CLINICAL & BASIC RESEARCH

Voluntary Fasting to Control Post-Ramadan Weight Gain among Overweight and Obese Women

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صوم التطوع للتحكم بزيادة الوزن بعد شهر رمضان لدى زائدات الوزن والبدينات من النساء

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ABSTRACT: *Objectives:* This study aimed to examine the effectiveness of an Islamic voluntary fasting intervention to control post-Ramadan weight gain. *Methods:* This study was conducted between July and November 2011. Two weight loss intervention programmes were developed and implemented among groups of overweight or obese Malay women living in the Malaysian cities of Putrajaya and Seremban: a standard programme promoting control of food intake according to national dietary guidelines (group B) and a faith-based programme promoting voluntary fasting in addition to the standard programme (group A). Participants' dietary practices (i.e., voluntary fasting practices, frequency of fruit/vegetable consumption per week and quantity of carbohydrates/protein consumed per day), body mass index (BMI), blood pressure, fasting blood high-density lipoprotein cholesterol (HDL-C) and total cholesterol (TC):HDL-C ratio were assessed before Ramadan and three months post-Ramadan. *Results:* Voluntary fasting practices increased only in group A (P <0.01). Additionally, the quantity of protein/carbohydrates consumed per day, mean diastolic pressure and TC:HDL-C ratio decreased only in group A (P <0.01, 0.05, 0.02 and <0.01, respectively). Frequency of fruit/vegetable consumption per week, as well as HDL-C levels, increased only in group A (P = 0.03 and <0.01, respectively). Although changes in BMI between the groups was not significant (P = 0.08), BMI decrease among participants in group A was significant (P <0.01). *Conclusion:* Control of post-Ramadan weight gain was more evident in the faith-based intervention group. Healthcare providers should consider faith-based interventions to encourage weight loss during Ramadan and to prevent post-Ramadan weight gain among patients.

Keywords: Overweight; Obesity; Religion and Medicine; Fasting; Weight Gain; Malaysia.

الملخص: الهدف: تهدف هذه الدراسة إلى اختبار مدى فاعلية صوم التطوع الإسلامي في السيطرة على زيادة الوزن في مرحلة ما بعد رمضان. الطريقة: أجريت هذه الدراسة بين يوليو إلى نوفمبر 2011. تم تطوير وتطبيق برنامجَيْن لتقليل الوزن بين مجموعات من النساء الملايو الزائدات الوزن أو السمينات اللاتي يعِشْنَ في مدينتين من مدن ماليزيا هما بوتراجايا وسيريمبان: أحدهما برنامج معياري لترويج السيطرة على تناول الطعام وفقا لمبادئ التوجيهات الغذائية الوطنية (المجموعة ب) والثاني برنامج ديني إيماني لترويج صيام التطوع بالإضافة إلى البرنامج المعياري (مجموعة أ). تم تقييم نسبة الممارسات الغذائية للمشاركين (أي ممارسات صيام التطوع، و تكرار استهلاك الفاكهة/الخضار في الأسبوع، وكمية استهلاك البروتينات/الكربوهيدرات يوميا)، ومؤشر كتلة الجسم (BMI)، وضغط الدم، والكوليسترول المحمول على البروتين الدهني عالي الكثافة (HDL-C) ونسبة الكوليسترول الكلي إلى العالي الكثافة HDL-C:(TC) قبل رمضان وثلاثة أشهر بعد رمضان. النتائج: ممارسات صيام التطوع زادت فقط في مجموعة أ مقارنة بالمجموعة (ب) (0.01> P). بالإضافة إلى ذلك، فإن نسبة كمية بروتين/الكربوهيدرات المستهلكة يوميا، والضغط الانبساطي و HDL-C:TC انخفضت فقط في مجموعة(أ) (0.01> P، 0.05، 0.02، 0.01> على التوالي). تردد استهلاك الفاكهة/الخضار في الأسبوع و مستويات HDL-C، ازدادت فقط في مجموعة (أ) (0.03 = P، 0.01> على التوالي). على الرغم من أن التغيرات في مؤشر كتلة الجسم بين المجموعات لم تكن مؤثرة إحصائياً (0.08 = P)، فقد انخفض مؤشر كتلة الجسم بين المشاركين في مجموعة (أ) بشكل مؤثر (0.01> P). النتيجة: كان التحكم في زيادة الوزن في مرحلة ما بعد رمضان أكثر تأثيرا في المجموعة التي تبنت التدخل الإيماني. لذا يجب على مقدمي الرعاية الصحية اعتبار التدخلات ذات التأثير الإيماني لتشجيع فقدان الوزن خلال شهر رمضان والوقاية من زيادته في مرحلة ما بعد رمضان بين المرضى.

مفتاح الكلمات: الوزن الزائد؛ السمنة؛ الدين والطب؛ الصوم؛ زيادة الوزن؛ ماليزيا.

Advances in Knowledge
- The findings of this study suggest that the promotion of Islamic teachings regarding voluntary fasting and the control of food consumption is useful for regulating food intake among overweight and obese women, helping them to prevent post-Ramadan weight gain.

Applications to Patient Care
- The faith-based intervention proposed in this study could be implemented in other populations similar to those of Malaysia in order to control post-Ramadan weight gain.
- Healthcare workers should consider using faith-based communications to control food intake among selected patients for the purposes of weight control.

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OVERWEIGHT- AND NUTRITION-RELATED non-communicable diseases are increasing globally. According to a systematic review of 38 nationally representative studies from six Gulf countries, approximately two-thirds to three-quarters of adults were overweight or obese.[1] In these countries, the prevalence of nutrition-related non-communicable diseases, such as hypertension and diabetes, was among the highest in the world, with a notably higher prevalence in women.[1] Obesity is a known health risk with critical implications in terms of related mortality.[2] In Malaysia, the third National Health and Morbidity Survey (NHMS) reported a 12.5% increase in overweight individuals and a 9.6% rise in obesity in 2006 compared with results from 1996.[3] Specifically, the most significant increase noted was in obesity rates among women, which had increased by 11.7%. The NHMS 2006 report found that obesity among ethnic Malays, who are predominantly Muslim, was 29.8% (95% confidence interval [CI]: 29.1–30.5).[3] In comparison, the NHMS 2011 report revealed that this rate had increased to 31.1% (95% CI: 29.9–32.3).[4]

Current epidemiological evidence indicates that the rise in the number of overweight individuals in Islamic countries, including Malaysia, is alarming.[1,3,4] Specific intervention models are therefore needed to target this high-risk group. Diet control is acknowledged as an effective method of managing obesity.[5] For certain individuals, dietary practices may be influenced by faith teachings; these teachings may therefore potentially aid the development of dietary interventions. Voluntary fasting and control of food quantity are commendable acts according to Islamic religious teachings.[6,7] Christian faith-based health and dietary interventions have reportedly been successful in reducing weight and health risks.[8,9] A study by Jaber *et al.* demonstrated that a culturally specific programme with both dietary and exercise components was more readily received than other dietary programmes and could be more effectively implemented to achieve weight loss among participants.[10]

Among Islamic followers, the most obvious dietary change occurs during Ramadan, when Muslims fast during the day for a period of one lunar month. While many studies report significant weight reduction during Ramadan, the weight that was lost is typically regained within one month.[11–13] The purpose of this study was to examine the effectiveness of an Islamic faith-based dietary intervention to control post-Ramadan weight gain. The intervention promoted post-Ramadan voluntary fasting and encouraged individuals to control their food intake at all times. It was hypothesised that the control of food consumption and the retainment of Ramadan-induced weight loss would be more pronounced in the faith-based intervention group than the control group.
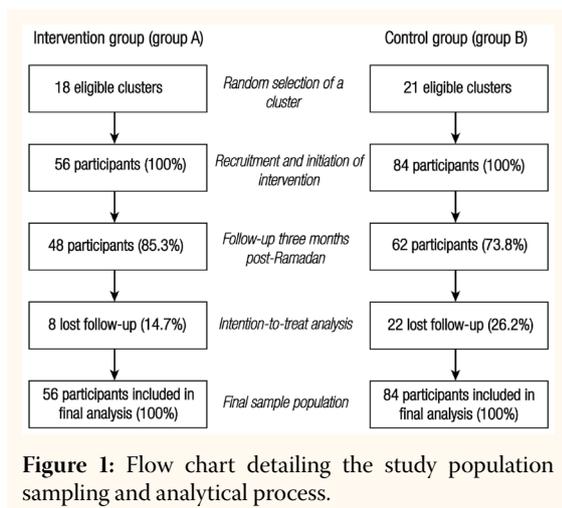
Methods

This study was conducted between July and November 2011 and included 140 Muslim Malay women working at selected government offices in the Malaysian cities of Putrajaya and Seremban. The participants all had a body mass index (BMI) of >25 kg/m^2. Participants were excluded from the study if they were pregnant, taking cholesterol-lowering medications, following a commercial replacement diet to lose weight or if they had a medical condition that prevented them from fasting. A quasi-experimental design was followed and included an intervention group and a control group, with serial data collected pre- and post-intervention.

A randomised cluster sampling method was used among consenting government offices [Figure 1]. The head of each office gave administrative approval and participants were unaware of the allocation of the groups. The sample size was calculated using a mean difference formula based on a previous lifestyle intervention study conducted in Malaysia that evaluated similar variables.[14] After estimating a non-response rate of 10%, the appropriate sample size was calculated at 86 participants per group; however, only 56 and 84 respondents agreed to participate in the intervention and control groups, respectively.

Two dietary intervention programmes were developed. The first was a standard programme promoting food quantity control, which consisted of a copy of national dietary guidelines developed by the Malaysian Ministry of Health in 2010 as well as a food diary based on these guidelines.[15] The second intervention included the same components as the standard programme, with additional faith-based components. The faith-based components took the form of four booklets containing relevant Islamic information motivating participants to be healthy, control the quantity of food consumed, practice voluntary fasting and remain steadfast in their efforts. Additionally, the food diary in the faith-based intervention was printed with religious quotations.

Participants in the intervention group (group A) received the faith-based intervention, prescribing post-Ramadan voluntary fasting and dietary control, while those in the control group (group B) received the standard intervention only. All participants had the relevant dietary intervention programme explained to them thoroughly. In addition, all subjects were trained on methods of monitoring, estimating and reporting their food quantity intake (determined by the number of days per week during which vegetables

Figure 1: Flow chart detailing the study population sampling and analytical process.

and fruit were consumed and the number of servings of carbohydrates and protein consumed per day).

Data were collected from the participants as follows. Pre-intervention/baseline data were collected in the month before Ramadan at the participants' place of work and the follow-up data were collected three months post-Ramadan using a validated self-administered questionnaire. BMI was calculated using height and weight measurements determined via a tape measure and scale. Blood pressure was also measured on-site and blood biochemistry was tested using fasting venous blood drawn for laboratory analysis on the same day. The respondents' levels of physical activity were measured at baseline only using a Malaysian version of the International Physical Activity Questionnaire.[16]

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS), Version 20.0 (IBM Corp., Chicago, Illinois, USA). An intention-to-treat analysis technique was also applied [Figure 1]. Any missing values were replaced with baseline values, assuming that there was no change for that participant. Basic characteristics between the groups were compared using a t-test. Changes between baseline and post-intervention values were compared using a repeated measure analysis of variance test (time*group effect). Behavioural changes within the groups were determined using McNemar's test for categorical data and a paired t-test for continuous data. Appropriate covariate adjustments were performed for the relevant analysis (e.g. age and parity for the BMI analysis and physical activity scores for the blood biochemical analysis).

This study was approved by the Universiti Kebangsaan Malaysia Medical Centre Research & Ethics Committee. Written consent was obtained from all respondents and confidentiality was assured.

Table 1: Baseline characteristics measured before Ramadan among Malay Muslim women in a faith-based dietary intervention (group A) and those adhering to a standard dietary intervention (group B)

Characteristic	Group A (n = 56)	Group B (n = 84)	*P*
Age in years, mean ± SD	36.65 ± 10.16	39.84 ± 10.28	0.07
Parity, mean ± SD	1.79 ± 2.14	2.67 ± 1.89	0.01*
Monthly income in RM, mean ± SD	3,472 ± 1,979	3,369 ± 2,212	0.76
Physical activity score in MET-minutes/week, mean ± SD	1,204 ± 1,408	2,120 ± 2,787	0.03*
Marital status, n (%)			
Single	14 (25.0)	12 (14.3)	0.28
Married	42 (75.0)	72 (85.7)	
Education level, n (%)			
High school	36 (64.3)	57 (67.9)	0.23
Tertiary	20 (35.7)	27 (32.1)	
Employment position, n (%)			
Managerial	17 (30.4)	18 (21.4)	0.23
Clerical	39 (69.6)	66 (78.6)	

*SD = standard deviation; RM = Malaysian ringgit; MET = metabolic equivalent of task. *Significant at P ≤0.05.*

Results

A total of 56 Malay Muslim women agreed to participate in group A (the faith-based intervention group) and 84 agreed to participate in group B (the control group). The characteristics of the two groups were similar at baseline, except that the mean parity and physical activity scores were significantly lower in group A than in group B [Table 1]. The mean number of children was 1.79 ± 2.14 and 2.67 ± 1.89 (*P* <0.01) and the mean physical activity score was 1,204 ± 1,408 and 2,120 ± 2,787 metabolic equivalent of task-minutes/week (*P* = 0.03), in groups A and B, respectively.

The follow-up rate at three months post-Ramadan was 85.7% in group A (n = 48) and 73.8% in group B (n = 62). Table 2 shows the changes in voluntary fasting practices from baseline within the groups. Assessments at three months post-Ramadan showed an overall increase in voluntary fasting in group A (*P* <0.01) as well as an increase in all types of voluntary fasting, with a significant increase in fasting on Mondays only, Thursdays only and for six days in *Syawal*, the month following Ramadan (*P* = 0.01, 0.04 and 0.03, respectively). Among the participants in

Table 2: Voluntary fasting practices at baseline and at three months post-Ramadan follow-up among Malay Muslim women adhering to a faith-based dietary intervention (group A) or a standard dietary intervention (group B)

Practice	Group A (n = 56)					Group B (n = 84)				
	Baseline n (%) a	Follow-up n (%) b	% difference b−a	% change (b-a)/a x 100	$P^†$	Baseline n (%) a	Follow-up n (%) b	% difference b−a	% change (b-a)/a x 100	$P^†$
Overall	34 (80.7)	45 (80.4)	19.7	32.4	<0.01*	62 (73.8)	61 (72.6)	−1.2	−1.6	1.00
Specific										
Mondays only	4 (7.1)	13 (23.2)	16.1	226.8	0.01*	23 (27.4)	19 (22.6)	−4.8	−17.5	0.45
Thursdays only	6 (10.7)	13 (23.2)	12.5	118.8	0.04*	17 (20.2)	18 (21.4)	1.2	5.9	1.00
Mondays and Thursdays	25 (44.6)	29 (51.8)	7.2	16.1	0.42	34 (40.5)	32 (38.1)	−2.4	−5.9	0.77
Three days in a month	4 (7.1)	7.1 (4)	0.0	0.0	1.00	10 (11.9)	7 (8.3)	−3.6	−30.2	0.45
Prophet David's fasting	0 (0.0)	0 (0.0)	0.0	0.0	-	1 (1.2)	1 (1.2)	0.0	0.0	1.00
Six days during *Syawal*	19 (33.9)	29 (51.8)	17.9	50.1	0.03*	36 (42.9)	41 (48.8)	5.9	13.8	0.48
Other‡	2 (3.6)	6 (10.7)	7.1	213.9	0.22	15 (17.9)	8 (9.5)	−8.4	−46.9	0.12

Syawal = the month following Ramadan.

*†McNemar's test. *Significant at P ≤0.05. ‡Including obligatory fasting to replace any fasting not performed during Ramadan as well as fasting to fulfil a pledge.*

group B, no increase was noted in overall voluntary fasting and there were no significant increases among specific types of voluntary fasting.

Table 3 shows that baseline dietary practices (i.e. voluntary fasting, the number of days per week during which fruit and vegetables were consumed and the number of servings of carbohydrates and protein consumed per day) were similar between groups A and B. However, significant differences were noted between the groups during post-Ramadan assessments regarding the frequency of vegetable consumption per week ($P = 0.03$) and the number of servings of protein and carbohydrates consumed per day ($P <0.01$ and $P = 0.05$, respectively). The frequency of vegetable consumption per week increased in group A and decreased in group B, whereas the number of servings of protein and carbohydrates consumed per day decreased in group A and increased in group B.

Additionally, Table 3 shows that the mean BMI in groups A and B were similar at baseline. At three months post-Ramadan, mean BMI had decreased significantly in group A from 31.01 ± 4.07 kg/m² to 30.52 ± 4.03 kg/m² ($P ≤0.01$; CI: 0.22–0.75). In comparison, the decrease in mean BMI for group B was not statistically significant (31.14 ± 4.26 kg/m² to 30.98 ± 4.28 kg/m²; $P = 0.16$; CI: −0.06−0.38).

However, changes in BMI between the groups was not significant ($P = 0.08$).

The mean baseline diastolic blood pressure (DBP) in group B was lower than that of group A ($P = 0.05$). However, at three months post-Ramadan, mean DBP had reduced significantly in group A ($P <0.01$) and a comparison of the changes between the two groups found a statistically significant difference ($P = 0.02$). Baseline high-density lipoprotein cholesterol (HDL-C) levels were higher in group B ($P <0.01$) and the calculated total cholesterol (TC):HDL-C ratio was lower in group B ($P <0.01$). Post-Ramadan, HDL-C levels had increased in group A and decreased in group B; comparing the changes between the groups showed that the difference was statistically significant ($P <0.01$). The mean TC:HDL-C ratio decreased in group A and increased in group B with a statistically significant difference between the two groups ($P <0.01$).

Discussion

In this study, a faith-based approach was used to develop a weight loss intervention. The treatment prescribed in this Islamic faith-based programme was to practice voluntary fasting after Ramadan and

Table 3: Changes in baseline dietary and weight loss variables among Malay Muslim women adhering to a faith-based dietary intervention (group A) or a standard dietary intervention (group B) before Ramadan and at a three month post-Ramadan follow-up

Variable	Group A (n = 56)			Group B (n = 84)			Comparison			
	Baseline, mean ± SD	Follow-up, mean ± SD	$P^{\dagger}$	Baseline, mean ± SD	Follow-up, mean ± SD	$P^{\dagger}$	At baseline		At follow-up	
							t value	$P^{\ddagger}$	F statistic (df)	$P^{\S}$
Fasting in days/month	2.30 ± 2.62	2.34 ± 3.02	0.91	2.71 ± 2.62	2.27 ± 2.30	0.05*	0.91	0.37	1.61 (1,138)	0.21
Vegetable consumption in days/week	4.63 ± 2.02	5.02 ± 1.80	0.06	4.86 ± 2.21	4.48 ± 2.21	0.13	0.64	0.53	4.95 (1,138)	0.03*
Fruit consumption in days/week	3.80 ± 1.86	4.13 ± 1.73	0.13	4.32 ± 2.05	4.12 ± 1.91	0.35	1.52	0.13	2.82 (1,138)	0.10
Carbohydrates servings/day	3.17 ± 0.91	2.98 ± 0.95	0.11	3.14 ± 1.09	3.29 ± 1.05	0.18	0.17	0.87	4.00 (1,138)	0.05*
Protein servings/day	2.38 ± 1.15	2.20 ± 0.92	0.08	2.15 ± 0.83	2.42 ± 0.99	0.01*	1.36	0.18	8.70 (1,138)	<0.01*
BMI in kg/m²	31.01 ± 4.07	30.52 ± 4.03	<0.01*	31.14 ± 4.26	30.98 ± 4.28	0.16	0.17	0.86	3.12 (1,136)	0.08
SBP in mmHg	123.4 ± 12.3	122.0 ± 14.3	0.33	124.5 ± 18.1	124.0 ± 19.9	0.63	0.30	0.70	0.14 (1,137)	0.71
DBP in mmHg	79.8 ± 10.3	77.1 ± 10.5	<0.01*	76.4 ± 10.1	77.1 ± 11.0	0.44	1.96	0.05	6.09 (1,137)	0.02*
HDL-C in mmol/L	0.73 ± 0.19	0.79 ± 0.22	0.01*	1.27 ± 0.36	0.90 ± 0.29	<0.01*	10.29	<0.01*	78.63 (1,131)	<0.01*
TC:HDL-C ratio	6.97 ± 1.73	6.82 ± 2.36	0.40	3.87 ± 1.06	4.87 ± 1.58	<0.01*	13.12	<0.01*	30.66 (1,131)	<0.01*

SD = standard deviation; df = degrees of freedom; BMI = body mass index; SBP = systolic blood pressure; DBP = diastolic blood pressure; HDL-C = high-density lipoprotein cholesterol; TC = total cholesterol.

*†Paired t-test. ‡Independent t-test. §Repeated measure analysis of variance (time*group effect). *Significant at $P \leq 0.05$, adjusted to covariate age and parity.*

to control food quantity consumption at all times. In the comparison between the control and fasting intervention groups of overweight or obese Malay women, most baseline characteristics were similar. However, the control group appeared to be healthier as the respondents were more physically active and their mean HDL-C levels were higher than that of the fasting intervention groups. These differences could have resulted from unknown confounding variables among the groups associated with the local setting and could not be controlled in a study with a quasi-experimental design.

The effect of the two weight loss programmes was investigated at a three month post-Ramadan follow-up. Control of food consumption and voluntary fasting practices were more pronounced in the faith-based intervention group than in the control group. Decreased food consumption among the intervention group could have resulted from the practice of voluntary fasting; religious motivation may have caused subjects to exercise greater control. The overall

percentage of participants practicing voluntary fasting increased only among those taking part in the faith-based intervention. When the dietary behaviour changes were quantified, a comparison between the groups showed that the number of servings of carbohydrates and protein consumed decreased in group A. A further positive dietary behaviour change observed among this group was the significantly increased frequency of vegetable consumption. This is important as several studies have shown that an increase in vegetable intake contributes to increased weight loss.[14,17]

The food quantity control demonstrated by participants taking part in the faith-based intervention could also be translated as reduced energy consumption. Reduced consumption may have corrected an energy imbalance in the overweight and obese respondents, contributing to the successful retainment of Ramadan weight loss. As a result, the participants' mean BMI was significantly lower three months after Ramadan than it had been before. Additionally, mean DBP was

observed to decrease in the intervention group and increase in the control group. Generally, reduction in DBP may occur due to a corresponding decrease in weight, as weight loss has been shown to positively correlate with reduced blood pressure.[18,19] The effect of the faith-based dietary intervention was more obviously observed in the participant's DBP rather than systolic blood pressure. Several studies have also shown that intermittent fasting and caloric restriction lowers blood pressure because it reduces oxidation damage and increases cellular resistance.[20,21] As these fasting practices were more frequent among subjects in the faith-based intervention, this may further explain the reduction in mean BP.

In the current study, biochemical changes in the blood were assessed in order to compare changes in health risk using the TC:HDL-C ratio, a measurement that indicates the risk of several diseases such as coronary heart disease.[22] At baseline, mean TC:HDL-C ratio was significantly higher in the faith-based group. Although the mean ratio remained high in this group even at the three month follow-up, there was a significant decrease in the mean ratio due to the increase in mean HDL-C. This may have resulted from the act of fasting as research has shown that HDL-C increases 20–30% after fasting.[23,24] Changes in the control group, however, showed the opposite result. This may have been due to several confounding factors that were not measured in this study, such as reduced physical activity, which is positively associated with HDL-C, or reduced consumption of HDL-C-producing foods such as fish.[25,26]

Studies have shown that one of the best predictors of weight loss maintenance is adherence to the programme.[27,28] Women participating in the faith-based intervention may have been more successful in maintaining Ramadan weight loss due to an improved adherence to the weight loss regime.

The theory of planned behaviour (TPB) is used to explain the expected differences in behavioural changes; this theory states that behaviour intention predicts behaviour change.[29] Although material provided in the standard intervention was received by both groups, the faith-based intervention group received additional relevant religious information. This included, for example, reminders of the prohibition of overeating from a religious perspective. This additional information may have enhanced the motivation of these subjects to control their food consumption (behaviour intention). Previous studies have shown that faith-related goals can strengthen behaviour intention and drive on-going pursuits with or without immediate tangible health outcomes.[30,31] Therefore, a faith-based approach to dietary control could

prevent participants from giving up after failed weight loss attempts.

The main limitations of this study include the quasi-experimental study design, as local environmental influences could not be controlled, and the loss of participants during the three month follow-up period. The limitation of the study design was minimised by using a control group and serial data collection. The effect of the loss of follow-up was minimised by using the intention-to-treat statistical principle.

Conclusion

In this study, the control of post-Ramadan weight gain was more evident among overweight and obese Malay women undergoing an Islamic faith-based intervention than among those undergoing a standard dietary intervention. These findings suggest that voluntary fasting during Ramadan and at other times could serve as an excellent method to control food intake, while relevant Islamic-based motivation and information could enhance these practices. Healthcare providers should consider promoting faith-based dietary interventions by encouraging Ramadan weight loss and the prevention of post-Ramadan weight gain.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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