living with an ostomy. Our results suggest that CS with ostomies may not be meeting ACS PA guidelines. Blanchard et al [5] determined that overall, 35% of colorectal CS and 36% of bladder CS met the ACS recommendations for PA. However, in our sample of CS with ostomies, only 17.2% of colorectal CS and 6.3% of bladder CS met the PA guidelines. Our findings suggest that ostomies may be a considerable barrier to achieving ACS PA recommendations. This is an important issue to address with CS with ostomies because ostomies will continue to be a necessary component of care, and strategies to overcome the barriers associated with ostomies can be developed and tested to ensure CS with ostomies can achieve optimal activity after surgery.

Our findings suggest that CS who reported meeting the ACS PA guidelines were active across all three PA intensities. They also reported higher self-efficacy for both mild and aerobic exercise than those who did not meet these recommendations. This suggests that self-efficacy is a key construct supporting PA in this sample. Of note, we observed that the CS who did not report meeting ACS PA guidelines still, on average, expressed *moderate* self-efficacy in the ability to engage in PA. This discrepancy suggests that other barriers to PA, beyond lower self-efficacy, may undermine CS' ability to achieve these goals. Importantly, self-efficacy plays a key role in the postoperative psychosocial adjustments made by patients with ostomies[6] and has been shown to be a mediator of the effects of PA interventions [31, 32]. Overall, these results support elevating self-efficacy in conjunction with ostomy-specific self-management education to produce sustainable positive changes in PA behavior in CS with ostomies.

PA has been associated with higher QOL in colorectal CS [33] and bladder CS [34]. However, few studies have focused on the impact of HRQOL on PA, particularly among CS with ostomies. Our previous study suggested that higher levels of PA may improve HRQOL in rectal CS with ostomies, particularly in the psychological well-being domain [19]. Here, we show that higher HRQOL was associated with higher prevalence of achieving PA guidelines for CS.

Overall, we observed that dietary intake and diet modifications varied by ostomy type. Related to food consumption, Silva et al. [35] previously found that patients with ileostomies reported them as more tolerable than colostomies, likely due to the lack of an offensive odor from the stoma output. Of note, the absence of odor was associated with appetite preservation [35]. These results may explain our findings which suggest that CS with ileostomies consumed, on average, more meals and snacks daily than CS with colostomies or urostomies.

A majority of CS in our sample with fecal ostomies did not drink alcohol. This may be related to diarrhea and malabsorption associated with alcohol consumption [36]. Daily average liquid intake was consistently high among the ostomy types when compared to average American adult liquid ingestion for ages 71 and older; more CS with urostomies met or exceeded average daily liquid ingestion than colostomy patients. While dehydration is a common problem for all ostomy types, patients with ileostomies are in a state of recurrent fluid depletion due to the liquid composition of the stoma effluent [37] and therefore may need to consume more fluids to compensate. High liquid intake may also reflect an adherence to medical recommendations for urostomy CS to increase fluid intake in an effort to reduce the risk of infections common after urinary diversion surgery [38-40]. In fact, in our sample, more CS with urostomies exceeded the average fluid consumption of their respective age groups. Additionally, dietary choices and PA are known to alter fluid requirements. This was beyond the objective of these analyses but should be considered as future observational and intervention studies are developed for patients with ostomies.

Related to diet patterns, about half of the study participants reported no special diet, regardless of type of ostomy. Among those who did modify diet, more CS with fecal ostomies reported GI symptom modulating diets, citing specific restrictions such as limiting fruits and vegetables due to their seeds and skin and avoiding high fiber foods. This behavior is supported by the finding that patients with ostomies reported worsening symptoms due to consuming foods that are high in fiber [41]. An ostomy may thereby serve as a barrier for achieving a healthy diet consistent with ACS recommendations, which include higher fiber and fruit and vegetable intake, because the CS is avoiding certain foods for ostomy symptom management [18]. In support of this, we found that more CS with fecal ostomies adjusted their diets due to their ostomies compared to those with urostomies, with adjustments reported by 67.5% and 25.8% of CS in each ostomy group, respectively. Limited research has focused on dietary behavior for CS with urostomies; this may be due to the relatively low impact that the urostomy may have on appetite and gastrointestinal processes.

Food can be perceived as both a sensory and physiological pleasure, and the psychological and social aspects of eating can confer benefits to an individual's well-being and overall HRQOL [42]. There is a paucity of data that evaluates the relationship between HRQOL and diet quality among CS. The limited data available suggest that diet quality is associated with mental and physical functioning and vitality in CS [43, 44], but little is known about the impact of a healthy diet on HRQOL in CS with ostomies. In our study, participants reporting intake of a higher fat and higher sodium diet reported worse gas and diarrhea symptoms, although this was not associated with lower overall HRQOL. However, we did observe a notable trend of higher HRQOL and individual domain scores in the participants reporting a plant-based diet (vegetarian or vegan).

This study's strengths include its status as one of only a few studies to capture PA and diet behaviors among CS with variable ostomy types. Importantly, our study characterized the types of activity and dietary modifications in which CS were engaged. Our attention to self-efficacy and HRQOL, both constructs of change in lifestyle behaviors, afforded a unique opportunity to assess their relevance in the setting of ostomy type and its relationship with self-reported PA, and to a lesser extent, diet. Further, as this study is the first to compare diet and PA behaviors among the ostomy types, it provides important knowledge to inform on future in-depth research in these topics.

One of the limitations to this study is its use of highly motivated group of CS who were willing to participate in an educational intervention. Our results therefore may not be generalizable to ostomy populations as a whole. Additionally, ostomy symptoms may vary over time. As a cross-sectional secondary analysis, we were not able to analyze temporal variations. Hence, future research efforts should include repeated data collection and analysis of changes over time. Another limitation of this study is that we used subjective, self-reported measures of PA and diet. Our data lack the reliability that objective measures such as accelerometry and circulating nutrient biomarkers can offer [45]. As with any self-reported dietary measure, the COH-QOL-O diet responses lack rigor compared to objective measures or validated self-reported diet measurement tools. However, our intent was to begin to explore the relationship between diet and ostomy type in the event that an association was observed that should be further elucidated with more rigorous methods. Due to the design of our diet categorization hierarchy, we could not capture all of the facets of a participant's diet as a multiple day food diary would. In order to maintain reasonable participant burden, we focused on evaluating the breadth of health behaviors rather than going into further depth on any one behavior.

This analysis provides important information to inform future interventions that aim to promote healthy lifestyle behaviors after ostomy surgery. CS with ostomies employ substantial, yet distinct lifestyle behaviors to adapt to their ostomies. Successful changes are likely influenced by self-efficacy and HRQOL, two potentially modifiable constructs. Future interventions should emphasize the role of self-efficacy and HRQOL in the achievement of PA guidelines among CS with ostomies. Additionally, our observations can be incorporated into modified PA and diet recommendations to improve symptom management in CS with ostomies.

DECLARATIONS

Ethics approval: All studies were approved by the Institutional Review Boards of the University of Pennsylvania, Beckman Research Institute of the City of Hope, and Yale University.

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FIGURE LEGENDS

Figure 1. Framework of diet category classification.

Table 1. Physical activity by ostomy type

	Colostomy	Ileostomy	Urostomy	p-value
N	87	46	66	
Met ACS PA Guidelines, N (%)	18 (20.7)	6 (13.0)	9 (13.6)	0.39[b]
PA per week				
Moderate minutes, mean (SD)	59 (122.3)	31 (66.6)	30.1 (62.7)	0.32[c]
Vigorous minutes, mean (SD)	16.2 (63.3)	3.8 (17.1)	9.9 (36.1)	0.08[c]
Weighted PA-minutes[a], mean (SD)	91.3 (198.2)	38.6 (79.6)	49.8 (100.2)	0.06[c]

[a] Weighted PA-minutes was calculated as moderate minutes/week + 2 × vigorous minutes/week
[b] Chi-squared test
[c] Two-way ANOVA with ostomy type and aerobic PA self-efficacy as independent variables

Table 2: Health-Related Quality of Life by PA guideline categories

	Not active, weighted PA-min = 0 min/week (N=87)	Insufficiently active, weighted PA-min >0 to <150 min/week (N=37)	Meeting or exceeding guidelines, weighted PA-min ≥150 min/week (N=25)
COH-QOL-O	Adjusted Mean[a] (SE)		
Total QOL	6.32 (0.18)	6.71 (0.26)	7.08 (0.26)[b]
Physical well-being	6.86 (0.22)	7.28 (0.28)	7.43 (0.35)
Psychological well-being	6.01 (0.21)	6.59 (0.29)	7.06 (0.33)[b,c]
Social well-being	6.32 (0.21)	6.42 (0.32)	6.91 (0.30)
Spiritual well-being	6.10 (0.22)	6.50 (0.31)	6.83 (0.28)
Fatigue	5.94 (0.30)	6.61 (0.42)	6.76 (0.53)
Physical Strength	6.15 (0.30)	6.89 (0.40)	7.48 (0.48)[b,c]

COH-QOL-O City of Hope Quality of Life Ostomy, *weighted PA-min* "physical activity minutes" calculated as 2×vigorous minutes/week + moderate minutes/week

[a] Predicted mean adjusted for BMI only

Higher score = better HRQOL

[b] $p < 0.05$ compared to the not active group, Bonferroni adjusted

[c] Exceeds minimally important difference compared to not active group (0.88 for COH-QOL-O scales)

Table 3. Diet Category and Adjustments by Group, Adjusted for Co-Morbidities (Diabetes, Heart Disease, Arthritis, and Mobility Issues)

Category	Fecal group (%) (N=123)	Urinary group (%) (N=66)	Odds ratio[a]	95% CI
Diet				
No special diet	51.2%	51.5%	1.03	(0.54, 1.97)
Health promoting/Therapeutic	26.8%	37.9%	1.53	(0.75, 3.13)
Fast food	6.5%	3.0%	0.52	(0.07, 2.43)
GI symptom modulating	12.2%	3.0%	0.27	(0.04, 1.07)
Vegetarian or Vegan	3.3%	4.5%	1.81	(0.32, 9.19)
Adjusted diet because of ostomy/surgery	67.5%	25.8%	0.16	(0.08, 0.38)

[a] Odds ratios were calculated using the fecal group as reference.