

Modifying attitude and intention toward regular physical activity using protection motivation theory: a randomized controlled trial

Kamal Mirkarimi¹, Maryam Eri¹, Mohammad R. Ghanbari², Mohammad J. Kabir¹, Mojtaba Raeisi³, Rahman B. Ozouni-Davaji¹, Mohammad Aryaie⁴ and Abdurrahman Charkazi⁵

تعديل الاتجاهات والنوايا نحو النشاط البدني المنتظم باستخدام نظرية التحفيز على الوقاية: تجربة معشة ذات شواهد

كمال ميكاريمي، مريم إري، محمد خانباري، محمد قابيل، مجتبا رئيسي، رحمت آزوني - دافاجي، محمد آريائي، عبد الرحمن شركازي

الخلاصة: لقد استرشدنا بنظرية "التحفيز على الوقاية" لاختبار تأثير المقابلات التحفيزية على توجه البدنيات ومفرطات الوزن ونواياهن تجاه أداء نشاط بدني منتظم. وفي تجربة معشة ذات شواهد، اخترنا أخذ عينة مناسبة من 60 امرأة تعاني من زيادة الوزن والسمنة كن يترددن على المراكز الصحية. فُتسّمت النساء إلى مجموعتين كل مجموعة من 30 امرأة لتلقي برنامج معياري لمراقبة الوزن أو مقابلات تحفيزية. وقد اختلفت جميع مفاهيم النظرية (تصوّر القابلية للإصابة، والشدة، والفعالية الذاتية، وفعالية الاستجابة) واختلفت جميع خصائص القياسات البشرية (باستثناء مؤشر كتلة الجسم) اختلافاً كبيراً بين المجموعتين في ثلاثة أوقات للدراسة. وكانت أقوى التنبؤات لاعتزام المشاركات على أداء تمارين رياضية بدنية بانتظام هي تصوّر فعالية الاستجابة والتوجه في الشهر الثاني والشهر السادس من المتابعة. وأظهرنا أن المقابلات التحفيزية الهادفة مع التركيز على مفاهيم نظرية "التحفيز على الوقاية" تبدو مفيدة في تصميم التدخل المناسب وتطويره لتحسين حالة النشاط البدني بين البدنيات ومفرطات الوزن.

ABSTRACT We were guided by the Protection Motivation Theory to test the motivational interviewing effects on attitude and intention of obese and overweight women to do regular physical activity. In a randomized controlled trial, we selected using convenience sampling 60 overweight and obese women attending health centres. The women were allocated to 2 groups of 30 receiving a standard weight-control programme or motivational interviewing. All constructs of the theory (perceived susceptibility, severity, self-efficacy and response efficacy) and all anthropometric characteristics (except body mass index) were significantly different between the groups at 3 study times. The strongest predictors of intention to do regular physical exercise were perceived response efficacy and attitude at 2- and 6-months follow-up. We showed that targeting motivational interviewing with an emphasis on Protection Motivation Theory constructs appeared to be beneficial for designing and developing appropriate intervention to improve physical activity status among women with overweight and obesity.

Modification de l'attitude et de l'intention vis-à-vis d'une activité physique régulière à l'aide de la théorie de la motivation à la protection : essai contrôlé randomisé

RÉSUMÉ Nous nous sommes servis de la théorie à la motivation à la protection pour tester l'impact des entretiens motivationnels sur l'attitude et l'intention des femmes obèses et en surcharge pondérale vis-à-vis de la pratique d'une activité physique régulière. Lors d'un essai contrôlé randomisé, 60 femmes obèses et en surcharge pondérale se présentant dans des centres de santé ont été sélectionnées par échantillonnage de commodité. Les femmes ont été réparties en deux groupes, chaque groupe comprenant 30 femmes suivant un programme standard de gestion du poids ou assistant à des entretiens motivationnels. Les composantes de la théorie (vulnérabilité perçue, gravité, auto-efficacité et efficacité de la réponse) ainsi que les caractéristiques anthropométriques (sauf l'indice de masse corporelle) étaient toutes significativement différentes entre les groupes à trois moments de l'étude. Les indicateurs de l'intention les plus forts concernant la pratique régulière de l'exercice physique étaient l'efficacité de réponse perçue et l'attitude lors du suivi à deux et six mois. Nous avons prouvé que la réalisation des entretiens motivationnels en mettant l'accent sur la théorie de la motivation à la protection s'est avérée profitable pour la conception et l'élaboration des interventions appropriées afin d'améliorer le statut de l'activité physique chez les femmes obèses et en surcharge pondérale.

¹Health Management and Social Development Research Center, Golestan University of Medical Sciences (Correspondence to: A. Charkazi: rcharkazi@yahoo.com). ²Department of Public Health, Golestan University of Medical Sciences. ³Cereal Health Research Center, Golestan University of Medical Sciences. ⁴Deputy of Research, Golestan University of Medical Sciences. ⁵Environmental Health Research Center, Golestan University of Medical Sciences, Gorgan, Islamic Republic of Iran.

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Introduction

Obesity is now a global problem and the World Health Organization (WHO) has reported that ~300 million people worldwide are affected (1). Overweight and obesity have increased the risk of cardiovascular disease, dyslipidaemia, hypertension and type 2 diabetes mellitus (2). Women might be at greater risk of overweight and obesity than men are (3). Even developing countries such as the Islamic Republic of Iran are affected by the pandemic (4). It has been shown that 34% of Iranian women have body mass index (BMI) > 25 kg/m² (5). Cardiovascular disease is the most important cause of mortality among women (5). Iranian women are 3–4 times more likely to suffer from cardiovascular disease compared to women in other areas of the world (6).

Lack of physical activity (PA) is one of the leading causes of obesity. An 80% decrease in modifiable risk factors including unhealthy diet and lack of PA could reduce the risk of premature heart disease (7). WHO estimates that 31% of adults aged > 15 years are sedentary (8) and ~60% of people worldwide do not meet the recommended daily minimum level of PA (9). Sedentary lifestyle is recognized as a serious challenge in the Islamic Republic of Iran (10). Regular PA is an effective method for prevention of obesity and associated disease (11), and also its wider benefits have been acknowledged (12).

Counselling or education can improve physical activity status (13). Health promotion attempts to modify health-promoting and unhealthy behaviour. Therefore, health promotion research has been designed and implemented to follow or modify healthy behaviour. The Health Belief Model has been used for the study of health promotion behaviour and then revised as the Protection Motivation Theory (PMT) (14,15). The PMT applies an individual's perception of fear in response to health threats. Fear means

motivating or persuading persons to either engage in or adopt behaviour that is determined by the person's belief in the ability of that behaviour to reduce the fear caused by the health threat (16). The aforementioned cognitive process justifies the rationale for the selection of the PMT in the current survey. We also assumed that because PMT is a good predictor of dietary (17) and physical (16) activity, then it would also be a good predictor of overweight and obesity.

Motivational interviewing is a client-oriented and directive method to resolve the individual's ambivalence and increase intrinsic motivation (18). Motivational interviewing has frequently been used in the health area, with beneficial outcomes (18). The number of scientific articles published in this field in the past 3 years has doubled (19). Thus, we sought to investigate the effect of motivational interviewing on attitude and intention toward regular PA based on PMT among women with overweight and obesity who attended urban health centres.

Methods

Study design

We carried out a single-blind, randomized control trial between December 2013 and February 2015 in Gorgan City, Islamic Republic of Iran (Iranian Registry of Clinical Trials code IRCT2015061517736N5). All participants were selected using convenience sampling. All 6 health centres in Gorgan City were considered and 2 were selected (Centres 1 and 6) using a simple random sampling technique. Women are the major users of health centres in the Islamic Republic of Iran because of the type of services provided, such as childhood vaccination and child care.

Participants

Inclusion criteria were as follows: (1) BMI 25–29.9 kg/m² (overweight) or 30–35 kg/m² (obese); (2) being literate and (3) ability to exercise. Exclusion criteria were: (1) pregnancy and (2) absence from > 1 session (standard and motivational interviewing). There were 30 participants in the control group and 30 in the motivational interviewing group. At 2 months follow-up, 2 women were excluded from the control group due to absence from > 1 session. In the motivational interviewing group, 1 woman was excluded due to migration to another city. No women were lost at 6 months follow-up.

Sample size

According to Navidian et al. (20) and the estimation of mean self-efficacy of 57.9 (standard deviation, 34.9) in the intervention group and 44.06 (8.68) in the control group, 95% confidence interval, 95% test power, 30 women in each group and 60 participants in total were considered necessary.

$$n = \frac{(s_1^2 + s_2^2) (z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2}{(\bar{x}_1 - \bar{x}_2)^2}$$

Where s_1 and s_2 are the variances of the two groups, $z_{1-\frac{\alpha}{2}}$ is the confidence level, is the test $z_{1-\beta}$ power, and \bar{x}_1 and \bar{x}_2 are the means of the two groups.

Interventions

The control group received a standard weight-control programme regarding exercise and its beneficial effects on obesity, comprising 2 1-hour sessions per week for 2 weeks. Each session was delivered by a health education specialist. At the end of the sessions, the participants had access to the researchers for asking questions. Motivational interviewing consisted of 5 sessions of 45–60 minutes executed by a psychologist for 7–10 of women for each session held during 2 weeks. A pamphlet designed based on PMT constructs was distributed to all participants. Its

content described the effect of PA in controlling and preventing overweight and obesity. The motivational interviewing group also received the same standard weight-control programme as the control group (4 sessions).

Variables definition

Educational status of participants was classified into 4 levels: elementary school, middle school, high school and university. Current occupation was categorized as housewife, employed, unemployed, retired or others (such as nongovernmental organization). Marital status was classified as single or married. Definitions of overweight and obesity were based on the WHO criteria of $25 \leq \text{BMI} < 30 \text{ kg/m}^2$ for overweight and $\text{BMI} \geq 30 \text{ kg/m}^2$ for obesity (21). Intention toward regular PA was defined as intention to do at least 30 minutes of moderate exercise at least once a week, 3–5 times a week (16).

Anthropometric measurements

Anthropometric measurements were made by an appropriately trained person. Weight was measured to the nearest 0.1 kg using a digital scale, with the women dressed in lightweight clothing. Height was calculated without shoes to the nearest millimetre using a height rod. Waist circumference was measured at the midpoint between the lower costal margin and the top of the iliac crest in a standing position. BMI was the ratio of weight (kg) to square of height (m). Waist girth was measured at the minimum circumference between the iliac crest and the rib cage, and hip girth at the maximum width over the greater trochanters. Waist to hip ratio was then calculated.

Questionnaire

The questionnaire was designed and developed using 7 constructs of PMT theory: (1) sociodemographic characteristics; (2) perceived susceptibility

(28 questions; range 28–140); (3) perceived severity (29 questions; range 29–145); (4) self-efficacy (10 questions; range 10–50); (5) perceived response efficacy (8 questions; range 8–40); (6) intention (2 questions; range 2–10); and (7) attitude toward PA (10 questions; range 10–50). All parts of the questionnaire were scored 1–5 based on a 5-point Likert scale comprising: completely agree, agree, no comment, disagree and completely disagree. Two main variables of the present survey comprising intention and attitude toward regular PA were measured by questions such as: “I intend to increase PA in the 2 future months” for intention, and “PA is an effective way to decrease the risk of obesity” for attitude.

Face validity (5 specialists commented) and content validity (10 specialists commented) were tested, and content validity rate and content validity index were calculated. Reliability of the questionnaire was studied using internal homogeneity and Cronbach's α and the values of these coefficients were also calculated for all structures. Cronbach's α was 0.83, 0.89, 0.78 and 0.88 for perceived susceptibility, perceived severity, perceived response efficacy and intention, respectively. The highest α was for perceived self-efficacy (0.94) and the lowest was for attitude toward PA (0.73).

Ethical approval

The study protocol was approved by the Ethical Committee of the Golestan University of Medical Science (no 930417063). Written informed consent was obtained from all women before participation in the study.

Data analysis

Sociodemographic characteristics and anthropometric data were descriptively reported as mean, standard deviation and percentage. The Kolmogorov–Smirnov test was used to test the normal distribution of the data such as age, BMI, weight, waist circumference and

waist-to-hip ratio, and the constructs of the theory. One-way analysis of variance (ANOVA) was also used to explore the normality of the data (constructs and anthropometric characteristics) at baseline. Repeated measures ANOVA was used to compare anthropometrics characteristics and PMT constructs at 3 times during the survey. Bonferroni test was carried out to assess the changes in constructs at 3 times during the study (comparing pre-intervention with 2- and 6-months follow-up, and 2-months follow-up with 6-months follow-up). A logistic regression model was used to test the relative importance of the theory constructs that predicted the women's intention toward regular PA. A P value ≤ 0.05 was defined as significant.

Results

Baseline characteristics

Baseline characteristics of the control and motivational interviewing groups are shown in Table 1. The mean age of the women was 37.95 (8.78) years (range 21–54) and mean BMI was 28.54 (2.06) kg/m^2 (range 26–33). Most women in the 2 groups had an academic education, were employed and were married.

Change in PMT constructs using repeated measures ANOVA

Repeated measures ANOVA revealed that all PMT constructs comprising perceived susceptibility, perceived severity, self-efficacy, perceived response efficacy, intention and attitude were significantly different in the 2 groups before intervention and at 2- and 6-months follow-up (Table 2). Bonferroni findings revealed that there were significant associations between the 3 times for severity and susceptibility constructs (between pre-intervention and 2- and 6-months follow-ups as well as between 2- and 6-month follow-up) ($P = 0.001$). For the constructs of

Table 1 Demographic characteristics and anthropometric indices of women with overweight and obesity

Variables	Motivational interviewing group (n = 30) Mean (SD)	Control group (n = 30) Mean (SD)	P
Age, yr	37.20 (8.08)	39.03 (9.25)	0.425**
Body mass index, kg/m ²	28.59 (1.81)	28.50 (2.32)	0.873**
Weight, kg	76.05 (6.99)	74.93 (7.16)	0.543**
Waist circumference, cm	84.47 (9.24)	79.97 (7.01)	0.038**
Waist-to-hip ratio	0.79 (0.04)	0.82 (0.04)	0.045**
Education	n (%)	n (%)	
Elementary and middle school	4 (13.3)	7 (23.3)	0.706*
High school	10 (33.4)	8 (26.7)	
Academic	16 (53.3)	15 (50)	
Job	n (%)	n (%)	
Housewife	-	-	
Employed	20 (66.7)	17 (56.7)	0.783*
Unemployed	6 (20)	6 (20)	
Other	4 (13.3)	7 (23.3)	
Marital status	n (%)	n (%)	
Single	5 (16.7)	6 (20)	0.739*
Married	25 (83.3)	24 (80)	

* χ^2 test.

**Independent t test.

Table 2 Comparison of motivational interviewing and control groups about PMT constructs before and after intervention

Constructs	Group	Pre-intervention		2-mo follow-up		6-mo follow-up		P
		Mean	SD	Mean	SD	Mean	SD	
Perceived susceptibility	Control	92.43*	11.95	90.28	11.77	81.96**	9.90	0.001a
	MI	90.76	14.47	108.8	11.04	108.3	10.72	
	Total	91.60	13.1	99.86	14.65	95.40	16.80	
Perceived severity	Control	94.20*	12.59	93.71**	12.22	85.35***	11.94	0.001a
	MI	93.43	14.83	114.5	10.38	112.4	12.44	
	Total	93.81	13.65	104.4	15.35	99.12	18.23	
Perceived self-efficacy	Control	20.96*	7.00	29.21**	8.17	27.89	7.42	0.001a
	MI	22.26	7.35	37.40	7.33	39.27	6.11	
	Total	21.61	7.15	33.44	8.72	33.68	8.84	
Perceived response efficacy	Control	17.13*	4.98	23.57**	6.11	23.00	3.35	0.001a
	MI	17.06	4.77	30.63	5.31	30.48	3.51	
	Total	17.10	4.83	27.22	6.69	26.80	5.08	
Intention	Control	4.00*	1.43	6.17**	1.80	5.87	1.50	0.001a
	MI	4.46	1.69	8.40	1.13	8.75	0.98	
	Total	4.23	1.57	7.32	1.85	7.33	1.93	
Attitude	Control	20.73	4.10	20.73**	4.10	26.96***	6.45	0.001a
	MI	21.23	5.23	21.23	5.23	39.75	5.79	
	Total	20.98	4.67	20.98	4.67	33.47	1.17	

^aRepeated measures analysis of variance.*Bonferroni test (pre-intervention and 2-months follow-up) ($P \leq 0.001$).**Bonferroni test (pre-intervention and 6-months follow-up) ($P \leq 0.001$).***Bonferroni test (2- and 6-months follow-up) ($P \leq 0.001$).

MI = motivational interviewing.

perceived self-efficacy, perceived susceptibility, response efficacy, attitude and intention toward regular PA, there were significant relationships between pre-intervention and 2- and 6-months follow-up ($P < 0.001$), but not between 2- and 6-months follow-up.

Changes in anthropometric characteristics

Weight, waist circumference and waist-to-hip ratio differed significantly between the 2 study groups such that they were decreased more in the motivational interviewing group compared to the control group, whereas BMI did not differ significantly (Table 3).

Predicting regular PA intention based on the PMT constructs using linear regression models

We entered all PMT constructs into the linear regression model using the forward method (Table 4). Perceived response efficacy ($P < 0.001$), perceived severity ($P = 0.014$) and perceived self-efficacy ($P = 0.043$) predicted the women's intention to participate in regular PA at 2-months follow-up. At 6-months follow-up, attitude ($P < 0.001$) and perceived severity ($P = 0.020$) were the only predictors of PA. The strongest

predictors of women's intention to do regular PA were perceived response efficacy ($\beta = 1.398$) and attitude ($\beta = 0.729$) at 2- and 6-months follow-up.

Predicting attitude toward regular PA based on the PMT constructs using linear regression models

We entered all PMT constructs into the linear regression model using the forward method (Table 5). Perceived self-efficacy ($P = 0.009$) was the only predictor of attitude toward regular PA at 2-months follow-up. Perceived self-efficacy ($P < 0.001$) and perceived susceptibility ($P = 0.042$) were predictors of PA at 6-months follow-up. Perceived self-efficacy ($\beta = 0.807$) was the stronger of the 2 predictors.

Discussion

We utilized the PMT to find factors that determined the intention of women attending urban health centres in Gorgan to do regular PA. To the best of our knowledge, the current investigation is the first survey using PMT in the Islamic Republic of Iran focusing on regular PA by women.

In our study, at 2-months follow-up, perceived response efficacy, self-efficacy and severity were predictors of intention to do PA. This agrees with a meta-analysis of 65 related studies representing > 20 health issues (22). Increases in constructs such as perceived severity, perceived susceptibility, response efficacy, and self-efficacy simplified adaptive intentions or behaviours (23). In a study conducted by Yan et al. (22) in China, smoking intention was predicted by PMT constructs (severity, susceptibility, intrinsic rewards, extrinsic rewards, self-efficacy, response efficacy, and response cost), which is similar to our findings. In a review carried out by Cox et al. (24), PMT predictors of intention to consume functional foods explained 59–63% of the variance, and self-efficacy was the strongest predictor. Attitude was the strongest predictor of intention in our survey after 6-months follow-up, which might be explained by the fact that attitude change requires a long time compared to other constructs. Mirkarimi et al. (19) and Park et al. (25) reported that perceived self-efficacy and response efficacy were the strongest predictors of women's intention to follow weight-loss programmes and intention toward functional food

Table 3 Comparison of MI and control groups about anthropometric characteristics before and after intervention

Constructs	Group	Pre-intervention		2-mo follow-up		6-mo follow-up		P
		Mean	SD	Mean	SD	Mean	SD	
BMI	Control	28.39	2.35	27.74	2.21	27.60	2.11	0.938*
	MI	28.58	1.84	27.75	1.72	27.52	1.71	
	Total	28.49	2.09	27.75	1.96	27.56	1.90	
Weight	Control	74.70	7.35	72.98	6.58	72.75	6.53	0.001*
	MI	76.22	7.06	73.89	6.54	72.96	5.92	
	Total	75.47	7.18	73.44	6.51	72.86	6.17	
Waist circumference	Control	79.79	7.21	77.82	6.35	77.39	6.36	0.001*
	MI	84.24	9.32	82.00	8.78	77.96	17.10	
	Total	82.05	8.58	79.95	7.90	77.68	12.88	
WHR	Control	0.823	0.046	0.812	0.042	0.809	0.042	0.001*
	MI	0.800	0.045	0.781	0.045	0.774	0.047	
	Total	0.811	0.046	0.796	0.046	0.791	0.047	

*Repeated measures analysis of variance.

BMI = body mass index; MI = motivational interviewing; WHR = waist-to-hip ratio.

Table 4 Predicting regular PA intention of women based on the PMT constructs using adjusted and unadjusted regression models at 2- and 6-months follow-up

Constructs of the PMT	Unstandardized coefficients		Standardized coefficients	
	β	β	β	<i>P</i>
2-mo follow-up				
Constant	0.760			0.480
Perceived response efficacy	0.388	1.398		0.001
Perceived severity	0.027	0.220		0.014
Perceived self-efficacy	0.157	0.738		0.043
6-mo follow-up				
Constant	0.106			
Attitude	0.159	0.729		0.001
Perceived severity	0.021	0.203		0.020

PA = physical activity; PMT = protection motivation theory.

consumption, which is similar to our present findings.

In the current study, all constructs of the PMT were significantly different between the 2 study groups. This agrees with the survey of Milne et al. (26) that combined motivational and volitional interventions to promote exercise participation. That study presented remarkable differences between the control, motivational interviewing and volitional intervention groups for all the PMT variables about intention and behaviour. Gaston et al. (27) confirmed the beneficial effect of motivational intervention based on the PMT with volitional intervention to promote exercise during pregnancy. They reported that a PMT-centred intervention was not sufficient to bring about behaviour

modification and it must be accompanied by action and coping planning. This might have been caused by 2 different samples in our study (obese and overweight women) and in theirs (pregnant women). Mirkarimi et al. (19) also revealed that all constructs of the PMT were changed significantly after intervention in the motivational interviewing and motivation-intention groups compared to the control group. A meta-analysis of weight-loss interventions exploring diet only with diet and PA reported medium changes of 1.64 kg or 1.24 kg/m² after a combination of dietary and augmented PA (28).

We found that all anthropometric characteristics (except for BMI) were significantly different after intervention between the 2 groups, such that women

in the motivational interviewing group lost more weight and also showed improved indices such as waist circumference and waist-to-hip ratio at 2- and 6-months follow-up. Also, Bonferroni test revealed significant differences at the 3 times of the survey. Moreover, the decrease in BMI or weight loss was greater in the motivational interviewing than the control group. Carels et al. (29) explained that motivational interviewing was effective for people who failed to achieve weight loss through standard programmes, and that they participated in the PA programme, which is in line with our results. Di Marco et al. (30) presented a medium effect of motivational interviewing on BMI, and concluded that it had greater efficacy than traditional treatments.

Table 5 Predicting women's attitude toward regular PA based on the PMT constructs using adjusted and unadjusted regression models at 2- and 6-months follow-up

Constructs of the PMT	Unstandardized coefficients		Standardized coefficients	
	β	β	β	<i>P</i>
2-mo follow-up				
Constant	14.819			0.001
Perceived self-efficacy	0.185	0.340		0.009
6-mo follow-up				
Constant	1.293			0.676
Perceived self-efficacy	0.808	0.807		0.001
Perceived susceptibility	0.079	0.150		0.042

We showed that anthropometric changes in the motivational interviewing group were more stable than those in the control group, which has also been shown in other studies (20, 31).

Our study had some limitations. First, this survey relied upon a self-administered questionnaire (albeit valid) and objective methods might have been preferable. Second, we only included women, which may limit the generalization of the results beyond this survey. It is better to conduct long-term follow-up of PA after implementing motivational interviewing. Despite these limitations, the study protocol was approved by

the Iranian Registry of Clinical Trials. A benefit of this survey was that it was the first to utilize PMT as a theoretical framework to study PA in the Islamic Republic of Iran and may be used as a basis to explore other populations such as teenagers or adults that might be more at risk.

In conclusion, our findings suggest that PMT constructs could be effective in predicting intention to undertake regular PA among women with overweight and obesity. However, further studies should be implemented with the other populations mentioned above to confirm the application of the PMT.

Factors influencing the intention to undertake regular PA should continue to be investigated until age- and gender-tailored strategies can be developed to improve PA in more populations.

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