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## Original Research

## The CHANGE Program: Comparing an Interactive Vs. Prescriptive Approach to Self-Management among University Students with Obesity

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## ABSTRACT

**Objective:** To assess the effectiveness of 2 self-management (SM) approaches on obesity via a 12-week telephone-based intervention. An interactive motivational interviewing administered via Co-Active Life Coaching (MI-via-CALC) and a structured lifestyle treatment following the LEARN Program for Weight Management were compared. A secondary purpose was to explore the experiences of participants qualitatively.

**Methods:** University students 18–24 years of age with a body mass index  $\geq 30$  kg/m<sup>2</sup> (n = 45) were randomized to either the: 1) MI-via-CALC condition that involved working with a certified Co-Active coach to achieve personal goals through dialogue, or 2) LEARN Program that entailed learning from a trained specialist who provided scripted, education-based lessons pertaining to lifestyle, exercise, attitudes, relationships and nutrition. Food consumption patterns, anthropometric and lipid profiles were examined at baseline, mid- and immediately posttreatment, and 3 and 6 months after the program. A semistructured questionnaire was completed at all follow-ups.

**Results:** Analyses revealed a significant time effect for weight (p = 0.01) with the LEARN group decreasing more (M = –7.76 lb) than the MI-VIA-CALC group (M = –2.5 lb) between baseline and week 12. MI-via-CALC participants decreased caloric intake more (M = –662.76) than LEARN participants (M = –105.5) during this same period. The MI-via-CALC group focused on self-understanding, and self-responsibility as primary outcomes of their experience; the LEARN group stressed their appreciation of practical knowledge gained.

**Conclusions:** Both conditions seem similarly effective and are warranted as SM treatments. The best fit and unique contributions of each approach should be considered when working with this population.

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## R É S U M É

**Objectif :** Évaluer l'efficacité de 2 approches de prise en charge autonome (PCA) de l'obésité par une intervention téléphonique de 12 semaines. Une entrevue motivationnelle interactive effectuée par le Co-Active Life Coaching (EM-par-CALC) et un traitement structuré sur le mode de vie selon le LEARN (Lifestyle, Exercise, Attitudes, Relationships and Nutrition : mode de vie, exercice, attitudes, relations et nutrition) Program for Weight Management (programme de prise en charge du poids) ont été comparés. Le but secondaire a été d'explorer sur le plan qualitatif les expériences des participants.

**Méthodes :** Des étudiants de 18 à 24 ans ayant un indice de masse corporelle  $\geq 30$  kg/m<sup>2</sup> (n = 45) ont été répartis au hasard selon : 1) la condition EM-par-CALC qui exige un travail en collaboration avec un coach certifié Co-Active pour atteindre les objectifs personnels à travers le dialogue; 2) le programme LEARN qui comporte l'apprentissage à l'aide d'un spécialiste formé offrant des leçons rédigées de formation sur le mode de vie, l'exercice, les attitudes, les relations et la nutrition. Les modèles de consommation alimentaire, et les profils anthropométriques et lipidiques ont été examinés au début, au milieu et immédiatement après le traitement, et à 3 et à 6 mois après le programme. Un questionnaire semi-structuré a été rempli à tous les suivis.

## Mots clés:

Co-Active Life Coaching  
intervention sur le mode de vie  
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**Résultats :** Les analyses ont révélé un effet temporel significatif du poids ( $p = 0,01$ ) : le groupe LEARN a montré une plus grande perte ( $M = -7,76$  lb) que le groupe EM-par-CALC ( $M = -2,5$  lb) entre le début et la 12<sup>e</sup> semaine. Les participants EM-par-CALC ont plus diminué leur apport calorique ( $M = -662,76$ ) que les participants LEARN ( $M = -105,5$ ) durant cette même période. Le groupe EM-par-CALC a souligné la connaissance de soi et l'autoresponsabilité comme principaux résultats de leur expérience; le groupe LEARN a souligné leur appréciation des connaissances pratiques acquises.

**Conclusions :** Les deux conditions semblent similairement efficaces et s'avèrent justifiées comme traitements de PCA. La meilleure combinaison et les contributions uniques de chacune des approches devraient être considérées lorsqu'il existe un travail en collaboration avec la population.

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## Introduction

An estimated 60% of Canadian adults are overweight (i.e. body mass index [BMI]  $\geq 25$  kg/m<sup>2</sup>) and more than 1 in 4 can be classified as obese (i.e. BMI  $\geq 30$  kg/m<sup>2</sup>) (1,2). Although excess body weight increases the likelihood of developing a number of chronic health conditions, it is the cardiometabolic ramifications of obesity, such as type 2 diabetes mellitus, that are among the most prevalent and detrimental (3). To date, over 8 million Canadians are affected by type 2 diabetes (4) and are subsequently at risk for myocardial infarction, heart disease, stroke and premature death, in addition to adverse complications such as blindness and end-stage renal disease (5,6). Exacerbating the issue is the positive relationship between increases to BMI and type 2 diabetes (7). Because obesity is also an independent risk factor for cardiovascular disease, the risk for cardiovascular complications and mortality among individuals living with type 2 diabetes is heightened (8). Given the human and financial burdens Canadians experience, managing type 2 diabetes as an obesity-related comorbidity (9), preventive measures are imperative (10).

Apart from being obese, the significant surge in the incidence of type 2 diabetes has been attributed largely to modifiable behaviours such as physical inactivity and poor dietary practices (11). Although a number of randomized trials have provided evidence that the prevention or delay of type 2 diabetes is, in fact, feasible through lifestyle modification in high-risk populations (12,13), one recurrent challenge faced by researchers and clinicians alike is translating this evidence into real-world settings in a cost-effective manner (3,10,14). One component of many health promotion programs shown to influence health behaviours, outcomes, and cost is self-management (SM), a concept that connotes an individual taking personal responsibility for his/her day-to-day care over the length of a chronic illness (15,16). In the context of type 2 diabetes prevention and obesity, SM can include the integration of three key tasks: 1) behavioural management, such as adhering to a medication or specific diet, 2) role management, which involves creating and maintaining new meaningful life roles, and 3) emotional management, which requires that individuals explore the emotional sequelae associated with the disease and learn to manage these emotions as part of managing the condition (15,17).

When integrating these SM tasks within a type 2 diabetes prevention framework, a theoretically-grounded behavioural intervention should be included as a core lifestyle modification component (14). Recent literature suggests that Co-Active Life Coaching (CALC), a theoretically-grounded behaviour change method typically delivered over the telephone (18–20), is effective for initiating and maintaining new health behaviours over time (21–24). CALC encompasses and applies the tenets of motivational interviewing (MI), a client-centered counseling style that helps people to explore and resolve their ambivalence regarding change (25,26). The MI applied via-CALC approach (i.e. MI-via-CALC) seeks to forward clients toward personal learning and/or action using specific tools and strategies congruent with the aforementioned tasks and principles of SM including: problem solving, decision making, resource use, forming a client-provider partnership, action

planning and self-tailoring (15,18; for details on the MI-via-CALC approach see 26,27).

Among adults with obesity, previous small-scale studies (i.e.  $n \leq 20$ ) have shown that physical (e.g. decreased weight/waist circumference) and psychological (e.g. increased self-esteem and quality of life) indices are malleable and respond well to MI-via-CALC (21–24). University years represent a prime period to transition into life-lasting behaviours. An estimated 25% of Canadians with some postsecondary education are overweight or obese (28,29) and many fail to meet national dietary and physical activity recommendations (29). Therefore, a marked need for interventions aimed at enabling these students to become healthy adults exists. There is currently a paucity of research aimed at critically evaluating innovative SM-based behaviour change methods among individuals with obesity with a view to reducing risk of developing type 2 diabetes. In light of the severity of these two correlated epidemics, a larger MI-via-CALC-obesity program with a strongly validated comparison treatment was developed.

The purpose of the CHANGE (Coaching toward Healthy Actions Naturally through Goal-related Empowerment) Study was to compare 2 SM approaches. Specifically, we assessed the effectiveness of an interactive 12-week MI-via-CALC program compared to a structured cognitive behavioural-based lifestyle treatment among university students with obesity. The LEARN (Lifestyle, Exercise, Attitudes, Relationships, Nutrition) Program for Weight Management (30), a validated, prescriptive lifestyle-change program, was chosen for the comparison condition. Previous research has demonstrated the efficacy of LEARN with results published in a number of esteemed journals (e.g. The New England Journal of Medicine; Archives of Internal Medicine; Journal of the American Medical Association). Moreover, its longevity (i.e. 10 editions of the program have now been circulated), and on-going commercial use by healthcare professionals, weight control clinics, and the general population are also a testament to its robustness and utility. Throughout the study and up to 6 months after completion of the intervention, we assessed the impact of the 2 treatments on risk factors associated with the development of type 2 diabetes including body composition, blood glucose and lipid profiles, and dietary consumption patterns. To gauge their relative usefulness further, we explored qualitatively the experiences of the participants enrolled in both treatment conditions as a secondary purpose. Given no MI-via-CALC studies to date have included a comparison condition nor examined these dependent measures simultaneously, no specific hypotheses were made.

## Methods

### Design

To compare the primary outcome variables between the 2 treatment conditions over the course of the intervention and during the follow-up period, a 2-arm, repeated measures design was used. The methods pertaining to the protocol have been

described in detail elsewhere (27); a brief procedural account in relation to the present study is described below.

### Participants

Individuals were recruited through flyers and E-mail messages for a 12-week health behaviour program integrating MI-via-CALC or a validated lifestyle treatment (LEARN). Students enrolled at a large urban university and who were between the ages of 18 and 24, with a BMI  $\geq 30$  kg/m<sup>2</sup>, and free from type 1 diabetes, major medical conditions or diseases were invited to participate. On confirming eligibility, participants were randomized to their respective treatment group and a baseline assessment was arranged with the Project Coordinator. Ethical approval was obtained through the University's research ethics board and written informed consent was acquired before commencing study involvement.

### Intervention

The MI-via-CALC intervention group received 12 weekly unscripted confidential sessions over the telephone, each one lasting approximately 45 minutes, and delivered by a randomly assigned volunteer Certified Professional Co-Active Life Coach (CPC) who partnered with the participant for the duration of the intervention. It was the participant's responsibility to call the coach each week at a pre-arranged time, during which the duo would explore various topics of the participant's choosing and work collaboratively to identify solutions for goal attainment. Dependent on the needs of each participant, the CPC used a variety of techniques in accordance with his/her training (e.g. asking meaningful, open-ended questions; being genuinely curious about that participant's life experiences; acknowledging the participant and his/her actions; challenging him/her to attain desired goals).

Participants assigned to The LEARN Program for Weight Management (30) comparison condition were provided with 12, 30–45 minute scripted lessons over the telephone. The topics involved modifying behaviours and thinking patterns in relation to the principles of lifestyle, exercise, attitudes, relationships, and nutrition via educational content (e.g. planning for and integrating physical activity into daily life; learning the micro/macro nutrient content of commonly consumed foods; and exploring the relationships between caloric intake, expenditure, and weight) and practical applications (e.g. setting goals; overcoming barriers and embracing facilitators to healthy living; enlisting social support; enhancing self-efficacy; and self-monitoring). Each participant worked consistently with his/her randomly assigned LEARN "Specialist" (i.e. a thoroughly trained research assistant) who telephoned the participant on a weekly basis at a predetermined time and delivered the prescriptive lessons in a lecture-style format (i.e. reading the information).

### Procedure

Assessments were conducted by the Project Coordinator at baseline (time 1), mid-intervention (i.e. 6-weeks; time 2), immediately postintervention (i.e. 12-weeks; time 3), and 3 and 6 months after the intervention (i.e. times 4 and 5). Participants completed a 24-hour dietary recall (31) at each time point, and had their height (time 1 only), weight, and waist circumference measured. After each assessment (with the exception of time 2), participants were directed to the local hospital lab test centre where a fasting blood glucose and lipid profile were collected. Finally, an open-ended, semistructured questionnaire aimed at uncovering participants' experiences in the program was administered at times 3, 4 and 5.

### Measures

#### Dietary intake

A 24-hour dietary recall (31) was administered to obtain consumption patterns for the day preceding each assessment (collected for weekdays only). Participants were instructed to list everything consumed including meals, beverages, and snacks. Standardized measuring utensils were provided to assist with portion size estimations. On completion, participants reviewed the food record with the Project Coordinator or a trained research assistant to confirm the items and add supplementary details wherever necessary. Benefits of this recall format include its cost-effectiveness, low responder/interviewer burden and the fact that 1 day has been deemed sufficient to provide a good characterization of a population's average nutrient consumption (32,33).

#### Anthropometry and blood lipid measures

Weight and height were measured using the Tanita BWB-800S Digital Scale and HR-200 Height Rod. Waist circumference was assessed following Heart and Stroke Foundation guidelines (34). A fasting blood specimen was collected at times 1, 3, 4 and 5 to capture changes to participant plasma lipid status (i.e. total cholesterol, triglycerides, high-density lipoprotein cholesterol [HDL] and low-density lipoprotein cholesterol [LDL]) and blood glucose levels: all are markers that have been associated with obesity and identified as metabolic risk factors for the development of type 2 diabetes and cardiovascular sequelae (35).

#### Participant program experience questionnaire

A semistructured questionnaire was administered immediately after the 12 week intervention and at the 3 and 6 month follow-up assessments to capture their experiences in the program. Participants responded to conversational open-ended questions such as: What did you find most/least helpful about being in the study, and why?; The number one thing you got out of the study was?; What types of actions have you taken that you attribute to your specific treatment and involvement in the study (if any)?; What (if anything) is different about how you feel about yourself now since the study ended (i.e. how has your life changed)?

### Data Analysis

To calculate participant macro and micro nutrient consumption at each time point, dietary recall records were entered into a food processor computer program (Food Processor SQL 10.5, ESHA Research, Salem, OR). In accordance with Canada's Food Guide (36), the number of vegetable and fruit, grain products, milk and alternatives, and meat and alternative servings were calculated manually. All statistical analyses were conducted using IBM SPSS Statistics and the principle of intention to treat with the last observation carried forward was applied to account for missing data. The General Linear Model (GLM) with repeated measures was carried out to examine differences among the dependent variables over time between the 2 treatment conditions and a Bonferroni confidence interval adjustment was applied to compare main effects between the means by time point. After these analyses, residualized change scores were calculated and multiple independent samples t-tests were used to examine the differences in means between the study groups further from pre- to postintervention, postintervention to the 6 month follow-up and from pre-intervention to the 6 month follow-up.

Finally, to explore the programmatic strengths, limitations and outcomes qualitatively, inductive content analysis (37) was used by 3 researchers independently to code and categorize the data emanating from the participant program experience questionnaires. In accordance with Lincoln and Guba (38) several strategies

were implemented throughout the analysis to ensure the trustworthiness of the data (i.e. participant quotations to augment credibility, details of processes to support dependability, multiple-coders to enhance confirmability, and participant demographics to heighten potential transferability).

## Results

Seventy-eight individuals were enrolled in the CHANGE Program and participated in a baseline assessment. To examine the impact of the 2 treatment conditions on the dependent variables of participants over time, only those who completed their respective intervention and at least one of the follow-up assessments were included in the present study ( $n = 45$ ). To test for group equivalency at baseline, univariate ANOVAs were conducted on the demographic characteristics and primary outcomes measures revealing no significant differences between the MI-via-CALC ( $n = 25$ ) and LEARN ( $n = 20$ ) groups (Table 1). Among the 33 young adults who did not complete the program, scheduling conflicts ( $n = 7$ ), lack of treatment fit ( $n = 12$ ) and personal issues ( $n = 4$ ) were cited most often as reasons for withdrawal whereas the remaining decisions were unknown ( $n = 10$ ). Additional demographic details pertaining to noncompleters are reported elsewhere (39).

### Anthropometric and blood lipid profiles

To capture changes to participant anthropometrics over the course of the intervention and follow-up period by treatment group, repeated measures ANOVAs were conducted revealing a significant time effect for body weight [ $F(4,40) = 3.76$ ,  $p = .01$ ,  $\eta^2 = .27$ ]. Post-hoc analysis using a Bonferroni confidence interval adjustment indicated that decreases occurred specifically between times 1 and 2 ( $p < 0.05$ ), 1 and 3 ( $p < .01$ ) and 1 and 4 ( $p < 0.05$ ), whereas a trend toward significance was observed between times 1 and 5 ( $p = 0.06$ ). To examine further the differences in weight between the groups for times 1–3, 1–5 and 3–5, independent samples t-tests using change score values were calculated. On average, participants in the LEARN group decreased their total weight more ( $M = -7.76$ ,  $SE = 2.05$ ) than those in the MI-VIA-CALC group ( $M = -2.5$ ,  $SE = 1.70$ ) between baseline and week 12. This difference was significant  $t(43) = -1.98$ ,  $p = 0.05$  and represented a medium-sized effect,  $r = 0.29$ .

To examine participant plasma lipid status (i.e. total cholesterol, triglycerides, HDL and LDL) and blood glucose level changes by group, repeated measures ANOVAs were conducted revealing

a significant time effect for cholesterol [ $F(3,39) = 2.73$ ,  $p = .05$ ,  $\eta^2 = .17$ ] and HDL [ $F(3,39) = 3.71$ ,  $p = .01$ ,  $\eta^2 = .22$ ], whereby both variables decreased across the groups. Post-hoc analyses showed that these decreases occurred specifically between times 1 and 3 ( $p = 0.01$ ), and 1 and 4 ( $p = 0.05$ ) for HDL. Although a between group interaction approaching significance was found for LDL [ $F(1,41) = 3.78$ ,  $p = .06$ ,  $\eta^2 = .08$ ] suggesting that the LEARN group had higher values than those assigned to the MI-via-CALC condition, this should be interpreted with caution as a univariate analysis of variance revealed a trend toward significance between groups for the mean baseline values ( $p = 0.08$ ).

### Dietary intake

For dietary intake, repeated measures ANOVAs showed decreases among several variables with a significant time effect occurring between times 1 and 5 for: total calories [ $F(4,40) = 3.08$ ,  $p < 0.05$ ,  $\eta^2 = .24$ ]; and calories from carbohydrates [ $F(4,40) = 3.76$ ,  $p = .01$ ,  $\eta^2 = .27$ ]; a trend toward significance for calories from protein was also observed [ $F(4,40) = 2.44$ ,  $p = .06$ ,  $\eta^2 = .20$ ]. Post-hoc analyses revealed that decreases occurred specifically between times 1 and 3 for total calories and calories from carbohydrates ( $p < 0.05$ ) whereas an increase for calories from protein occurred between times 4 and 5 ( $p < 0.05$ ). To examine further the differences between groups for these variables in addition to calories from fat for times 1–3, 1–5 and 3–5, independent samples t-tests using change score values were calculated. On average, participants in the MI-via-CALC group decreased their total calories consumed to a greater degree ( $M = -662.76$ ,  $SE = 167.42$ ) than those in the LEARN group ( $M = -105.5$ ,  $SE = 180.03$ ) between times 1 and 3. This difference was significant  $t(43) = 2.26$ ,  $p < 0.05$  and represented a medium-sized effect,  $r = 0.32$ . For calories from fat, participants in the MI-via-CALC group decreased their average consumption more ( $M = -319.6$ ,  $SE = 95.58$ ) than the LEARN group ( $M = 15.3$ ,  $SE = 88.06$ ) between times 1 and 3, a difference that was significant  $t(43) = 2.52$ ,  $p = 0.01$  and represented a medium effect size,  $r = 0.36$ . No significant differences were observed for saturated fat, fibre, calcium, sodium, caffeine, or food group servings. Table 2 contains descriptive statistics for all dietary variables by time point.

### Participant program experience questionnaire

The social support provided by the CPCC was reported as especially helpful by most MI-via-CALC participants. Many

**Table 1**  
Participant demographics and primary outcome measures by time point ( $n = 45$ )

Variable	Baseline (time 1)		6 Weeks (time 2)		12 Weeks (time 3)		3 Months (time 4)		6 Months (time 5)	
	M	L	M	L	M	L	M	L	M	L
Age (year)	20.5 (1.7) <sup>*</sup>	21.4 (1.8)	—	—	—	—	—	—	—	—
Sex										
Women	21	13	—	—	—	—	—	—	—	—
Men	4	7	—	—	—	—	—	—	—	—
Height (in)	66.5 (3.5)	66.7 (3.2)	—	—	—	—	—	—	—	—
Weight (lb)	221.7 (36.8)	220.7 (32.6)	220.3 (38.8)	216.8 (31.3)	219.1 (40.8)	212.9 (29.5)	218.2 (39.7)	212.7 (28.6)	216.4 (39.1)	212.6 (28.6)
Waist circumference (in)	44.1 (4.1)	43.7 (4.2)	43.9 (4.2)	43.2 (3.9)	43.6 (4.5)	42.7 (4.0)	43.2 (4.9)	43.0 (3.8)	43.6 (5.0)	42.9 (4.1)
Blood (mmol/L) <sup>†</sup>										
Fasting glucose	4.83 (0.4)	4.91 (0.3)	—	—	4.77 (0.5)	4.83 (0.3)	4.86 (0.5)	4.76 (0.2)	4.81 (0.4)	4.73 (0.3)
Triglycerides	1.36 (0.6)	1.19 (0.6)	—	—	1.26 (0.6)	1.18 (0.6)	1.26 (0.6)	1.21 (0.6)	1.19 (0.5)	1.19 (0.6)
Total cholesterol	4.29 (0.6)	4.38 (0.8)	—	—	4.03 (0.7)	4.32 (1)	4.09 (0.7)	4.50 (0.9)	4.13 (0.7)	4.34 (1)
HDL	1.38 (0.4)	1.27 (0.3)	—	—	1.23 (0.4)	1.21 (0.3)	1.25 (0.4)	1.24 (0.3)	1.28 (0.4)	1.22 (0.3)
LDL	2.25 (0.6)	2.60 (0.7)	—	—	2.18 (0.6)	2.58 (0.8)	2.21 (0.6)	2.69 (0.7)	2.25 (0.6)	2.59 (0.8)
Cholesterol:HDL	3.31 (0.8)	3.43 (0.8)	—	—	3.61 (1.2)	3.53 (0.7)	3.59 (1.2)	3.55 (0.7)	3.55 (1.1)	3.51 (0.8)

M, MI-via-CALC condition ( $n = 25$ ); L, LEARN condition ( $n = 20$ ).

\* Mean ( $\pm$ standard deviation) unless indicated otherwise.

<sup>†</sup> M ( $n = 23$ ).

**Table 2**  
Participant dietary intake by time point (n = 45)

Variable	Baseline (time 1)		6 Weeks (time 2)		12 Weeks (time 3)		3 Months (time 4)		6 Months (time 5)	
	M	L	M	L	M	L	M	L	M	L
Total calories	2279.0 (858.1)	2050.3 (776.4)	1946.8 (836.2)	2017.0 (792.3)	1616.3 (670.8)	1940.9 (914.1)	1770.6 (606.0)	1775.5 (965.2)	1849.7 (721.5)	1869.3 (727.2)
Calories from carbohydrates	1177.8 (403.8)	1064.8 (452.7)	1039.2 (495.1)	1090.6 (495.08)	894.6 (416.6)	937.2 (422.0)	874.3 (386.7)	980.2 (767.3)	971.2 (469.9)	1016.2 (529.1)
Calories from protein	333.5 (166.1)	328.4 (143.4)	327.4 (144.6)	327.4 (139.0)	281.9 (114.9)	337.4 (137.7)	301.1 (125.1)	290.2 (143.2)	355.0 (168.0)	397.0 (177.1)
Calories from fat	787.2 (523.2)	653.4 (342.5)	579.6 (334.2)	585.9 (269.2)	467.3 (238.8)	668.7 (442.7)	550.2 (308.6)	512.7 (268.8)	610.6 (437.1)	573.6 (190.1)
Saturated fat (g)	32.9 (31.4)	25.5 (14.9)	23.7 (15.9)	21.9 (15.5)	19.6 (14.4)	25.0 (19.4)	21.3 (14.8)	20.1 (12.1)	26.0 (23.8)	22.0 (11.0)
Cholesterol (g)	311.5 (256.4)	270.5 (189.6)	273.4 (208.4)	210.3 (159.2)	214.0 (172.8)	218.2 (137.9)	257.8 (219.5)	169.6 (120.3)	259.7 (254.2)	279.0 (204.2)
Fibre (g)	20.7 (8.8)	19.4 (9.9)	21.8 (14.6)	22.0 (12.4)	19.7 (10.4)	19.3 (8.1)	21.3 (10.6)	19.7 (11.2)	17.9 (7.4)	20.3 (9.9)
Calcium (mg)	1047.3 (1062.2)	814.1 (377.8)	983.5 (509.2)	888.1 (414.8)	854.6 (745.9)	882.6 (494.6)	746.6 (251.5)	727.2 (429.8)	809.3 (410.3)	815.1 (431.6)
Sodium (mg)	3458.4 (1693.3)	3361.4 (1753.2)	3158.5 (1558.7)	3621.7 (2097.1)	2788.2 (1658.2)	3490.2 (1895.7)	2909.1 (1161.4)	3066.8 (1407.1)	2801.8 (1320.8)	3231.7 (1898.3)
Caffeine (mg)	71.4 (104.5)	106.5 (100.2)	65.5 (82.6)	113.7 (114.3)	83.7 (142.6)	139.6 (166.6)	56.7 (76.1)	91.8 (85.2)	68.2 (82.2)	129.6 (140.5)
Food group servings										
Milk and alternatives	1.52 (1.47)	1.02 (1.14)	1.48 (1.34)	1.71 (1.20)	1.33 (1.74)	1.40 (1.32)	1.31 (1.10)	1.41 (1.11)	1.55 (1.35)	1.23 (1.36)
Meat and alternatives	2.44 (1.58)	2.37 (1.55)	2.08 (1.60)	2.77 (2.27)	2.06 (1.58)	2.43 (1.52)	2.51 (1.99)	2.41 (1.53)	2.16 (1.88)	2.37 (1.54)
Grain products	6.40 (2.79)	5.68 (3.51)	5.10 (2.88)	5.98 (2.99)	4.40 (1.98)	4.96 (2.65)	5.15 (1.93)	5.05 (2.61)	5.07 (3.57)	5.61 (2.70)
Vegetables and fruit	4.51 (2.71)	4.26 (2.80)	4.58 (3.65)	4.86 (4.11)	5.18 (3.32)	4.42 (2.45)	5.35 (3.94)	6.01 (4.52)	4.14 (2.23)	4.06 (3.51)

M, MI-via-CALC condition (n = 25); L, LEARN condition (n = 20).

commented that the weekly interaction was motivating and facilitated personal accountability for decision-making, while also enhancing self-confidence and awareness. Four found the lack of instruction frustrating and thus the treatment fit unsuitable. LEARN participants found the information on nutrition particularly beneficial in combination with specific strategies (e.g. goal setting, calorie counting) and tools (e.g. self-monitoring) for making behavioural changes. The lack of interactivity and the desire for a more personally tailored program were deemed least helpful. Participants in both treatments reported eating healthier and exercising more since starting the program, and whereas the MI-via-CALC group focused on self-understanding, -reflection and -responsibility as primary outcomes of their experience, the LEARN group stressed their appreciation of practical lifestyle tips and knowledge gained. Typical quotes pertaining to participant experiences by group are in Table 3.

## Discussion

The purpose of the present study was to compare the effectiveness of 2 SM approaches delivered via a 12-week telephone-based intervention on risk factors associated with the development of type 2 diabetes among university students with obesity. Overall, positive changes to anthropometric (i.e. weight loss), blood lipid (i.e. total cholesterol) and dietary profiles (i.e. total calories) were observed across the MI-via-CALC and LEARN conditions between baseline and the 6-month follow-up period. These findings suggest that participants were receptive to each condition, one interactive and the other prescriptive. Consequently, it appears that both interventions should be made available and even merged on a case-by-case basis for young adults struggling with their weight. It is important to note that although both arms seem similarly effective, they appear to address different challenges associated with obesity treatment: MI-via-CALC focusing on the underlying relationship with one's self, and LEARN, the more practical "how to" aspects of weight loss and behaviour change. Thus, the personal preferences, needs and differential learning styles of individuals must be considered. Also, these findings extend those arising from previous research examining the use of MI-via-CALC and LEARN as viable obesity treatments (22,39,40), thereby providing preliminary empirical evidence for their application with respect to type 2 diabetes risk. According to Corbin and Strauss (17), programs aimed at managing chronic conditions must incorporate content that addresses SM tasks pertaining to behavioural, role and emotional management. One criticism of many health promotion and patient education programs is that they often address the first SM task but fail to consider the remaining 2 (15). From a SM perspective, we believe that the CHANGE Program offers a comprehensive approach to obesity treatment and type 2 diabetes risk through the inclusion of 2 interventions that are congruent with all 3 management tasks while simultaneously incorporating many elements necessary to attenuate health risks in this population.

Weight loss is an important therapeutic strategy for individuals with obesity who are at risk for developing type 2 diabetes and its associated comorbidities (41). Irrespective of group allocation, analyses revealed consistent decreases to weight among participants across the 5 time points. Notably, individuals assigned to the LEARN group lost significantly more weight (i.e. 7.76 pounds) than their MI-via-CALC counterparts (i.e. 2.5 pounds) during the first 12 weeks of the program. Although this 5 pound difference in weight loss may not be considered a clinically substantial finding given the mean starting weights of each group it is, none the less, statistically significant. One key skill of SM is decision-making, which requires that an individual have the appropriate knowledge necessary to make behavioural changes (15). Analogous with the qualitative feedback received, it is possible that this group difference was

**Table 3**

Participant perspectives on program involvement

**What did you find most helpful about the study and why? Time 3 assessment****MI-via-CALC**

"Just being able to talk to someone who really listened and made sense of some of the jumbled thoughts in my head; kept me/got me back on track."

"Coaching made me reflect on what my obstacles were and on what I could do to help myself—it was motivational in a sense."

"Regular check-ins that made me feel accountable for my actions and decisions."

"[H]aving someone believe in me and give [me] the confidence to make even little changes."

**LEARN**

"The dietary and calorie information because it made me realize I could be healthy, lose weight and still enjoy food—it is not a struggle anymore."

"Recording food intake (calories) made me a lot more aware of what I was actually eating."

"[The]focus [was] on health and not just weight loss. Concept that every little bit counts and that it is possible to be in control."

"Small changes in your lifestyle make a big difference to losing weight. It makes losing weight seem more possible."

**What did you find least helpful about the study and why? Time 3 assessment****MI-via-CALC**

"Unclear about what was to be discussed with coach."

"I found that a coach is probably not the greatest plan for me."

"The group I was placed in didn't motivate or make clear ways to lose weight. My goals changed because of this. I needed clear direction but it was up to me to figure out how to do so. Made things difficult and frustrating at times..."

**LEARN**

"The study was based on an introductory level and I feel it was not useful for anyone who already has the knowledge and intro base of weight loss."

"Lack of interactivity. I felt less compelled to follow through..."

"Many things did not apply to me and many things I could not comply with."

"The method of the calls was more lecture style and it would have been nice if it was more interactive."

"No real personal contact/connection with specialist. i.e. Felt like it was a set program for everyone and not tailored to me."

**The number one thing that you got out of the study was... Time 3 assessment****MI-via-CALC**

"Awareness of myself, my challenges and how I can make my life a richer and more meaningful experience."

"Learning to be more reflective of my daily choices and taking responsibility for the changes I need to make."

"Creating new ways to be successful when I find that something isn't working for me."

"The confidence in myself to know that I can successfully make healthy changes in my life."

"Realizing that only I can make my own changes."

"Learning to understand myself and the reasons behind my thoughts and actions."

**LEARN**

"I never paid any attention to calories whatsoever before. Once I understood what they were, how much I should have, and how much calories certain foods contain, I have definitely permanently changed my eating habits."

"Learning to think positively and not put myself down, integrating healthy habits into everyday life (e.g. being sensitive to portions, wearing a pedometer)."

"Small tips that could be applied to every day routine (e.g. Be conscious of # of bites; where you sit when you eat; substituting something for carbs, taking stairs when you can etc.)."

**What types of actions have you taken that you attribute to your specific treatment and involvement in the study (if any)? 4 = Time 4 assessment; 5 = Time 5 assessment****MI-via-CALC**

"... [P]utting my own needs before the needs of others more often..." – 4...

"Stress management techniques that I discussed with my life coach; seeking out weight management programs/techniques research as a result of motivation provided by program/treatment." – 4

"I think I assert myself more – I have more confidence. I am more comfortable with myself." – 4

"Watch what I am eating (portion size) and trying hard to fit exercise into my day." – 4

"I cut down on eating unhealthy, premade foods [and] began cooking for myself [and] making healthy decisions; I learned how to motivate myself to exercise; I've learned to fight temptations." – 4

"More attention and credit given to myself even when only achieving very small things." – 4

"I still use methods of relaxation and motivation that my life coach suggested. I feel more confident in going to the gym and working out in general." – 5

"Taking a different daily outlook; seeing myself in many different ways." – 5

"Making conscious decisions regarding the types of foods I buy and eat. Paying attention to calorie, protein, sugar, fibre content in the food I eat." – 5

"I've learned how to motivate myself to exercise. I've also learned healthy eating habits and that I have the power to limit unhealthy foods." – 5

**LEARN**

"I always make sure I walk for at least an hour each day. Before the study I had absolutely no physical activity and now I have to go out on walks to feel good." – 4

"I am more mindful of portion sizes and try to maintain a calorie deficit each day. I'm more active – not just going to the gym but taking the stairs or walking instead of taking the bus." – 4

"Writing down what I eat when I feel my habits are getting out of control; eating slow and in a designated place (i.e., Kitchen table)." – 4

"I have been making my weight-health more of a priority ...." – 5

"Feeling good about walking for short periods of time when not having enough time for a full workout routine. Doing extra little things like walking the last bus stop or taking the stairs instead of the escalator." – 5

"Joined a gym, walking to/from work instead of taking the bus, eating healthier foods." – 5

"Making time for preparing healthier meals; making an effort to move (bike, walk, climb stairs etc.) even for 15 minutes a day." – 5

**What (if anything) is different about how you feel about yourself now since the study ended (i.e., how has your life changed)? 4 = Time 4 assessment; 5 = Time 5 assessment****MI-via-CALC**

"I've learned to take responsibility for my choices and feel more in control of my food and exercise regimen." – 4

"I feel I have more knowledge and information to apply my attempts for lifestyle change. I am also more confident in decision-making both related to diet and exercise and other aspects of my life." – 4

"I definitely feel better about my body and happier with who I am. I can control my emotions more and I am able to talk to people close to me about feelings and emotional issues." – 4

"I now feel as if I have the power to make changes in my lifestyle which can allow me to easily achieve the results I want to see. I have recently noticed that I have dropped a dress size and that to me is more important than what the scale says...Not being the biggest size anymore has raised my confidence while shopping tremendously." – 4

"I am much more aware of the challenges I need to overcome to achieve my health goals. I don't ignore health issues anymore." – 5

"I feel much more independent and capable. Also, I realize how well-equipped I am to succeed." – 5

"I feel better about myself and the way I look. I want to continue to lose weight, even though it takes me a longer time. I appreciate my body more now than I did before." – 5

"I feel more confident that if I want to make a change I am in control of my own body." – 5

(continued on next page)

**Table 3** (continued)

LEARN
"I feel more knowledgeable about the issue at hand." – 4
"I do feel a little more confidence in my appearance now that I feel better, I dress better to match. I am not as disgusted by my body as before. I realize it is a lot easier than I initially assumed to make changes in my life and lose weight." – 4
"I have lots of energy and I'm very proud of the weight I've lost." – 4
"I have lost more weight so I have become a lot more confident in my ability to reach my goals." – 4
"I learned how to like myself regardless of my progress in the program, and I've also learned how to keep myself upbeat and positive whenever I don't quickly succeed. I've learned patience with myself." – 4
"More empowered to make healthy choices." – 4
"I have finally dropped my weight below 200lbs, which was a big milestone for me. Being under this mark has made a big emotional difference for me, knowing I am under this red line I have drawn for myself makes me feel confident that I can continue losing weight healthily and successfully." – 5
"I've felt more confident, I've gained some more self-esteem and I've also gained more confidence in clothes and food choices." – 5
"More confident that I can make a long term change; better educated on what makes a healthy lifestyle." – 5

attributable to the didactic information and practical tips provided through the LEARN program lessons. This information may have contributed toward satisfying the dimensions of behavioural (e.g. adhering to new portion control practices; stopping a medication required previously) and role management (e.g. integrating and identifying more with physical activity; shopping differently) among those assigned to this condition. This highlights the importance of education.

Findings for dietary intake revealed that the MI-via-CALC group decreased their total calories consumed significantly more than the LEARN group between times 1 and 3; the majority of this difference was attributed to reductions in fat versus carbohydrate or protein-based calories. Although the current study does not lend itself to determining a causal explanation as to why this may have been the case, it is an interesting finding given the agenda of each MI-via-CALC session is determined entirely by the participant/client and may or may not involve direct obesity-related, topical issues (18,25). Psychological support has been recommended as an important complement to weight loss programs to attenuate distress that could be incurred as a result of behavioural changes (42). From a SM perspective, focusing on the issues brought forth by the participant (and not imposed by the coach/provider) is imperative for addressing and managing the emotional outcomes that can accompany excess weight while facilitating the integration of personally relevant coping strategies (18,24). During the qualitative feedback, many participants in the MI-via-CALC group described an internal shift in their relationship with themselves, a shift that involved greater self-acceptance, -awareness, -responsibility and -confidence, and living a healthier lifestyle as a result of study involvement and working with a CPCC. It is possible that the observed decreases in caloric consumption were impacted by this personal relationship shift. That is, perhaps the increase in self-knowledge and -reflection enhanced understanding of the connections between emotions and food intake rendering participants in the MI-via-CALC group more focused on their internal relationships with food rather specific actions to reduce weight (e.g. focusing on reducing emotional eating versus increasing physical activity). Although future research is warranted to explore this hypothesis, in accordance with research conducted previously (21,24), these findings do highlight the use of MI-via-CALC as an innovative support technique for individuals with obesity.

Given the well-recognized role that cholesterol plays in developing cardiovascular disease, not to mention the inverse correlation between cardiac-related mortality and improvements in controlling cholesterol (43), it is promising that a significant time effect was observed for this variable across participants in the present study. Although this change cannot be attributed to a specific causal mechanism or treatment, the downward trend may be indicative of participants integrating a SM skill referred to as "taking action" (15); this involves creating and carrying out a short-term, realistic action plan for a particular behaviour (e.g. dietary or physical activity changes). For example, in MI-via-CALC this skill is

congruent with balance coaching, a specific style of coaching that involves: 1) working with a client/patient collaboratively to uncover new perspectives/ways of viewing a barrier or life event, 2) brainstorming possible solutions using a new way of viewing the situation, 3) creating a plan of action, and 4) following through (18). The glucose levels and remaining lipid values presented in the normative reference ranges (43) at the time points examined suggesting that the participants may have been too heterogeneous to capture salient trends, were too small in number, or a longer intervention is required to elicit significant changes in these domains. Additional research is warranted to clarify further, the link between these markers and type 2 diabetes risk in this context.

#### *Limitations and future directions*

One limitation of the present study includes its smaller than ideal sample size. In addition, the reliance on self-report data for dietary intake may have resulted in underestimations and/or recall bias; thus, future studies should consider collecting this data over a longer period of time (i.e. 3–7 days) to enhance the likelihood that reported consumption is an accurate reflection of nutrition practices. It is concerning that respondents' food records indicated inadequate nutrient intake, such as high sodium and low fibre, in both groups pre- and postintervention. Future interventions could also focus on helping to ensure that caloric limitations do not coincide with nutritional deficiencies. Finally, the study was not designed to assess the relative contributions of specific programmatic components toward changes in the dependent variables examined. Given the multifaceted nature of each treatment, this is an important consideration for future research. Moreover, to maximize the generalizability of the treatment approaches, future studies should aim to enroll larger samples across a wider spectrum of individuals (i.e. nonstudents of varied ages and sexes and socio-economic status). Despite these limitations, one strength of the present study is its delivery modality. When administered over the telephone, this program represents an accessible, convenient treatment with the potential to reach a large number of individuals in a cost-effective manner (39). In light of the mosaic of areas in participants' lives affecting obesity and vice versa, future programs should explore this format further via a longer and more intensive intervention (lasting for at least a year) with a view toward eliciting long-lasting changes to an even greater degree (22).

In conclusion, MI-via-CALC and the LEARN Program appear similarly effective suggesting that both interventions hold promise and are warranted as viable SM treatments for attenuating type 2 diabetes risk factors among young adults with obesity. Whereas the LEARN program provides integral knowledge, strategies, and tips congruent with behavioural and role SM, MI-via-CALC facilitates emotional management through personal reflection and self-exploration. Based on the differential responses to both treatments observed in the present study, future programs should consider the unique contributions of each when working

collaboratively with an individual to design a treatment plan congruent with his/her values, aspirations, and goals (18). The inclusion of participants/clients into the best-fit treatment program may prove to be an essential first step toward instilling the SM tenets of choice and empowerment necessary to incur long-lasting behavioural change in this at-risk population.

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