



Long-Term Effect of Motivational Interviewing on Dietary Intake and Weight Loss in Iranian Obese/Overweight Women

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ABSTRACT

Background: This study aimed to determine whether motivational interviewing (MI) could change dietary habit and body mass index (BMI) in obese/overweight women.

Methods: A cluster-randomized controlled study was performed in four health centers in Qazvin, central Iran. In total, 327 obese/overweight women were selected by a multi-stage sampling method and randomly assigned into control and experimental groups. Food frequency (using questionnaire; FFQ), BMI, and metabolic markers including blood pressure, total serum cholesterol and fasting blood glucose levels were measured in all participants. Data were collected twice (before and one year after the MI interventions). Data were analyzed using student *t*-test, and Stepwise Linear Regression.

Results: There was a significant increase in daily consumption of dietary fiber, whole grain products, fruits and vegetables in the MI group ($P < 0.05$). The consumption of meat product, total fat, saturated fat, carbohydrate and total energy intake were also significantly reduced after MI intervention ($P < 0.05$). As a result, body weight and BMI were significantly reduced in the intervention group compared to the control group ($P < 0.05$).

Conclusion: MI is suggested to be an effective strategy to change life style and reduce BMI in overweight/obese women in the long term. This effect needs to be further investigated in different gender and age populations.

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Introduction

Obesity is a combination of multiple metabolic disorders, including glucose intolerance and hyperlipidemia, which may render obese individuals more susceptible to various micro- and macro-vascular diseases. As such, obesity is the fifth leading cause of death in the world.¹ According to WHO, in

2008 worldwide more than 1.4 billion adults were overweight and there were more obese women than men.² In Iran, the prevalence of overweight, obesity and morbid obesity was estimated as 28.6%, 10.8% and 3.4%, respectively, and the number of obese females nearly doubles that of the males.^{3,4}

Small changes in dietary habit, such as reducing fat and increasing fruit and vegetable consumption, can reduce the risk of obesity-related diseases by up to 50%.⁵ Therefore, a preventive intervention that modifies lifestyle to maintain healthy weight may be more cost-effective than weight loss surgery and medications.⁶

Traditional consultation that uses externally driven methods can cause resistance from the patients, especially when there is no motivation to change.⁷ Motivational interviewing (MI), on the other hand, is an education method using a patient-centered and goal-directed approach, which may overcome the challenge of patient compliance and the conflicts between the patient and counselor to promote change. MI was originally established for drug rehabilitation. Evidence suggests that MI is also efficient in behavior change in a range of other health issues.⁸ MI has been effective in increasing physical activity and changing dietary habit to induce weight loss in overweight/obese people,⁹ as well as patients with hypertension.¹⁰

The objective of the current study was to investigate the long-term impact of MI intervention on the changes of dietary habit, body weight and metabolic markers in overweight and obese Iranian women.

Materials and Methods

Participants and procedures

This was a cluster-randomized controlled study performed in four health centers of Qazvin City, central Iran between 2011 and 2013. Each health center was randomized as control or MI intervention group.

In Iran, the public sector is responsible for providing primary, secondary, and tertiary health services. More than 94% of Iranian populations have access to public health services, and approximately 71% of Iranian populations are urban dwellers. Therefore, urban health centers play a significant role in healthcare.

There are eight urban health centers in Qazvin City and four of them were randomly selected using multi-stage random

sampling. The centers were then randomly assigned into two groups, control and MI. All overweight and obese women were recruited between February 2011 and January 2013, who were referred to the urban health centers for primary health care services.

A power analysis suggested that a minimal of 150 female patients/group was needed to achieve a 0.75 kg/m² difference in BMI between the MI and control groups, with a power=90% and $\alpha=0.05$.⁹ Therefore, 327 obese and overweight women were selected (control n=157, MI n=170) according to the inclusion and exclusion criteria. The inclusion criteria were: (1) BMI = 25-35 (overweight 25-29.9; obese 30-35), (2) age>18, (3) no involvement in any weight loss program and anti-obesity medications, (4) absence of pathological conditions that can lead to obesity, (5) ability to read and write. In addition, those women with existing cardiovascular disease, movement disabilities, psychological disorders, and absence for more than one MI counseling session were excluded from the study. The participants were assessed against these criteria based on available medical records, and interviewed by trained healthcare professionals. All participants provided signed consent and personal information was kept as confidential. Data were collected prior to and one year after the commencement of the first MI sessions.

Measures

Food frequency

The food frequency questionnaire (FFQ) is a method to record long-term food intake, which is simple to use with relatively low cost and high accuracy.¹¹ The intake of all food items and beverages was recorded within 2 consecutive days before the intervention by both groups, which was performed again one year later. Food consumption frequency was also recorded according to food types, on either daily (e.g. bread, fruits, and vegetables), weekly (e.g. chicken and rice), or monthly basis (e.g. fish).

Anthropometric Assessments

Anthropometric indices included height, body weight, and waist/hip circumference.

Standing height was measured without shoes using a calibrated stadiometer (down to 0.5 cm); while body weight was measured in light clothes using a calibrated digital scale (down to 10 g). Body mass index (BMI) was calculated as weight (kg)/height (m)². The waist circumference was measured at the smallest circumference at or below the costal margin and the hip circumference was measured at the level of greater trochanter. All the anthropometric measurements were performed by trained nurses in the morning.

Metabolic Assessment

Serum total cholesterol level was measured using an enzymatic colorimetric method. Fasting blood glucose was measured after an overnight fasting for 12h. Glycated haemoglobin (HbA1c) was measured by the WHO colorimetric method (Mahsayaran Kit, Iran, normal rang 5.0-7.5%). Blood pressure was measured by trained nurses using a mercury sphygmomanometer.

Intervention

Prior to the commencement of MI, an education session on the importance of low-calorie and low-fat diet, as well as physical activity, was delivered by a health psychologist with the assistance of a nutritionist in the health centers to all the participants.

After the initial data collection on food intake and metabolic measurements, MI sessions were carried out on a one-to-one basis with the implementation of five 60-minute face-to-face sessions in the health centers according to the previous studies.¹²⁻¹⁴ The sessions were carried out in the 1st (baseline), 3rd, 6th, 9th and 12th months. Briefly, an introduction session was held on general information, including the principles of healthy dietary intake, the definition of MI, expected outcomes (e.g. weight loss, and change to a healthy diet), and confidence evaluation (how the patient can assess her self-efficacy for actions). The second session focused on the recognition of emotions rising from the MI practice, where the researchers tried to discover those that may contribute to resistant behaviors. The participants were educated on how to overcome them. The third

session focused on the pros and cons of certain behavioral change and the solutions to overcome the negative outcomes. The fourth session focused on the values of healthy behaviors and healthy eating on the improvement of health outcomes. The fifth session focused on the perspectives and the final assessment of metabolic markers. All sessions were carried out in a semi-structured interview format based on the DiLillo's recommendations.¹²

Techniques used in the MI included, using open-ended questions to encourage the participant's involvement, confirmation of the positive statements by the participants, using reflection to promote positive thinking, and providing summaries of the key components of the discussion, which focused on decisional balance, readiness for change, conflicts between the health values and nutritional diet, control of eating in front of likely temptations, and the perspectives of positive health outcomes. During the sessions, expressions such as '*Could I summarize what you have just said...*' and '*Could you please explain to me ...*' were used by the counselor to elicit and support any voluntary changes. Planning strategy for a better interaction in future sessions was also discussed in each session. The women in the control groups did not receive any intervention after the initial common session.

Ethical Considerations

Ethics approval for the current study was obtained from the Human Ethics Committee of the Qazvin University of Medical Sciences. The study was performed according to the Consolidated Standards of Reporting Trials (CONSORT) guidelines.

Statistical Analysis

Data were presented using mean \pm standard deviation and number/percentage. Chi-square was used to assess the differences between groups before intervention (SPSS v17). Paired sample *t*-test was used to compare the differences between the baseline and post-intervention results within the group. Independent sample *t*-test was used to compare the differences between the ex-

perimental groups. A multiple linear regression test was used to evaluate the interaction between MI and the other factors, including age, educational, marital and occupational status. $P < 0.05$ was considered as significant.

Results

Initially, 327 women were enrolled in the study, with 26 dropping out. There was no difference in the dropout rate between the groups.

Table 1: Demographic characteristics of participants

Variables	MI (n=157)	Control (n=170)	P-Value
Age (yr)	33.99±6.49	34.62±5.63	0.297
Marital status			
	n (%)	n (%)	
	Single	26 (15.3)	0.368
	Married	127 (74.7)	
	Divorced /Widowed	17 (10.0)	
Occupational status			
	Employed	12 (7.1)	0.483
	Unemployed	158 (92.9)	
Educational level			
Illiterate	5 (3.2)	7 (4.1)	0.597
Primary school	21 (13.4)	19 (11.2)	
Secondary school	32 (20.4)	30 (17.6)	
Diploma	56 (35.7)	82 (48.2)	
Academic degree	43 (27.4)	32 (18.8)	

Data on the age were expressed as mean ± standard deviation.

The average ages of the women in both groups were similar (Table 1). The majority participants were married (Table 1) and worked as housewives (Table 1). In terms of education, most women in both groups had finished secondary school. There was no significant difference between the two groups in terms of demographic profile and health status (Table 1). Prior to the MI intervention, the average body weight, height,

BMI, waist circumference, blood pressure, as well as serum cholesterol, fasting glucose and HbA_{1c} levels were similar between the MI and control groups. A year after the commencement of MI intervention, there was significant increase in the consumption of whole grains, dietary fiber, fish, fruits and vegetables in the MI group ($P < 0.05$, Table 2).

Table 2: Changes in energy intake and dietary composition according to Food Frequency Questionnaire in the MI and control groups

Variables	MI (n=157)		Change	Control (n=170)		Change
	Before MI Mean (SD)	One year after MI Mean (SD)		Baseline Mean (SD)	One year after Mean (SD)	
Energy Intake(kcal/day)	2812 (592)	2470 (170)	-342.1	3008.71(348.54)	3064.16 (268.67)	55.9
Macronutrient						
Total fat (g)	43.6 (12.2)	36.55 (13.84)	-7.09	43.18 (19.63)	42.86 (19.55)	-0.32
Saturated fat (g)	13.2(3.8)	10.95 (4.10)	-2.23	12.88(3.22)	12.72 (3.19)	-0.16
Protein (g)	43.57(8.5)	41.91 (11.01)	-1.66	43.02(14.12)	43.06 (17.17)	0.04
Carbohydrate (g)	92.15(15.36)	85.59 (12.95)	-6.56	99.47 (45.54)	99.28 (34.56)	-0.19
Dietary fiber (g)	8.95 (2.96)	12.12 (7.15)	3.17	8.06 (2.33)	8.04 (4.30)	-0.02
Food (g/d)						
Fruits (g/d)	153.14 (42.71)	170.21 (64.77)	17.07	156.70 (38.23)	158.13 (39.30)	1.43
Vegetables (g/d)	186.78 (43.89)	221.12 (77.86)	34.34	181.86 (48.94)	183.32 (51.70)	1.46
Meat (g/d)	69.93 (13.63)	57.85 (10.02)	-12.08	74.10 (17.97)	73.01 (12.89)	-1.09
Whole grains (g/d)	50.36 (12.19)	60.22 (15.90)	9.86	44.72 (11.80)	47.02 (12.49)	2.30
Dairy product (g/d)	190.42 (48.13)	178.57 (66.09)	-11.85	184.52 (42.07)	181.38 (45.82)	-3.14

In addition, daily energy intake and the consumption of meat, total fat, saturated fat,

and carbohydrate were significantly reduced in the experimental group ($P < 0.05$, Table 2).

In addition, body weight and BMI were significantly reduced in the MI group ($P<0.05$, Table 3), which was not changed in the control group over the one year period (Table 3). Furthermore, metabolic markers, including systolic and diastolic blood pressure, total

serum cholesterol levels, and fasting blood glucose and HbA1c levels were significantly reduced in the MI group at 1 year post-intervention and which was again not changed in the control group (Table 3).

Table 3: Anthropometric characteristics of the participants at Baseline and one year post-intervention in the MI and control groups

Variables	MI group (n=157)		Change	Control (n=170)		Change
	Baseline Mean (SD)	One year after Mean (SD)		Baseline Mean (SD)	One year after Mean (SD)	
Body Weight (kg)	80.96(15.00)	77.82 (14.94)	-3.14	81.77(9.86)	80.35 (9.93)	-1.42
Body Mass Index	35.11(6.11)	31.05 (6.39)	-4.06	35.09(5.29)	33.30 (5.26)	-1.79
Waist Circumference (cm)	103.66(21.90)	99.91 (14.95)	-3.75	100.89(19.30)	100.05 (19.37)	-0.84
Serum total cholesterol (mg/dl)	196.25 (61.17)	190.80 (49.28)	-5.45	174.88(33.20)	174.69 (33.90)	-0.19
Blood pressure						
Systolic (mm Hg)	129.33(15.37)	124.65 (16.03)	-4.68	131.97(19.92)	132.23 (20.05)	0.26
Diastolic (mm Hg)	83.43(10.98)	79.59 (11.89)	-3.84	81.04(14.35)	80.75 (14.17)	-0.29
Fasting Serum glucose (mg/dl)	107.07 (17.80)	96.25 (22.90)	-10.82	102.62(12.97)	101.37 (21.11)	-1.25
HbA1c (%)	7.44(0.99)	6.50 (1.29)	-0.94	7.41(0.98)	7.40 (0.98)	-0.01

The results of the multiple linear regression analyses are summarized in Table 4. Women in the control group were more likely to have greater BMI than those in the MI group ($\beta=2.404$, $P<0.05$, Table 4). Age, marital status, and employment were the significant predictors of BMI change at one year post intervention. Low levels of education,

being single or widowed, and employment status were the predictors for body weight changes at one-year post intervention (Table 4). Moreover, women in the control group were more likely to maintain their body weight compared with those in the MI group ($\beta=2.923$, $P<0.05$).

Table 4: Multiple Linear Regression analysis using BMI and body weight as the dependent variable

Independent variables	BMI				Body Weight			
	B	SE	Beta	P Value	B	SE	Beta	P Value
BMI baseline	0.856	0.010	0.820	<0.001	0.928	0.016	0.920	<0.001
Age	0.026	0.009	0.022	<0.001	0.600	0.031	0.029	0.060
Educational status								
Diploma and higher (n=114)	Referent				Referent			
Under diploma (n= 213)	0.064	0.126	0.011	0.861	0.963	0.402	0.076	0.019
Marital status								
Married (n=256)	Referent				Referent			
Single/widowed (n=71)	1.422	0.163	0.238	<0.001	1.370	0.542	0.108	0.013
Occupational status								
Housekeeper (n=295)	Referent				Referent			
Employee (n=32)	1.186	0.202	0.199	0.007	2.062	0.689	0.162	0.003
Group								
MI (n= 157)	Referent				Referent			
Control (n=170)	2.404	0.115	0.403	<0.001	2.923	0.373	0.230	<0.001

Discussion

This study demonstrates that MI intervention may lead to significant improvement

in dietary composition, resulting in significant reduction in body weight, BMI, and improvement of metabolic profiles in overweight and obese Iranian women.

Miller and Rollnick define four basic principles of MI use.¹⁵ Firstly, the expression of empathy is required to facilitate communication and provides a supportive environment for behavior change. Secondly, some kind of cognitive dissonance needs to be created by magnifying the conflict between the positive health outcomes due to healthy behaviors and negative outcomes due to current unhealthy behaviors. In this step, cognitive dissonance may facilitate change. The third principle is to roll with resistance, where the resistance to change by individuals should be acknowledged and accepted, before helping them to consider, and facilitate them to change. Finally, sufficient support is provided to build-up individual's confidence in their ability to change.¹⁵

Patients prefer patient-centered consultation more than a passive advice-styled approach.¹⁶ During MI, specific counseling techniques have been adopted, such as open-ended questions, self-reflection, and self-evoked behavioral change. In this motivational approach, a collaborative process has been used which can strengthen the commitment to change, instead of information giving, persuasion, and forced implementation to induce behavioral changes.^{17,18} In this study, MI enabled patients to investigate their own health perceptions, which helped them to actively change their unhealthy behaviors. Moreover, patients were encouraged to have their own solutions in order to improve their dietary habits toward a healthy direction. This type of encouragement has been shown to be a useful strategy and may have permanent positive health implications.¹⁹

MI intervention also appears to encourage successful participation, given that the attrition rate in the current study was low. This may be related to the implementation of one-to-one consultation to ensure sufficient attention to the individuals. There were also apparently adequate numbers of counseling sessions to ensure sufficient communication to collect participants' perceptions. The counseling environment was similar in each session within the familiar health center

settings, thus avoiding potential anxiety due to novel environment.

In this study, MI intervention significantly improved dietary composition, which is consistent with previous studies.^{20,21} Significantly increased physical activity and weight loss after four MI sessions have been previously demonstrated.²² Moreover, participants in the MI sessions showed high compliance for behavioral change and success in weight loss, which is similar to a prior study.²³ Thus, it appears that MI intervention can increase self-sufficiency and reduce behavioral resistance, strengthen participation, stimulate intrinsic motivation, increase the susceptibility to change, and improve treatment outcome. Indeed, in this study, the improvement in dietary composition was more prominent in the MI groups. This appears to have led to significant weight loss and decrease in BMI in the MI group, which is consistent with two previous studies using similar approaches.^{9,10} Furthermore, other studies suggest that MI can lead to successful weight loss in patients who have experienced repeated relapses of body weight gain^{9,10}. MI interventions have also been shown to be effective in reducing the risk factors for coronary artery disease.^{10,17,19,24} In addition, in adults, Smith and colleagues have shown that additional MI intervention is more effective to induce weight loss than a behavioral weight loss program alone.²⁵

MI intervention can also reduce risk factors for certain metabolic disorders. In this study, blood pressure, and circulating glucose and lipid levels, were all significantly reduced after the MI intervention. This suggests that the risk of developing cardiovascular disorders and diabetes may be reduced in the overweight and obese participants. Previously, it has also been shown that elderly women with type 2 diabetes have improved glycemic control after MI interventions.²⁶ Notably, a combination of MI, drug treatment and behavioral program intervention is a more effective strategy to achieve sustainable weight loss than any of the strategies alone.²⁷

Limitations

Firstly, this study was not carried out in a double-blinded manner. Given the nature of the intervention, where there was no consultation for the control group, it was impossible to be a double-blind study. Secondly, only one follow-up measurement at one-year post commencement of the intervention was carried out, and this may provide inadequate information on the trend of behavior change. Thus, performing multiple follow-up measurements during the intervention may provide longitudinal information and more robust outcome data.

Conclusions

The use of the MI technique is an effective way to implement healthy behavior in obese/overweight women. Certain health risks may also be modified by using MI. However, its application in different settings, target groups and health aspects need to be investigated in future studies to assess the effectiveness of MI.

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Competing Interests

The authors declare that there is no conflict of interest to declare.

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