

Factors associated with food choice among long-term weight loss maintainers

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Abstract

Background: The present study aimed to examine motivations for food choice among long-term weight loss maintainers (WLM) in a widely used commercial weight management program.

Methods: A cross-sectional study was employed where determinants of food choice were measured in the USA using validated scales: Food Choice Questionnaire, Consideration of Future Consequences, and Eating in the Absence of Hunger. Participants were 3806 WLM following a commercial weight management program (WW International, Inc.) who had maintained a weight loss ≥ 9.1 kg (mean 24.7 kg) for 3.3 years and had a body mass index (BMI) of 27.6 kg m². A control group of weight stable individuals with obesity (controls; $n = 519$) had a BMI of 38.9 kg m² and a weight change < 2.3 kg over the previous 5 years.

Results: WLM vs. controls made food decisions more based on health (18.9 vs. 16.3; $\eta_p^2 = 0.052$) and weight control (9.9 vs. 7.5; $\eta_p^2 = 0.16$) and less based on price (8.4 vs. 9.1; $\eta_p^2 = 0.10$). WLM also scored higher than controls with respect to considering future consequences of behaviours (44.3 vs. 38.4; $\eta_p^2 = 0.060$) and reported less external eating in the absence of hunger (7.1 vs. 7.5; $\eta_p^2 = 0.058$). Standard canonical coefficients indicated that making food choices based on weight (0.717) with less value placed on price (-0.33) and greater consideration of future consequences (0.262) contributed independently and most (overall $r = 0.593$; $p = 0.0001$) to discriminating WLM from controls.

Conclusions: In a widely used commercial weight management program, successful WLM reported food decisions based more on weight and less on price and considered future consequences of current behaviours.

KEYWORDS

dietary patterns, future orientation, motivations, weight loss maintenance

Key points

- Long-term weight loss maintainers consume a diet that is low in calories and micronutrient rich, although the diverse factors that govern these food choices remain unclear.
- The present study examined diverse factors associated with food choice among weight loss maintainers in a widely used commercial weight management program (WW International, Inc.) compared to weight stable individuals with obesity (“controls”).

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- Weight loss maintainers more than controls made food decisions based on health and weight control and less based on price. Both groups scored similarly in the role of convenience, mood, sensory appeal, natural content, familiarity and ethical concerns.
- Weight loss maintainers were overall more likely to consider future consequences.
- In a widely used commercial weight management program (WW International, Inc.), successful weight loss maintainers reported food decisions based more on weight and health and less on price. They also considered future consequences of current behaviours.

INTRODUCTION

Long-term weight loss maintainers (WLM) consume a low-energy dense diet that is micronutrient rich.¹ Successful WLM also report high dietary consistency, tending to eat the same foods during the week as on weekends and during the holidays vs. non-holiday times.² Moreover, high levels of cognitive restraint, defined as conscious control overeating, have been extensively reported among WLM.³ Although the content, consistency, and ability to restrict eating have been studied among WLM, other behavioural and attitudinal factors that may influence food choice have received less attention.

Prior research in general populations has shown that beliefs about food, health, weight, food familiarity and perceived sensory properties, current mood, ethical concerns, and food price may shape food choices.⁴⁻⁷ Moreover, an ability to focus on the future⁸ and resist eating in response to tempting food cues⁹⁻¹¹ have been identified as promising strategies for weight management. However, research to date generally has been limited by a restricted range of measures, lack of measurement of weight status, and a narrow range of populations, such as consumers,⁷ employees,⁹ undergraduate students⁸ or convenience⁶ samples. No known research has comprehensively surveyed the factors that relate to the food choices among people with varying weight statuses, including among long-term WLM. The scientific report for the 2020 Dietary Guidelines Advisory Committee¹² recognised the need for more research to better understand not only on what people choose to eat, but also the social, economic, and environmental factors that shape dietary patterns. A comprehensive understanding of the diverse factors that may influence eating decisions is critical for informing the development of effective interventions that aim to modify unhealthy dietary patterns and promote long-term successful weight control.

The present study aimed to examine the factors that distinguish food choices among long-term WLM in a widely used a commercial weight management program (WW International, Inc.) compared to weight stable individuals with obesity. The study hypothesised that WLM would report food choices that were more motivated by health and weight-related factors and less motivated by responses to

palatable food cues than weight stable individuals with obesity. WLM were also hypothesised to score higher on future orientation than weight stable individuals with obesity.

METHODS

Design

The WW Success Registry (WWSR) is an observational study of individuals who have lost weight in the WW International, Inc. program and were successful at long-term (≥ 1 year) maintenance of substantial (≥ 9.1 kg) weight loss.^{1,13,14} In this cross-sectional study, long-term WLM following the weight management program (WW) are compared with weight stable individuals with obesity (“controls”) to distinguish the factors associated with successful maintenance of weight loss.

Participants and eligibility

Procedures were approved by the Institutional Review Board, and all participants provided informed consent electronically via Research Electronic Data Capture (REDCap).

Weight loss maintainers

Prospective WLM were recruited through an email sent by WW to members who had reported a loss of ≥ 9.1 kg > 1 year ago when following WW. Interested individuals were referred to the study website hosted by the university for online screening, consent, and enrollment. Eligibility was based on self-reported weight, height, weight change, and duration of weight loss. To be eligible for enrollment, individuals were aged ≥ 18 years and had maintained a > 9.1 kg loss from WW entry for ≥ 1 year. The criterion 9.1 kg was selected to approximate a clinically significant 10% weight loss,¹⁵ assuming a starting weight of 90 kg among people entering WW and other weight loss programs.¹⁶ Use of an absolute weight

loss value was also intended to simplify messaging for recruitment and eligibility screening and has been used successfully in the National Weight Control Registry.¹⁷

Weight stable individuals with obesity

Weight stable individuals with obesity were recruited through local and national advertising channels, including Facebook, [ResearchMatch.org](https://www.researchmatch.org), Amazon, Mechanical Turk, and via the Academic Center for Health Research registry. Interested individuals were referred to the study website hosted by the university for online screening, consent, and enrollment. Eligibility was based on self-report and included age ≥ 18 years, with a body mass index (BMI) $> 30 \text{ kg m}^{-2}$ and reported weight stability (within 2.3 kg) for at ≥ 5 years prior to enrollment.¹⁸ Control participants were not currently enrolled in WW. Control participants were provided 1 month of the WW online program (WW Digital) free of charge after completion of the survey.

Measures

All measures were administered online via REDCap immediately after consent. All participants were asked standard demographic information (age, education level, income, marital status) and details about weight history (age of onset of overweight, maximum lifetime weight), as well as current weight and height. The validity of self-reported weight history has been established previously.³ Also, self-reported weights have been shown to correlate strongly with measured weights.¹⁹

The Food Choice Questionnaire (FCQ)²⁰ was used to measure diverse factors that influence food decisions, including subscales for health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern. Participants were asked to rate the importance of diverse determinants of food choice by responding to the prompt, "It is important to me that the food I eat on a typical day ...". Examples of items were "is low in calories" (weight control), "is cheap" (price), "is packaged in an environmentally friendly way" (ethical concern), and "cheers me up" (mood). Scores were on a scale where 1 = not at all important and 4 = very important. Scores on subscales are added and ranked to indicate relative importance of factors in shaping food choices.²⁰ The FCQ has been shown to have acceptable reliability (>0.70) and the internal consistency coefficients on its subscales range from 0.72 to 0.86.²⁰

The 12-item Consideration of Future Consequences Scale (CFC)^{20,21} was used to measure the extent to which people consider potential distant outcomes of their current behaviours (e.g., "I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes."). Each statement is rated on a scale from 1 ("extremely uncharacteristic") to 5 ("extremely characteristic").

The scale scores range from 12 to 60, and a high CFC score indicates greater importance being placed on the future consequences of a behaviour, whereas a lower CFC score indicates greater importance being placed on the more immediate consequences of behaviour. Cronbach's α values for the CFC range from 0.80 to 0.86.^{22,23} Eating in the Absence of Hunger (EAH) was measured using the EAH-C²⁴ scale. This scale is composed of 14-items that assess three dimensions related to stimuli that generate beginning or continuing to eat food in the absence of hunger. "Continuing EAH" is defined as continuing to eat immediately after being satiated at mealtime, and "beginning EAH" is defined as beginning to eat when not hungry several hours after being satiated.²⁴ Within these, the scale includes three motivators of eating in the absence of hunger: Negative affect (feeling sad or depressed, angry or frustrated, anxious or nervous); external eating (e.g., food looks, tastes or smells good and/or being in the presence of others who are eating); and fatigue/boredom. EAH-C was originally developed and validated for children and adolescents²⁴ but modified for college students and found to have high internal consistency across subscales (0.83–0.92).²⁵ In a subset of participants ($n = 1162$ [30.5%] WLM and 139 [26.8%] controls), the Diet History Questionnaire (DHQ-II) from the National Institutes of Health was used to measure self-reported calorie and macronutrient intake.²⁶ The DHQ-II was included as an exploratory and optional measure in the WWSR.¹

Statistical analysis

Independent *t*-tests and a chi-squared analyses were used to compare socio-demographic characteristics of WLM vs. controls and completers vs. non-completers. Subsequent general linear models compared WLM and controls on scores of the FCQ measure (i.e., health, convenience, mood, sensory appeal, weight control, price, natural content, familiarity, and ethical concern), the CFC, and the EAH (beginning and continuing domains for external eating, negative affect, fatigue/boredom) and adjusted for a priori covariates of age, race (white vs. non-white), employment (employed vs. not), education (\geq college education vs. $<$ college), income ($<$ \$25,000, \$25,000–75,000, \geq 75,000/year), maximum lifetime weight, sex assigned at birth (male vs. female), and marital status (married vs. not).

Discriminant function analysis was used to determine the variables that most discriminated WLM from controls among the set of variables (subscale scores only) that were found to differ between the two groups in the initial general linear model analyses. The resulting standardised canonical coefficients represent the measure of association between the discriminant function (based on the linear combination of variables) and each predictor variable and indicate the relative importance each variable in distinguishing the two groups (similar to a beta weight in a multiple regression). Within each group (i.e., WLM and controls), BMI and dietary intake (in a subset) were examined in relation to the

FCQ, CFC, and EAH questionnaire scores, adjusting for the same covariates. To guard against type 1 error due to multiple analyses, statistical significance was set to $p < 0.01$ and small effect sizes ($\eta_p^2 < 0.03$) were considered as not significant. SPSS, version 25.0.0 (IBM Corp.) was used for all of the analyses.

RESULTS

Participants

Of the 8047 WLM and controls, 4325 completed the FCQ, which was situated in the second half of a lengthy questionnaire. Comparing participants who completed ($n = 4325$) vs. those who did not complete ($n = 3722$) the questionnaire, completers were older (53.6 [12.9] vs. 51.4 [12.8] years; $p = 0.0001$), more likely to be white (93.8% vs. 68.4%; $p = 0.0001$), less likely to be Hispanic (3.6% vs. 5.9%; $p = 0.0001$), and less likely to be employed (65.2% vs. 73.4%; $p = 0.0001$). Also, a greater proportion of controls than WLM completed the questionnaire (61.6% vs. 52.9%; $p = 0.0001$). Among participants, WLM and controls differed on several demographic factors (Table 1). Weight loss maintainers were more likely than controls to be older (54.5 vs. 46.7 years; $p = 0.0001$), female (91.8% vs. 78.6%; $p = 0.0001$), white (95.1% vs. 83.6%; $p = 0.0001$), married (74.7% vs. 51.1%; $p = 0.0001$), with an annual family income exceeding \$75,000 (65.4% vs. 29.1%; $p = 0.0001$), and with at least a college education (89.5% vs. 84.6%; $p = 0.002$). Subsequent analyses statistically adjusted for these variables.

Motivators of food choices

In both groups, the top three factors rated as most important in food choices were health, convenience, and mood, and the lowest ranking factors were ethical concern, familiarity, and natural content (Table 2). Although health was the strongest reported motivation for food choice in both groups, WLM scored significantly higher than controls in the extent to which health influenced their food decisions (18.9 vs. 16.3; $\eta_p^2 = 0.052$; $p = 0.0001$) (Table 2). WLM also scored significantly higher than controls in reports of making food choices based on beliefs that the food aided in weight control (9.9 vs. 7.3; $\eta_p^2 = 0.159$; $p = 0.0001$). WLM reported lower scores than controls in making food decisions based on price (8.4 vs. 9.1; $\eta_p^2 = 0.10$; $p = 0.0001$). Both groups scored similarly on the extent to which convenience, mood, sensory appeal, natural content, familiarity, and ethical concerns shaped food choices. Examining future orientation, WLM reported greater consideration of future consequences (44.3 [95% confidence interval = 44.0–44.5] vs. 38.4 [37.8–39.1]; $\eta_p^2 = 0.060$; $p = 0.0001$). Also, WLM reported less eating in the absence of hunger during a meal in

response to external cues (7.1 [7.0–7.2] vs. 7.5 [7.2–7.7]; $\eta_p^2 = 0.058$; $p = 0.0001$). WLM relative to controls reported consuming a smaller proportion of daily calories from fat (0.32 [0.32–0.33] vs. 0.38 [0.36–0.39]; $\eta_p^2 = 0.05$; $p = 0.001$) and a higher proportion of daily calories from protein (0.18 [0.18–0.19] vs. 0.16 [0.16–0.17]; $\eta_p^2 = 0.03$; $p = 0.0001$) (Table 2). No meaningful differences were observed in scores for eating in the absence of hunger at the initiation of a meal or in response to negative affect or fatigue/boredom (Table 2).

Multiple discriminant analysis

Multiple discriminant analysis was conducted to determine the factors that most strongly discriminated WLM from controls. Standardised canonical coefficients indicated that making food choices based on beliefs that the food aided in weight control (0.717) and less based on price (−0.330) and greater consideration of future consequences (0.262) contributed independently and most (overall $r = 0.593$; $p = 0.0001$) to discriminating the two groups (Table 3).

Relationships with BMI and dietary intake

Weight loss maintainers

Among WLM, higher scores on the weight subscale of the FCQ were related to greater weight loss from lifetime maximum weight ($b = 0.02$ [0.01–0.02]; $p = 0.0001$), lower current BMI ($b = -0.03$ [−0.04 to −0.02]; $p = 0.0001$), lower daily percentage of calories from fat ($b = -4.01$ [−5.5 to −2.7]; $p = 0.0001$), and higher daily percentage of calories from carbohydrate ($b = 2.6$ [1.4–3.7]; $p = 0.0001$). Similarly, higher scores on health subscale of the FCQ were related to greater weight loss from lifetime maximum weight ($b = 0.03$ [0.02–0.04]; $p = 0.0001$), lower current BMI ($b = -0.06$ [−0.08 to −0.03]; $p = 0.0001$), and higher daily percentage of calories from protein ($b = 9.7$ [4.3–15.3]; $p = 0.001$). Higher scores on eating in the absence of hunger at the initiation of a meal were related to less weight loss from lifetime maximum weight ($b = -0.09$ [−0.12 to −0.06]; $p = 0.0001$), higher current BMI ($b = 0.22$ [0.15–0.30]; $p = 0.0001$), and greater daily calorie intake ($b = -0.002$ [0.001–0.0040; $p = 0.0001$]). Similar results were observed for eating in absence of hunger during a meal, which was related to less weight loss from lifetime maximum weight ($b = -0.09$ [−0.12 to −0.07]; $p = 0.0001$), higher current BMI ($b = 0.22$, [0.15–0.29]; $p = 0.0001$), and greater daily calorie intake ($b = 0.002$ [0.001–0.003]; $p = 0.003$). Higher scores on consideration of future consequences were related to more weight loss from lifetime maximum weight ($b = 0.07$ [0.05–0.09]; $p = 0.0001$) and lower current BMI ($b = -0.18$ [−0.24 to −0.13]; $p = 0.0001$) but not dietary variables.

TABLE 1 Characteristics of weight loss maintainers following a commercial weight management program (WW International, Inc.) vs. weight stable individuals with obesity (controls)

	WLM		Controls		<i>p</i> value
	<i>n</i> = 3806 ^a	SD	<i>n</i> = 519 ^a	SD	
Age (years), mean	54.5	12.6	46.7	13.1	0.0001
Female (%)	91.8		78.6		0.0001
Currently in WW (%)	90.3		0		0.0001
Lifetime maximum weight, mean (kg)	105.8	23.0	121.4	27.9	0.0001
Weight at start of WW (kg), mean	101.7	21.3	Not applicable		Not applicable
Current weight (kg), mean	76.5	16.5	111.1	23.2	0.0001
Weight loss since WW start (kg), mean	25.2	12.7	Not applicable		Not applicable
Duration 9.1 kg loss from WW start weight (years), mean	3.2	3.2	Not applicable		Not applicable
Weight lost from maximum weight (kg), mean	29.3	15.4	10.3	14.3	0.0001
Current BMI (kg m ⁻²), mean	27.6	5.4	39.6	7.8	0.0001
BMI categories					0.0001
Obese (%)	22.3		100%		
Overweight (%)	44.3		0		
Normal weight (%)	33.4		0		
Underweight (%)	0.0		0		
Income (total in family per year)					0.0001
<\$25,000 (%)	4.5		21.7		
\$25,000–75,000 (%)	30.1		49.2		
≥\$75,000 (%)	65.4		29.1		
Race/ethnicity					0.0001
White (%)	95.1		83.6		
Black (%)	2.3		11.9		0.0001
Hispanic (%)	3.3		6.0		0.003
Employed (%)	63.8		75.2		0.0001
College education or more (%)	89.5		84.6		0.002
Married (%)	74.7		51.1		0.0001

Abbreviation: WLM, weight loss maintainers.

^aSome participants did not answer some of the socio-demographic questions. This reduced the total sample sizes/denominators as follows: Income (WLM, *n* = 3392; controls, *n* = 509), employment (WLM, *n* = 3684; controls, *n* = 509); education (WLM, *n* = 3769; controls, *n* = 514), and, marital status (WLM, *n* = 3660; controls, *n* = 507).

Controls

Among weight stable individuals with obesity, higher scores on the weight subscale of the FCQ ($b = -0.07$ [−0.11 to −0.03]; $p = 0.001$) and on health subscale of the FCQ ($b = -0.13$ [−0.20 to −0.05]; $p = 0.002$) were related to lower current BMI. Also, higher scores on eating in the absence of hunger at the initiation of a meal were related to lower current BMI (0–0.25 [−0.04 to −0.06]; $p = 0.008$). Scores on eating in absence of hunger during a meal and consideration

of future consequences scales were not significantly ($p < 0.01$) related to BMI or dietary intake variables.

DISCUSSION

The present study is the first to comprehensively examine factors related to food choice among long-term WLM in a widely used commercial weight loss program. Compared with weight stable individuals with

obesity, WLM reported food decisions that were based more on beliefs that the food aided in weight control and based less on price. Moreover, WLM vs. weight stable individuals with obesity scored higher

on future orientation, suggesting greater consideration of future consequences of their current behaviour. Future intervention research should determine the efficacy of strategies that make weight control

TABLE 2 Food choice motivations in weight loss maintainers and weight stable individuals with obesity (controls)

	WLM <i>n</i> = 3327 ^a		Controls <i>n</i> = 507 ^a		Group effect ^b
	Mean	95% CI	Mean	95% CI	
Food choice questionnaire					
Health	18.9	18.8, 19.0	16.3	16.0, 16.6	$\eta_p^2 = 0.052$; $p = 0.0001^{**}$
<i>Ranking</i>	1		1		
Convenience	15.2	15.1, 15.3	15.4	15.1, 15.7	$\eta_p^2 = 0.001$; $p = 0.127$
<i>Ranking</i>	2		2		
Mood	13.4	13.2, 13.5	14.0	13.6, 14.4	$\eta_p^2 = 0.002$; $p = 0.002$
<i>Ranking</i>	3		3		
Sensory appeal	12.2	12.1, 12.3	12.0	11.8, 12.3	$\eta_p^2 = 0.0001$; $p = 0.204$
<i>Ranking</i>	4		4		
Weight control	9.9	9.8, 9.9	7.3	7.1, 7.5	$\eta_p^2 = 0.159$; $p = 0.0001^{**}$
<i>Ranking</i>	5		6		
Price	8.4	8.3, 8.5	9.1	8.9, 9.3	$\eta_p^2 = 0.10$; $p = 0.0001^{**}$
<i>Ranking</i>	6		5		
Natural content	8.2	8.1, 8.2	7.3	7.0, 7.5	$\eta_p^2 = 0.013$; $p = 0.0001$
<i>Ranking</i>	7		7		
Familiarity	6.8	6.7, 6.8	7.1	6.9, 7.2	$\eta_p^2 = 0.003$; $p = 0.002$
<i>Ranking</i>	8		8		
Ethical concern	5.8	5.7, 5.9	5.9	5.7, 6.1	$\eta_p^2 = 0.0001$; $p = 0.350$
<i>Ranking</i>	9		9		
Consideration of Future consequences, Total score (possible range from 12 to 60)	44.3	44.0, 44.5	38.4	37.8, 39.1	$\eta_p^2 = 0.060$; $p = 0.0001^{**}$
Eating in absence of hunger	32.4	32.1, 32.7	32.8	31.8, 33.6	$\eta_p^2 = 0.0001$; $p = 0.523$
Beginning to eat while not hungry					
External eating (20 maximum)	7.5	7.4, 7.5	7.8	7.5, 8.0	$\eta_p^2 = 0.002$; $p = 0.018$
Negative affect (15 maximum)	10.9	10.8, 11.0	11.3	11.0, 11.6	$\eta_p^2 = 0.001$; $p = 0.026$
Fatigue/boredom (10 maximum)	3.8	3.7, 3.8	3.8	3.6, 3.9	$\eta_p^2 = 0.0001$; $p = 0.906$
Continuing to eat after satiated	33.8	33.5, 34.1	33.9	33.1, 34.8	$\eta_p^2 = 0.0001$; $p = 0.750$
External eating (15 maximum)	7.1	7.0, 7.2	7.4	7.2, 7.7	$\eta_p^2 = 0.058$; $p = 0.001^{**}$
Negative affect (15 maximum)	8.3	8.2, 8.4	8.4	8.2, 8.7	$\eta_p^2 = 0.0001$; $p = 0.388$
Fatigue/boredom (15 maximum)	6.1	6.0, 6.2	5.9	5.7, 6.2	$\eta_p^2 = 0.0001$; $p = 0.296$
Dietary intake^c					
Daily calorie intake	1499	1467, 1531	1618	1524, 1711	$\eta_p^2 = 0.005$; $p = 0.02$
Calories from fat (%)	0.32	0.32, 0.33	0.38	0.36, 0.39	$\eta_p^2 = 0.05$; $p = 0.001^{**}$

(Continues)

TABLE 2 (Continued)

	WLM <i>n</i> = 3327 ^a		Controls <i>n</i> = 507 ^a		Group effect ^b
	Mean	95% CI	Mean	95% CI	
Calories from carbohydrate (%)	0.50	0.50, 0.51	0.46	0.44, 0.48	$\eta_p^2 = 0.02$; $p = 0.0001$
Calories from protein (%)	0.18	0.18, 0.19	0.16	0.16, 0.17	$\eta_p^2 = 0.03$; $p = 0.0001^{**}$

Abbreviations: CI, confidence interval; WLM, weight loss maintainers; η_p^2 , partial eta square.

^aSome participants did not answer questions for income (WLM: $n = 414$; controls, $n = 10$), employment (WLM: $n = 122$; controls, $n = 10$), education (WLM: $n = 37$; controls, $n = 5$), and marital status (WLM: $n = 146$; controls, $n = 12$). Because these covariates were included in analyses, the total analytic sample for each group was reduced to $n = 3327$ for WLM and $n = 507$ for controls.

^bGroup effect based on general linear model adjusting for age, race, employment, education, income, maximum lifetime weight, biological sex, and marital status. Means are adjusted for these variables.

^cDietary intake was only measured in a subset. Sample sizes after excluding people with missing covariates were $n = 1007$ for WLM and $n = 132$ for controls.

^{**}To guard against type 1 error due to multiple analyses, statistical significance was set to $p < 0.01$ and significance furthermore only interpreted for group differences that resulted in η_p^2 values ≥ 0.03 .

TABLE 3 Multiple discriminant analysis to determine factors that most strongly discriminate weight loss maintainers from weight stable individuals with obesity

Variables entered into the model	Canonical discriminant function coefficients ^a
Consideration of future consequences	0.26
Food Choice Questionnaire – Health	-0.001
Food Choice Questionnaire – Weight	0.71
Food Choice Questionnaire – Price	-0.33
Eating in the absence of hunger – Continuing to eat in response to external cues	0.02
Overall canonical correlation	0.593; $p = 0.0001^*$

^aAdjusted for sex, income, age, race, education, lifetime maximum weight, marital status, and employment.

* $p < 0.01$.

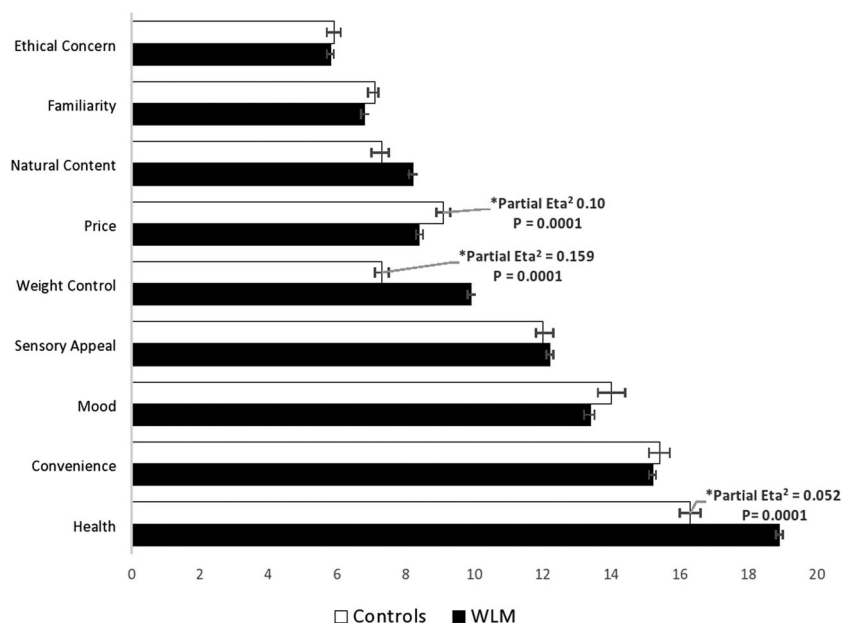
goals more salient and cultivate future orientation during food decision-making processes.

Interestingly, WLM scored higher than weight stable individuals with obesity with respect to considering future consequences of current behaviours; also, higher scores on the consideration of future consequences scale were related to greater weight loss and lower BMI. The ability to delay gratification and think about future consequences has been prospectively linked with lower weight status,²⁷ and emergent research has found that future orientation may help individuals avoid eating in response to external cues and reduce impulsive eating.^{28,29} Interventions that provoke vividly imagining the future or “episodic future thinking”³⁰ have been shown to reduce snacking²⁸ and ad libitum energy intake in the laboratory setting among individuals with obesity.²⁹ It is possible that an ability to engage in prospective thinking may be cultivated and used as an effective strategy for successful weight loss maintenance, although future clinical trial research is needed to address this hypothesis.

Making food choices based on beliefs that the food aided in weight control was a discriminating factor between WLM and weight stable individuals with obesity. Also, higher scores on making food decisions based on weight were related to lower BMI in both groups and to a greater initial weight loss and also a lower fat intake among WLM. The weight subscale of the FCQ is made up of ratings of importance of three items in determining food choices: “Is low in calories”; “helps me control my weight”; and “is low in fat.” That WLM in WW scored higher than weight stable individuals with obesity on this subscale is consistent with the WW program goals, which include promoting healthy weight management and consumption of nutrient-dense foods. The WW points algorithm nudges towards foods that are lower in calories, sugar, and saturated fat; its zero point foods, including fruits and vegetable, can be eaten ad libitum.^{31–34} Other studies have also found the weight subscale of the FCQ to be significantly correlated with dietary restraint²⁰ and consuming a diet with less red meat.³⁵ Future interventions should explore ways to elicit thoughts about the importance of weight control goals during the food decision-making process and determine impacts on food intake and weight management. Future research is also needed to examine whether higher FCQ-weight subscale scores are a defining characteristics among WLM in other contexts outside of WW.

Weight loss maintainers also made food choices less based on price compared to weight stable individuals with obesity. The WLM in the present study could have reported that cost was less influential of food choices because their income was, on average, higher than controls. However, statistical adjustments and stratified analyses within each income category (data not shown) suggested otherwise. In prior research of 83 low-income individuals with overweight/obesity vs. normal weight, those with overweight/obesity more commonly described being influenced by price when purchasing food compared to individuals with normal weight.³⁶ Other researchers have suggested that weight management approaches emphasising the high costs of foods such as

FIGURE 1 Food choice scores among weight loss maintainers (WLM) ($n = 3327$) and weight stable individuals with obesity ($n = 507$). Sample sizes remove participants without responses to socio-demographic covariates



fruits and vegetables may compound already existing barriers to consuming these foods and instead encourage the intake of less costly, energy-dense items.³⁷ Future prospective research is needed to understand the role of current income, food prices, and weight management priorities in shaping food decisions.

Eating in the absence of hunger has been related to weight gain³⁸ and to overeating.³⁹ In the present study, WLM reported less eating in the absence of hunger in response to external cues during a meal; also, less eating in the absence of hunger was related to a lower BMI. Research from the German Weight Control Registry⁴⁰ reported that WLM (vs. weight re-gainers) reported less propensity for eating in response to external cues. Nevertheless, in the present study, eating in the absence of hunger did not emerge as one of the strongest discriminator of WLM vs. weight stable individuals with obesity. Both WLM and weight stable individuals with obesity reported moderate levels of eating in the absence of hunger and scored similarly in eating in the absence of hunger as a result of negative affect, fatigue, and boredom.

The present study is the first to examine diverse factors related to food choices among WLM in a widely available commercial weight management program. The study included a comparison group of weight stable individuals with obesity and used validated measures. The study also has limitations. As a cross-sectional comparison, causality cannot be inferred. The study's measures were based on self-report and assumed that people were aware of the factors that shaped food choices. FCQ subscales were related with food intake was only measured in approximately 30% of participants, and these results should be interpreted with caution. There were several other, unmeasured factors, including the obesogenic environment, social factors, and biological factors that all contribute to food

choice.^{41,42} The study adjusted for socio-demographic differences, and the results of the regression analyses within both groups suggested sporadic relationships between socio-demographic variables and the subscales of interest. Nevertheless, these and other unmeasured socio-demographic characteristics could account for the observed differences between groups. Participants were self-selected and results may not be generalisable to other populations.

CONCLUSIONS

Individuals in WW who were successful at long-term weight loss maintenance differed from weight stable individuals with obesity in that they made food decisions more based on weight control goals and less based on price. Also, WLM were more likely to consider future consequences of their current behaviours. Future intervention research is needed to determine the effects of strategies that make weight management goals more salient during food decision making processes and that cultivate future orientation as a means to improve long-term weight loss maintenance (Figure 1).

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CONFLICT OF INTERESTS

Suzanne Phelan reports receiving a research grant from WW International, Inc. Rethorst was previously an employee and shareholder of WW. Foster is an employee and shareholder of WW.

ETHICAL STATEMENT

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the California Polytechnic State University, San Luis Obispo Institutional Review Board. Written informed consent was obtained from all participants via REDCap.

AUTHOR CONTRIBUTIONS

Study concept and design: Suzanne Phelan, Gary D. Foster, and Chad D. Rethorst. Analysis and interpretation of data: Suzanne Phelan, Jacob Young, and James Roake. Data collection and management: Noemi Alarcon. Drafting of the manuscript: Jacob Young, James Roake, and Suzanne Phelan. Critical revision of the manuscript for important intellectual content: Suzanne Phelan, Gary D. Foster, and Chad D. Rethorst. Administrative, technical or material support: Noemi Alarcon. Study supervision: Suzanne Phelan. Suzanne Phelan had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY DECLARATION

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The reporting of this work is compliant with STROBE guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

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PEER REVIEW

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