# The role of a healthy-eating educational module during Ramadan in a community health centre

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### Article points

1. Fasting can increase the risk of hypo- and hyperglycaemia.
2. Education on healthy eating, with a module on fasting for Ramadan, plus follow up improved adherence to a healthy diet and medication.
3. Blood glucose levels were better during follow up in participants who had received education.

### Key words

- Adherence
- Diabetes education
- Fasting
- Ramadan

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**A large number of adult Muslims fast during the month of Ramadan, including many people with type 2 diabetes. There are major changes in dietary pattern and medication consumption during this month and patients are therefore at risk of complications, such as hypoglycaemia and hyperglycaemia. This study evaluates the impact of an educational module and individual follow up on adherence to a healthy diet, medication use and glucose levels during Ramadan in a community setting.**

Many Muslims fast during Ramadan. The fasting period typically lasts 12–13 hours a day for 29–30 days. In general, there are two major meal times – before dawn and at dusk – often resulting in increased sugary drink and carbohydrate intake (Benaji et al, 2006). The EPIDIAR (Epidemiology of Diabetes and Ramadan) study reported that 43% of people with type 1 and 79% people with type 2 diabetes fast during Ramadan in Muslim countries, increasing their risk of severe hypo- or hyperglycaemia (Salti et al, 2004). Research suggests there is often inadequate consultation with healthcare professionals regarding medication adjustment and dietary modifications during Ramadan (Hassanein et al, 2017; Lee et al, 2017a). The management of diabetes during this period may be different to usual care and there should be an emphasis on education to prevent complications while respecting the individual's wishes.

## The role of education

The positive effects of systematic education and diabetes self-management have been widely established. Self-management has a profound impact on glycaemic index (Norris et al, 2001; 2002) and education has a favourable effect on quality of life (Brown, 1999; Renders et al, 2001). A recent randomised study of telemedicine in Malaysia suggested that pre-Ramadan education with continuous monitoring could reduce the incidence of hypoglycaemia and improve $HbA_{1c}$ concentration (Lee et al, 2017b). An earlier Saudi Arabia-based study also showed a reduction in hypoglycaemic index and improvement in $HbA_{1c}$ after a focused education programme (Tourkmani et al, 2016).

Most studies investigating the impact of diabetes education before Ramadan use $HbA_{1c}$ as the outcome measure; however, this may not accurately represent the variation in blood glucose (BG) levels during Ramadan. Our study aims to evaluate the effects of a specific educational module and individual follow up on adherence with a healthy diet and medication as well as observed BG profiles in people with type 2 diabetes who are fasting. The study took place in an outpatient community health setting in Indonesia.

## Method

This study was conducted during the month of Ramadan (7 June–6 July 2016) at Mulyorejo Community Health Centre in Surabaya City. Participants needed to be committed to fasting during the study process, have a confirmed

diagnosis of type 2 diabetes, be on oral medication, be literate and be willing to participate in the follow up. People were excluded if they were on insulin therapy or had chronic comorbidities including chronic kidney disease, ischaemic heart disease, chronic heart failure or liver disease. Ethical clearance was obtained from the Research Ethics Committee of the Faculty of Nursing at Universitas Airlangga in Surabaya, Indonesia.

Participants were recruited by consecutive sampling on attendance at the community health centre. Informed consent was obtained, participation was voluntary and patients were informed that they were free to withdraw consent at any stage. Participants had their capillary BG level measured and completed a questionnaire to determine their adherence to a healthy diet for diabetes (Morisky et al, 2008; Permatasari, 2014). They were interviewed to gather baseline data and identify daily dietary habits during Ramadan, following which they were assigned to the intervention or control group. All tests were repeated 1 week after admission to the study. Data were recorded on standardised forms and used consistently.

The intervention group was educated about what constitutes a healthy diet for people with diabetes. The education programme included a specific module about fasting during Ramadan. Participants were given an outline of the programme and received individual mentoring on the fasting module. Follow-up was scheduled on days 3 and 7. The aim of the follow up on day 3 was to confirm that participants were adhering to the study protocol and applying the principles of the education programme. Participants in the control group did not receive the educational programme; the follow-up appointments on days 3 and 7 were to confirm adherence to fasting.

## Dietary module

The *Diabetisi Sehat Saat Ramadan* (Healthy Diet for Diabetics during Ramadan) module, which was written in Bahasa (the Indonesian language), was developed by the Division of Medical Surgical Nursing and covers:

- Details of who is medically fit to fast
- The effects of fasting on those with diabetes
- Dietary recommendations during fasting,
- Advice on meal patterns
- Recommended ingredients
- Medication management during Ramadan.

The module was customised to incorporate local culture and understanding.

## Questionnaire

### Adherence to a healthy diet

The questionnaire used to assess dietary adherence was adapted from the one developed by Permatasari (2014). It contained 13 questions, see *Box 1*, with answers graded using a Likert scale. Favourable questions (1, 2, 8, 9, 10 and 11) scored 1 for strongly disagree, 2 for disagree; 3 for agree and 4 for strongly agree. For unfavourable questions (3, 4, 5, 6, 7, 12 and 13) this scoring was reversed, so a cross in the strongly agree box scored 1, etc. The questionnaire had a maximum score of 52 and has been assessed for validity and reliability in Bahasa (Permatasari, 2014).

### Medication adherence

The level of adherence to medication was assessed using the eight-question Morisky Medication Adherence Scale-8 (MMAS-8) questionnaire (Morisky et al, 2008). The validity of the questionnaire has been assessed in Bahasa (Vika et al, 2016). MMAS-8 is the latest version of MMAS-4, a similar questionnaire with four questions. It has an acceptable level of sensitivity and specificity (Morisky and DiMatteo, 2011) and was chosen because it is relatively simple to complete in a short period of time. The response to each question was

**Page points**

1. The intervention group received information on the education programme and individual mentoring on the fasting module.
2. Follow up was to determine adherence to the study protocol and principles of the programme (intervention group) or to confirm adherence to fasting (control group).
3. Adherence to diet, medication use and blood glucose levels were measured.

**Box 1. Questions patients were asked about adherence to a healthy diet**

1. I eat according to the schedule recommended by my doctor or health practitioner
2. I eat food according to the recommendation from my doctor or health practitioner
3 I do not want to follow the dietary recommendation from my doctor or heath practitioner because it is an inconvenience for me
4. I have been too busy with my work and I do not eat according to the recommended meal times
5. I often consume sweet or sugary foods and drinks
6 I often eat fast food or fatty food (such as fries or animal innards)
7. I eat more than three major meals every day
8. I consume food that contains more vitamins and minerals
9 I eat food that is rich in protein such as meat, eggs or soybean
10. I eat fruit and vegetables every day as recommended by the doctor
11. I weigh myself every day
12. I often consume salty food, such as dried fish
13. I often have snacks outside regular mealtimes

scored 0 or 1. Responses were categorised into three groups: high (score 8), medium (6–7) and low adherence (<6) (Morisky et al, 2008).

### Statistical analysis

Data obtained from the questionnaires were processed using Microsoft Excel and analysed using SPSS v22 software. Participants' baseline demographics were expressed as categorical data, with frequencies and percentages, or continuous data, with mean and one standard deviation. Continuous data were analysed using independent samples t-test and categorical data by applying Fisher's exact test.

Adherence to a healthy diet, MMAS-8 scores and random capillary BG levels were scored and displayed as continuous data. The differences in scores at the start and end of the study were measured using Wilcoxon signed-rank test. Baseline differences between these variables were tested using Mann–Whitney U test. A *P* value of <0.05 was considered significant.

**Table 1. Baseline characteristics of the participants.**

| Characteristic | Control group (*n*=49) | % | Intervention group (*n*=39) | % | *P* value |
|---|---|---|---|---|---|
| **Age (years; mean ± SD)** | 58.6 ± 8.6 | | 58.9 ± 7.5 | | 0.935 |
| **Gender** | | | | | 0.799 |
| Female | 39 | 80% | 30 | 77% | |
| Male | 10 | 20% | 9 | 23% | |
| **Employment status** | | | | | 0.378 |
| Employed | 20 | 41% | 12 | 31% | |
| Unemployed | 29 | 59% | 27 | 69% | |
| **Education level** | | | | | 0.176 |
| Primary school | 16 | 33% | 23 | 59% | |
| Secondary school | 10 | 20% | 4 | 10% | |
| High school | 6 | 12% | 3 | 8% | |
| Undergraduate/bachelor | 3 | 6% | 1 | 3% | |
| No formal education | 14 | 29% | 8 | 21% | |
| **Monthly income*** | | | | | 1.000 |
| Below regional wage | 46 | 94% | 37 | 95% | |
| Above regional wage | 3 | 6% | 2 | 5% | |
| **BMI** | | | | | 0.579 |
| Underweight (<18) | 2 | 4% | 3 | 8% | |
| Normal (18–25) | 26 | 53% | 21 | 54% | |
| Overweight (25–30) | 13 | 27% | 12 | 31% | |
| Obese (>30) | 8 | 20% | 3 | 31% | |
| **Other chronic diseases** | | | | | |
| Hypertension | 19 | 39% | 3 | 38% | 1.000 |
| Other metabolic diseases† | 14 | 29% | 21 | 54% | 0.028 |
| Neurovascular disease | 3 | 6% | 0 | 0% | 0.251 |
| Respiratory disease | 1 | 2% | 2 | 5% | 0.582 |
| Musculoskeletal disease | 1 | 2% | 0 | 0% | 1.000 |

*Minimum wage in 2016 ~US$235; †hyperuricaemia and/or hypercholesterolaemia.

## Results

### Demographic data

During the recruitment period, 172 individuals were screened for eligibility. Of these, 81 were excluded: 45 did not meet the inclusion criteria, 19 refused to participate and 17 were excluded for other reasons (such as they expected to menstruate during the study or were away during the follow-up period). Ninety-one participants who met the criteria and signed the informed consent form were included.

Eighty-eight participants – 19 male and 69 female – completed the study protocol. Participants' mean age was 58.8 ± 8.1 years (range: 36–79 years). Overall mean BMI was 25.1 ± 5.1 kg/m$^2$ (range: from 16.4–49.7 kg/m$^2$). Five participants (5.7%) were underweight, 47 (53.4%) were normal weight, 25 (28.4%) were overweight and 11 (12.5%) were obese.

Fifty-six participants (63.6%) were unemployed. Of the 32 who were employed, only five (5.7%) had a monthly income above the regional minimum wage (approximately US$235). Ten patients (11.4%) were smokers at the time of recruitment.

Both groups were similarly matched in age, sex, employment status, BMI, chronic comorbidities and income status, see *Table 1*. There was a non-significant difference in the groups' education level.

### Dietary adherence

All participants in the control group and 93% (39/42) of the intervention group completed the follow up. The mean start score was 36.6 ± 3.1 (range: 29–44) for the control group and 37.6 ± 4.8 (range: 24–47) for the intervention group (*P*=0.406). The end scores were 36.9 ± 2.9 (range:

30–43) and 42.2 ± 3.2 (range: 30–47) in the control and intervention group, respectively. There was a significant improvement in the intervention group test scores, with an absolute increase in mean score of 4.6 ($P$<0.001), see *Figure 1*. No significant difference was observed in the control group (absolute difference 0.3; $P$=0.277).

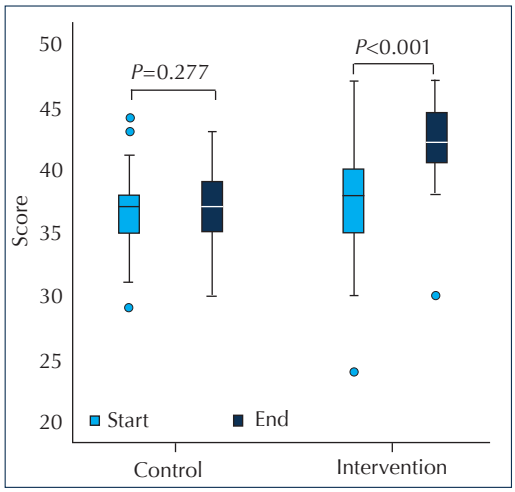


*Figure 1. Dietary adherence at the study start and end.*

## Medication adherence

Adherence to medication was measured using MMAS-8 scores, see *Figure 2*. At the start of the study, average MMAS-8 scores were 4.9 ± 1.9 and 5.3 ± 2.0 for the control and intervention group, respectively ($P$=0.443). At the end of the study, there was little change in the mean score of the control group (4.8 ± 2.1; $P$=0.557) but a significant increase in adherence (from low to medium) in the intervention group (6.6 ± 0.7; $P$ <0.001).

The intervention group had an increase in all MMAS-8 question scores except for question 7 (Do you ever feel hassled about sticking to your diabetes treatment plan?), see *Figure 2*. The highest absolute score was for question 1 (Do you sometimes forget to take your diabetes pills?). The mean scores for questions 1, 2 (Over the past 2 weeks, were there any days when you did not take your diabetes medicine?) and 4 (When you travel or leave home, do you sometimes forget to bring along your medications?) did not change in the control group. There was only a slight increase in scores for the remaining questions.

## Blood glucose levels

The random BG level for the intervention group was initially higher than the control group (10.8 ± 4.5 mmol/L versus 10.1 ± 5.0 mmol/L, respectively; $P$=0.445). At the end of follow up there was a significant decrease in BG level in the intervention group (7.0 ± 2.8 mmol/L; $P$<0.001). In contrast, the control group's BG level had increased (10.8 ± 4.2 mmol/L; $P$ =0.227), see *Figure 3*.

## Discussion

Outpatients with type 2 diabetes, such as the participants in this study, are generally 'healthier' than those in hospital and are more likely to fast during Ramadan. Adherence to a healthy diet in this group of patients was improved by participation in the education programme. This result is consistent with previous studies showing that educational programmes for people with diabetes can improve diabetes control (Bravis et al, 2010; Ahmedani et al, 2012; McEwen et al, 2015).

Factors that contribute to improved adherence to a healthy diet include knowledge and information

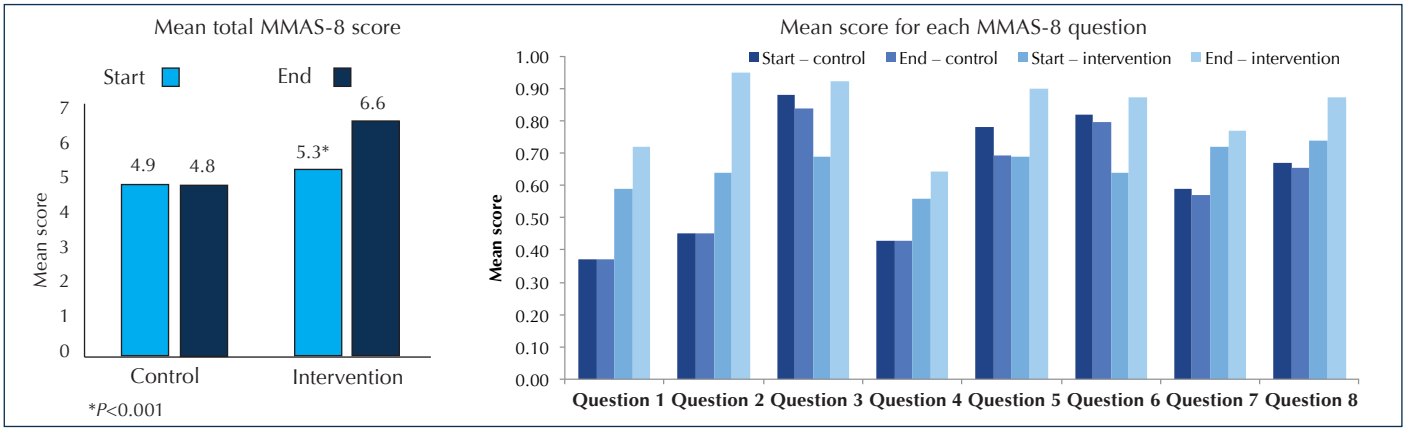


*Figure 2. Medication adherence at the start and end of the study and mean scores for the MMAS-8 questions in the intervention and control groups.*

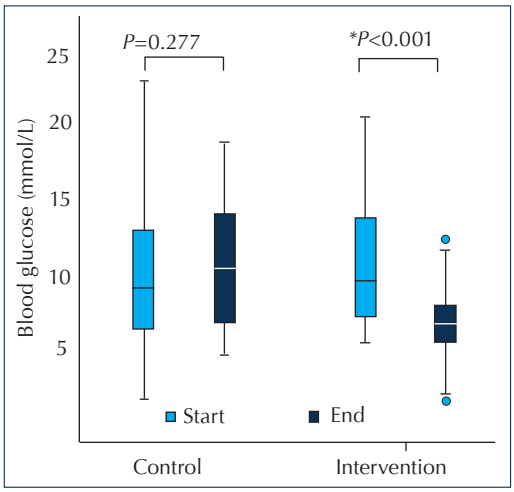


*Figure 3. Blood glucose levels at the study start and end.*

regarding dietary recommendations in diabetes (Archuleta et al, 2012), support, education and counselling (Schechter and Walker, 2002). This study found that people with diabetes were more likely to change their diabetes management after receiving individual mentoring. Participants also had greater knowledge of the symptoms of hypoglycaemia and how to reduce their BMI. Education before Ramadan resulted in the reduction in $HbA_{1c}$ level, and this may be partly associated with improved dietary management during Ramadan (Norris et al, 2001; 2002; Tourkmani et al, 2016; Lee et al, 2017b).

The intervention group reported greater adherence to medication than the control group; an outcome that was also found by Al-haj Mohd et al (2016), although the latter study was not specifically targeted at individuals fasting during Ramadan. Factors associated with medication adherence include the complexity of therapy, adverse drug events, reminder systems and psychosocial aspects (Garcia-Perez et al, 2013; Al-haj Mohd et al, 2016). The average score for 'Do you sometimes forget to take your diabetes pills?' increased in the intervention group, indicating that the external reminder is an important determinant of adherence. Adherence impacts not only complications, such as stroke, myocardial infarction and other vascular-related diseases (Simpson et al, 2016), but also the healthcare costs (Ho et al, 2009) associated with chronic diseases.

We found adherence to diet and medication to be consistent with the decrease in average random BG level. Siaw et al (2016) reported a significant reduction in $HbA_{1c}$ level in patients with high baseline BG, but this seems to be temporary during Ramadan. Studies examining glinide (Mafauzy, 2002) and mixed insulin (Hui et al, 2010) management during fasting indicated favourable glycaemic control. Despite the possibility that random capillary BG level may not reflect average glycaemic index, there was a strong correlation between education with follow-up and reduction in BG level via dietary and medication adherence in our study. It should be noted, however, that $HbA_{1c}$ value may not be a reliable parameter during a short period of intervention.

Fasting can be safe and there should be low risk of hypo- or hyperglycaemia provided that diet is managed well. It is recommended that people with diabetes be actively involved in their dietary management (Evert et al, 2013) and divide meals into smaller portions to prevent excessive intake.

### Study limitation

This study was non-randomised and only involved one community health centre, which may introduce bias. Despite this, we believe that a continuous structured educational programme during fasting can help people with diabetes achieve good control of the disease and reduce their risks of complications.

## Conclusion

Participation in the educational module and individual follow up during Ramadan improved adherence to a healthy diet and medication use as well as reducing random BG level. Further research involving more centres is required to explore the findings in greater depth. ■

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