

Second Edition



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Medical Nutrition Therapy Guidelines for Type 2 Diabetes Mellitus



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This is an update and revised medical nutrition therapy guidelines for Type 2 Diabetes (T2DM). This guideline supersedes the previous medical nutrition therapy guidelines produced in 2005.

STATEMENT OF INTENT

This guideline is meant to be a guide for providing medical nutrition therapy to T2DM individuals under the care of a dietitian, based on the best available evidence at the time of development. Adherence to this guideline may not necessarily guarantee the best outcome in every case. Every dietitian is responsible for the management of his/her unique patient based on the clinical, dietary and lifestyle picture presented by the patient.

OBJECTIVES

The aim of this guideline is to provide evidence-based recommendations to assist dietitians to provide medical nutrition therapy to people with T2DM. National guidelines are also taken into account.

CLINICAL QUESTIONS

The clinical questions were divided into major subgroups and members of the working group were assigned individual topics within these subgroups.

The clinical questions of these guidelines were:

1. What are the lifestyle measures that can help prevent the onset of diabetes?
2. How effective is Medical Nutrition Therapy (MNT) in achieving glycemic control?
3. What are the dietary recommendations in management of diabetes for the following:
 - a. Carbohydrate
 - b. Sucrose
 - c. Non-nutritive sweetener
 - d. Fiber
 - e. Protein
 - f. Fats
 - g. Sodium
 - h. Glycemic Index
4. What is the dietary recommendation for overweight and obese individuals?
5. What is the recommended dietary pattern for individuals on Oral Anti-Diabetic (OAD) Agents and/or insulin who are self-monitoring glucose levels?
6. What is the recommendation for individuals with complications such as cardiovascular disease and kidney failure?
7. How much and what type of physical activity should be recommended?
8. How to manage special situations such as hypoglycemia, Ramadan fasting and travel?

TARGET POPULATION

This guideline is applicable to only adults with T2DM (above 18 years old), not pregnant and those at risk of developing diabetes.

TARGET GROUP

This guideline is meant mainly for dietitians involved in treating individuals with T2DM. Other healthcare professionals may also use this guideline as reference, which includes medical doctors and specialists, nurses, pharmacists as well as diabetes nurse educators.

LEVEL OF EVIDENCE

The definition of types of evidence and the grading of recommendation used in this guideline is shown in Table 1.

This guideline is based largely on the findings of systematic reviews and meta-analyses in the literature, taking into consideration local practices. All literature retrieved were discussed during group meetings. The task force members agreed on all statements and recommendations formulated. Where the evidence was insufficient, the recommendations were derived by consensus of the task force members.

However, in addition to the evidence-based recommendations, other factors such as cultural practice, individual conditions and preferences must be taken into consideration in the decision-making process.

Table 1: Evidence Grading System for Clinical Practice Recommendations

Level of evidence

Level	Type of evidence
1a	Evidence from meta-analysis of randomized controlled trials
1b	Evidence from at least one randomized controlled trial
IIa	Evidence from at least one well-designed controlled study without randomization
IIb	Evidence from at least one other type of quasi-experimental/ cohort study
III	Evidence from well-designed non-experimental descriptive studies such as comparative studies, correlation studies and case control studies
IV	Evidence from expert committee reports or opinions and/ or clinical experiences of respected authorities

Source: U.S. Preventive Services Task Force, 2012; Canadian Task Force on Preventive Health Care, 2011

Grades of recommendation

Level	Type of evidence
GRADE A Level 1a, 1b	At least one meta-analysis, systematic review, or randomized controlled trial, or evidence rated as good and directly applicable to the target population.
GRADE B Level IIa, IIb and III	Evidence from well-conducted clinical trials, directly applicable to the target population, and demonstrating overall consistency of results; or evidence extrapolated from meta-analysis, systematic review, or non-randomized controlled trial.
GRADE C IV	Evidence from expert committee reports or opinions and/ or clinical experiences of respected authorities; indicates absence of directly applicable clinical studies of good quality.

Source: Modified from Scottish Intercollegiate Guidelines Network (SIGN), 2001

Section A: Prevention Of Diabetes

Lifestyle interventions are the mainstay of therapy for prevention of diabetes (Knowler et al., 2002; Tuomilehto et al., 2001). Individuals who are at risk of developing T2DM should be recommended the following diet and lifestyle measures:

1. If overweight or obese, weight loss of 5-10% of initial body weight is recommended as a realistic goal to achieve (Grade A). This weight loss should be achieved over a period of 6 months through:
 - a. A reduced calorie diet (Grade A). Standard weight-loss diets reduce daily energy by 500-1,000 kcal to achieve an initial weight loss of $\frac{1}{2}$ -1 kg per week (Hamman et al., 2006).
 - b. Physical activity of 150 min per week i.e. 30 minutes five days or more per week (Grade A). Moderate intensity physical activity is encouraged (Pan et al., 1997). Examples for moderate and vigorous physical activities are shown in Appendix 1. A combination of reduced calorie diet and physical activity can provide greater initial weight loss (Curioni et al., 2005).
2. A high dietary fiber diet is encouraged for the prevention of diabetes (Grade B).
 - a. Dietary fiber intake should be 20-30 g/day as recommended by the Malaysian Dietary Guidelines, 2010.
Appendix 2 shows the dietary fiber content of common foods.
 - b. Whole grains should form 50% of the total grains intake as recommended by the Malaysian Dietary Guidelines, 2010.

Higher consumption of whole grains can contribute to the prevention of T2DM. The evidence for beneficial metabolic effects is stronger for consuming a variety of whole grains than for wheat bran in isolation. Therefore, it is recommended to increase consumption of whole grains including whole wheat, whole oats, oatmeal, whole grain corn and popcorn, brown and wild rice, whole rye, whole grain barley, buckwheat, triticale, bulgur, millet, quinoa, and sorghum (de Munter et al., 2007).
 - c. At least 2 servings of cooked green leafy vegetables must be eaten daily (Grade B). This is based on a meta-analysis which showed that an increase of 1.15 serving a day of green leafy vegetables was associated with a 14% decrease in incidence of T2DM (Carter et al., 2010).
3. Limit consumption of sugar-sweetened beverages for prevention of diabetes and weight gain (Grade B).

In a meta-analysis of eight prospective cohort studies (n=310,819), a diet high in consumption of sugar-sweetened beverages (SSB) was associated with development of T2DM. Individuals in the lowest quartile of SSB intake (0 or <1 serving per month) compared with the highest quartile (≥ 2 servings per day) had a 1.26 relative risk of developing diabetes (de Koning et al., 2011; Malik et al., 2010). Intake of SSB especially carbonated drinks is also strongly associated with weight gain (Malik et al., 2006).

B1: Effectiveness of medical nutrition therapy (MNT) and diet counseling

1. MNT must be initiated or reviewed by a dietitian under the following conditions: at diagnosis, sub-optimal metabolic and/or weight control, at initiation of insulin therapy, development of other co-morbidities such as hyperlipidemia, hypertension and chronic kidney disease (Franz et al., 2008) (Grade C).
2. Diet counseling is effective to help lower HbA1c by an average of 1-2% (Morrison et al., 2012) (Grade A). Individuals who have diabetes should receive individualized MNT from a dietitian to achieve treatment goals (Grade A).
3. Diabetes MNT has the greatest impact at initial diagnosis, and it continues to be effective at any time during the disease process (Grade A).
4. Visits to the dietitian at initial diagnosis and continued follow-ups are recommended to provide education and counseling (Grade B).
5. Follow-ups should preferably be done monthly especially in individuals at high risk of diabetes complications (Morrison et al., 2012) (Grade A). Visits of 3-4 times within 3-6 months lasting 45-90 minutes each session is recommended or 6-12 group sessions are recommended (Grade A).
6. Diet counseling should be individualized taking into consideration individual needs and cultural preferences while respecting the individual's willingness to change.

B2: Nutrient recommendation

B2.1 Carbohydrate recommendations

1. Total carbohydrate (CHO) intake should be monitored in T2DM individuals (Wheeler et al., 2008) (Grade A).
 - a. Total CHO intake can be monitored by using grams, exchange list, household or hand measures as long as it is practical for individuals to comprehend and follow.
 - b. CHO intake must be kept consistent on a day-to-day basis if patient is on diet therapy alone, oral anti-diabetic agents (OADs) or fixed insulin regime. It is prudent to individualize the distribution of the total CHO exchanges allowed in a day into meals according to the patient's lifestyle.

For example, the CHO allowance for Mr. Y is 14 exchanges (for cereal, sugars, dairy, fruits, legumes) in a 1800 kcal diet. The total CHO can be distributed into 3-4 meals a day. If Mr Y is on Metformin and basal insulin once a day, then this distribution of CHO should be maintained on day-to-day basis.

- c. If patient is adjusting their meal-time insulin doses or on insulin pump (i.e. flexible insulin) consistency is not required. Insulin doses should be adjusted to match CHO intake. Self-monitoring of blood glucose is essential to adjust CHO intake and insulin dose.

Section B: Management Of Type 2 Diabetes

- d. When adjusting insulin to carbohydrate intake, protein and fat content of meals cannot be ignored as excessive energy intake may lead to weight gain.
 - e. A minimum of 130 g/day CHO should be provided to ensure adequate intake of fiber, vitamins, and minerals, as well as to prevent ketosis and to provide dietary palatability (Institute of Medicine, 2005) (Grade A).
 - f. Total CHO percentage of 45-60% of total energy is recommended (Grade C). The percent depends on weight, glycemic and other metabolic goals, cultural preferences and individual lifestyle (Kodama et al., 2009). Evidence for an optimal percentage for CHO in the food or meal plan on glycemic control is inconclusive.
2. Persons with diabetes may take sucrose between 10-20% of total energy when counted as part of the total CHO allowance without negative effect on glycemic or lipid levels (Franz, 2010) (Grade A).

For example, 1 CHO exchange equals 3 level tsp of sugar and should be substituted with other CHO sources if allowed.

Caution should be practiced when allowing sucrose due to the following reasons:

- a. Excessive sucrose may lead to weight gain (Grade B)
 - b. High sugary foods are low in nutrient content
3. Any other types of sugars (e.g. honey, brown sugar, cane sugar, *gula Melaka*) should also be substituted for CHO exchanges.
4. Non-nutritive sweeteners do not impact glycemic level (Grade B). Intake should not exceed Acceptable Daily Intake (ADI) levels (Appendix 6). Products containing non-nutritive sweeteners may contain energy and carbohydrate which should be taken into consideration when prescribed to individuals with T2DM.

Refer Appendix 3 for carbohydrate exchanges for sugars and local *kuih*,
Appendix 4 for carbohydrate content in common Malaysian foods,
Appendix 5 is the food groups and exchange list,
Appendix 6 is the ADI for non-nutritive sweeteners.

B2.2 Glycemic Index (GI)

1. Glycemic index of foods is not recommended as a primary strategy for dietary management of T2DM (Wheeler et al., 2008) (Grade A). Monitoring total carbohydrate intake remains a key strategy in achieving glycemic control (Grade A).

A recent systematic review (Wheeler et al., 2012) concluded that there is little difference in glycemic control and CVD risk factors reduction between low and high GI diets (Grade A). The study also concluded that GI data is confounded by presence of dietary fiber and cut off levels for what is considered low GI food needs further review. A list of Glycemic Index of foods is provided in Appendix 7.

B2.3 Dietary fiber

1. Persons with Type 2 DM should be encouraged to increase dietary fiber intake at least up to 20-30 g/day as recommended by the Malaysian Dietary Guidelines, 2010.
2. A high fiber diet will be beneficial to lower total cholesterol (2-3%) and LDL- cholesterol (up to 7%) (Grade A) and may improve glycemic control (Anderson et al., 2004) (Grade A).

Good sources of dietary fiber include whole grains cereals, vegetables, fruits, legumes, beans, lentils, nuts and seeds. Dietary fiber should be obtained from foods, rather than fiber supplements (in the form of tablets or powder) because foods provide other micronutrients and phytonutrients which provide their own nutritional benefits. Appendix 2 provides a list of dietary fiber content in foods.

B2.4 Protein

1. In individuals with normal renal function, usual protein intake of 15-20% energy has minimal effect on glycemic control (Larsen et al., 2011) (Grade A). It is recommended to include lean sources of protein such as lean meat, fish, chicken/poultry without skin and soy protein.
2. In individuals with impaired renal function (diabetic nephropathy/ diabetic kidney disease), protein restriction of 0.8-1.0 g/kg body weight /day may be recommended (Robertson et al., 2007) (Grade A).

B2.5 Cardio protective nutrition

1. All persons with diabetes should limit total fat (25-35% energy intake), saturated fats (<7% energy intake), minimal trans fat (<1% energy intake) and dietary cholesterol (<200 mg/day) for prevention and treatment of cardiovascular disease (Van et al., 2008; Franz et al., 2010) (Grade A).
2. Incorporation of enriched foods with plant sterols and stanols (2-3 g/day) may further lower total cholesterol by 4-11 % and low density lipoprotein (LDL) by 7-15% (Lee et al., 2003; Jenkins et al., 2011) (Grade A). If incorporated into the diet, the recommended dosage should be achieved.

However, foods containing plant sterols/stanols are limited in Malaysia, and mostly confined to margarines and low fat milk. Additional calories, carbohydrate and fat intake should be considered when recommending these foods.

3. All persons with diabetes should limit sodium intake to <2400 mg (Grade A).
4. A healthy diet incorporating oats, nuts and legumes, green leafy vegetables and soy protein may be beneficial (Van et al., 2008) (Grade A).

B2.6 Alcohol intake

1. If persons with diabetes choose to drink alcohol, it should be limited to 2 drinks for men and 1 drink for women (1 drink = 15 g alcohol). Examples of 1 drink = 360 ml beer / 150 ml wine / 45 ml hard liquor/distilled spirits
2. Alcohol should be taken with meals to prevent hypoglycemia especially individuals on insulin or insulin secretagogues.

Alcohol blocks gluconeogenesis and increases the effects of insulin by interfering with the counter regulation response to insulin-induced hypoglycemia. Alcohol also exacerbates hypertriglyceridemia.

3. Alcohol is used as a source of energy, but it is not converted to glucose. It is metabolized in a manner similar to fat. Appendix 15 shows the calorie, carbohydrate, alcohol and food exchange values for alcoholic beverages.

B3: Weight control

1. Overweight and obese individuals are recommended to lose weight. Weight loss of 5-10% of initial body weight is recommended as a realistic goal to achieve within the first 6 months (Grade A).
2. Dietitian should focus on glycemic control and prevention of weight gain in individuals with long term history of being overweight/obese (Franz, 2007a). Dietitians should assess based on the individual needs and treatment goals.

Evidence show that sustained weight loss interventions for more than 1 year reported inconsistent results on HBA1c (Franz et al., 2007b) (Grade A).

3. Meal replacements (MRPs) can be used as a part of a comprehensive meal plan for weight loss and weight maintenance (Grade A).

There are eight randomized clinical trials (RCTs), three non-randomized clinical trials and a positive-quality meta-analysis report equivalent or greater weight loss in subjects receiving a diet containing 1-3 daily meal replacements (Academy of Nutrition and Dietetics, 2012a).

- Overweight /obese individuals should undergo at least 3-6 months of conventional low calorie diet. Individuals who have difficulty to select low calorie foods or have problems to control portion size can then be recommended to use MRPs.
- Concurrent advice on adequate fluid intake (6-8 glasses as per Malaysian Dietary Guidelines, 2010) and balanced diet providing adequate nutrients throughout the whole day should be given.
- MRPs as weight loss strategy are not recommended for persons with complications such as chronic kidney disease stage 3 onwards, recent myocardial infarction and other severe complications. Risk of hypoglycemia should be assessed and monitored.

Section B: Management Of Type 2 Diabetes

- Meal replacement products should provide at least 50-100% of the Recommended Nutrient Intake (RNI) for vitamins and minerals and low in fat and sodium. A guide to suitable MRPs is shown in Appendix 8.
- Individuals on meal replacements for weight loss should be followed-up by a dietitian to progress to low calorie diets for weight maintenance where appropriate. However, continued use of meal replacements may be needed to maintain weight (The Look AHEAD Research Group, 2007) (Grade A).
- MRPs include multi-flavored and ready-to-go drinks, powdered shakes, and soups.
- One or two meals / snacks a day can be replaced with meal replacement products. Sample menu is shown in Appendix 9.

B4: Physical activity

1. Individuals with diabetes should be advised to perform at least 150 minutes per week of moderate-intensity aerobic physical activity (50–70% of maximum heart rate), spread over at least 3 days per week with no more than 2 consecutive days without exercise (Boule et al., 2001; Ministry of Health, 2009; American Diabetes Association, 2012) (Grade A): Examples of exercises to recommend include brisk walking and cycling (refer to Appendix 1).
2. Individuals with diabetes should be encouraged to perform resistance training at least twice per week (Boule et al., 2001; Ministry of Health, 2009; Academy of Nutrition and Dietetics, 2012b) (Grade A). Examples of resistance exercise include use of weights/dumbbells, gym ball, exercise band and others.
3. Dietitians should be cautious about giving exercise recommendations for individuals with complications such as retinopathy, foot injury or open sores, neuropathy and cardiovascular diseases (refer Appendix 10).
4. Dietitians should instruct individuals taking insulin or insulin secretagogues on safety guidelines to prevent hypoglycemia (e.g. frequent blood glucose monitoring, possible adjustments in insulin dose or carbohydrate intake, and to carry carbohydrate food/beverages while exercising).

Carbohydrate should be ingested if pre-exercise glucose levels are 5.55 mmol/L for individuals on insulin or insulin secretagogues. Add 15 g of carbohydrate every 30-60 minutes of moderate physical activity carried out over and above normal routine.

Caution - If pre-exercise blood glucose level is frequently below 5.55 mmol/L, consult a doctor to adjust medication especially for individuals who need to reduce weight.

B5: Self monitoring of blood glucose (SMBG)

1. Dietitians should be encouraged to use self-monitoring of blood glucose results and food records to assess the effectiveness of diet counseling (Grade C).
2. For persons with T2DM on insulin therapy, at least 3-8 glucose tests per day are recommended to determine the adequacy of the insulin dose(s) and to guide adjustments in insulin dose(s), food intake, and physical activity.

Some insulin regimens require more testing to establish the best integrated therapy (i.e. food, insulin, and activity). Once established, some insulin regimens will require less frequent self-monitoring of blood glucose.

Refer Appendix 11 for guidelines on frequency of self-monitoring, Appendix 12 provides list of oral anti-diabetic agents (OAD) and their actions, Appendix 13 provides the list of insulin preparations and their actions, Appendix 14 provides the timing of meals and insulin regimes.

1.0: Nutrition care process

The nutrition care process should be implemented for all individuals with T2DM referred to the dietitian.

- a. Nutrition assessment should be carried out by obtaining client history, anthropometry, biochemical profile and food and nutrition history. Appendix 16 shows the recommended areas for nutrition assessment.
- b. Common nutrition diagnosis for individuals with T2DM is shown in Appendix 17. Nutrition diagnosis should be individualized and derived from adequate assessment of nutrition status.
- c. Nutrition intervention should be evidence-based as provided in Section A and Section B of this guideline. Nutrition intervention should comprise of nutrition education and counseling. The use of counseling techniques such as Motivational Interviewing has been shown to be effective in changing dietary behavior (Burke et al., 2003; West et al., 2007) (Grade A).
- d. Nutrition monitoring and evaluation should be carried out frequently as recommended in Section B1 of this guideline.

2.0: Advice for hypoglycemia

<p>Definition</p>	<p>Mild</p> <ul style="list-style-type: none"> • Occurs when blood glucose levels drop below optimal levels. • Little or no interruption of activities, able to manage symptoms. • Hypoglycemia can be self-treated. <p>Moderate</p> <ul style="list-style-type: none"> • Some interruption of activities but still able to manage symptoms. <p>Severe</p> <ul style="list-style-type: none"> • Unable to manage symptoms, need medical attention.
<p>Symptoms</p>	<p>Mild to moderate</p> <ul style="list-style-type: none"> • Weakness, shakiness, sweating, headache, hunger, perspiration, rapid heartbeat, anxiety, trouble concentrating, blurred vision, inability to think clearly, tingling in extremities, fatigue, dizziness, nausea. <p>Severe</p> <ul style="list-style-type: none"> • Mental confusion, argumentativeness, combativeness, lethargy, seizures and unconsciousness.

Section C: Special Topics

Treatment	<p>Mild to moderate</p> <ul style="list-style-type: none"> • Glucose (15–20 g) is preferred treatment for conscious individual with hypoglycemia although any form of carbohydrate that contains glucose may be used. • If SMBG 15 min after treatment shows continued hypoglycemia, the treatment should be repeated. • Once blood glucose returns to normal, the individual should consume a meal or snack to prevent recurrence of hypoglycemia. <p>Severe</p> <ul style="list-style-type: none"> • Send to nearest clinic. • Glucagon should be prescribed for all individuals at significant risk of severe hypoglycemia. • Caregivers or family members of these individuals should be instructed in its administration.
Prevention	<ol style="list-style-type: none"> 1. Educate on hypoglycemia awareness and prevention. 2. Adjust amount and/or type of diabetes medication(s). <ul style="list-style-type: none"> • Coordinate timing of diabetes medication(s), food and activity • Check effect of medications on glucose 3. Adjust food intake. <ul style="list-style-type: none"> • Eat all planned food and/or carbohydrate • Eat meals on time, or snack if meals will be late • Increase food or reduce insulin when more active than usual • Address issues related to gastroparesis 4. Encourage SMBG and proper insulin injections.
Note	<p>If diabetes treatment involves combination of oral insulin secretagogue and alpha-glucosidase inhibitor (i.e. acarbose and miglitol), use glucose powder to resolve hypoglycaemia quickly.</p>

Source: American Diabetes Association. Standards of Medical Care in Diabetes. Diabetes Care 2012; 34 Suppl (1): S11 - S61.

3.0: Advice for travelling

Individuals with diabetes should be advised to:

- 1) Bring along a letter for travelling by doctor. Carry identification tag such as Medic Alert.
- 2) Keep closely to their usual food and medication schedule as possible when travelling.
- 3) Bring extra medications in case of unpredictable change in travel plans or delays.
- 4) Carry enough portable, easy-to-eat foods and a quick source of glucose to manage delays or emergencies.
- 5) Understand the potential pitfalls of foods and meals purchased or eaten away from home.
- 6) Develop healthful eating skills when making food choices away from home i.e. food portion control, less fat, less sodium.
- 7) Use nutrition information and menus from local restaurants to identify healthful alternatives.

4.0: Advice for Fasting

Fasting during the month of Ramadan is one of the five pillars of Islam hence it is obligatory for all healthy adult Muslims. Some are exempted from fasting. They include children before puberty, menstruating women and individuals who are suffering from illness that could be adversely affected by fasting. They are permitted not to fast for any length of time during the month, depending on the duration and the severity of their illness.

Ramadan fast can last up to 14 hours, from dawn to sunset in the day during which the individual abstain from taking food, drink and oral medication. There is a tendency to consume a large meal in the evening during the break of fast and a variable amount of food before dawn, which may affect glycaemic control.

Fasting Guidelines for Diabetes (Omar, 1984; Azizi & Siankolah, 1998)

Fasting should be safe for most people with diabetes except for the following individuals:

- Brittle (uncontrolled) Type 1 DM
- Poorly controlled Type 1 or 2 Diabetes
- Those known to be non-compliant to drug regimen, dietary and daily activity advice
- Those with serious complications e.g. unstable angina, uncontrolled hypertension or renal impairment
- Those with recent history of or are prone to ketoacidosis
- Pregnant women
- Those with inter-current infections
- Elderly individuals with any altered conscious state or those living alone
- Those with two or more episodes of moderate to severe hypoglycaemia during previous Ramadan

Diabetes and fasting Ramadan: Categories of Risks in Individuals With Type 1 or Type 2 Diabetes Who Fast During Ramadan (Al-Arouj et al., 2010)

Category 1: Very high-risk group

- Severe hypoglycaemia within the last 3 months prior to Ramadan
- Individuals with a history of recurrent hypoglycaemia
- Individuals with lack of hypoglycaemia awareness
- Individuals with sustained poor glycaemic control

- Ketoacidosis within the last 3 months prior to Ramadan
- Type 1 Diabetes
- Acute illness
- Hyperosmolar hyperglycaemic coma within the previous 3 months
- Individuals who perform intense physical labour
- Pregnancy
- Individuals on chronic dialysis

Category 2: High-risk group

- Individuals with moderate hyperglycaemia blood glucose levels of 10.0–16.5 mmol/L (180–300 mg/dL) or HbA1C 7.5 – 9.0%
- Individuals with renal insufficiency
- Individuals with advanced macrovascular complications
- People living alone who are treated with insulin or sulphonylureas
- Individuals living alone with comorbid conditions that present additional risk factors
- Old age with ill health
- Drugs that may affect mentation (cognitive state)

The ruling for individuals in categories 1 and 2 is that they are prohibited from fasting to prevent harming themselves based on the certainty or the predominance of probability that harm will occur to the individuals in these two categories.

Category 3: Moderate risk

- Well-controlled individuals treated with short-acting insulin secretagogues such as repaglinide or nateglinide.

Category 4: Low risk

- Well-controlled individuals treated with diet alone, lifestyle therapy, metformin, acarbose, thiazolidinedione, and/or incretin-based therapies who are otherwise healthy

The ruling for individuals in categories 3 and 4 is that they should fast. Obviously, the risk category for many people could be higher or lower depending on many changes such as an acute illness, pregnancy, a change in type of treatment, etc.

Adjustments for the RAMADAN

It is useful for those with diabetes who intend to fast to start practicing fasting in the months of Rejab and Syaaban. This is in accordance with Islamic teaching. This will help in the following.

- Adjustment of the diet protocol for fasting during Ramadan;
- Adjustment of the drug regimen (timing and possibly dose) - especially insulin
- Encouragement of continued proper physical activity
- Recognition of warning symptoms of dehydration, hypoglycaemia and other possible complications
- The need for monitoring of blood glucose and body weight

Adjustment of the diet protocol for Ramadan fasting

- Never skip *sahur* (dawn meal). *Sahur* should consist of balanced meal with adequate carbohydrate taken as late as possible just before *Imsak* to avoid unnecessary prolonged fasting.
- Do not delay “*berbuka*” i.e. the breaking of the fast at sunset, also known as *Iftar*. Limit intake of high-sugary foods e.g. *kuih*. However, 1-2 *kurma* (dates) at start of *berbuka* according to *Sunnah* may be taken as part of carbohydrate exchange. Main meal is encouraged after *Maghrib* prayers.
- Supper after *Tarawih* can be taken as replacement of pre-bed snack.
- Include fruits and vegetables at both *sahur* and *berbuka*. High fibre carbohydrates are encouraged at all meals.
- Limit fried or fatty foods.
- Limit intake of highly salted foods to reduce risk of dehydration.
- Sufficient fluid must be taken to replenish fluid loss during the day. Aim for 8 glasses a day. Choose sugar-free drinks. Drink adequately at *sahur*. Have a drink after going to the toilet to replace loss as long as before *Imsak*.

Dietary indiscretion during the non-fasting period with excessive gorging, or compensatory consumption of carbohydrates especially sweetened and fatty foods contributes to the risk of hyperglycemia and weight gain.

Adjustment of the drug regimen

Dosage and timing of oral medication or insulin may need to be adjusted according to the blood glucose results or the development of hypoglycemia.

Biguanides

Usually do not require dose adjustments. Tablets should be taken with or after meal.

Sulphonylurea

Generally the usual (non-*Ramadan*) morning dose of tablet should be taken with *berbuka puasa* and the evening dose or the smaller dose to be taken at *sahur* (before dawn). If hypoglycemia occurs during afternoon, the *sahur* dose should be reduced. Tablets may be taken during “*berbuka*” (break fast) or just immediately after.

Metglinides (Repliginides, Nateglinides)

To be taken with main meals (or heavy snack)

Alpha glucose reductase inhibitors

To be taken with main meals (or heavy snack)

Insulin

Adjustments need to be evaluated on an individual basis.

- For those on basal bolus regime, short-acting insulin to be taken before the *sahur* and after the *berbuka* and an intermediate/ long acting insulin at bedtime (Omar & Motala, 1997)
 - Rapid acting insulin analogues (Lispro or Novorapid) are useful for fasting since they can be injected just before or after the meal and also due to its shorter duration of action
 - Short acting or rapid acting insulin analogue dosages are adjusted according to the amount of food eaten and blood glucose results
- For those on conventional insulin regimes, the usual evening short-acting insulin and intermediate acting insulin should be taken at dawn while the usual morning dose of short-acting and intermediate-acting insulin should be injected at *buka puasa*
- If hypoglycemia occurs 2-4 hours after *sahur*, the short acting insulin should be reduced. If hypoglycemia occurs in the late afternoons the intermediate / long acting insulin need to be reduced.

Monitoring

Blood glucose levels may be erratic during *Ramadan*. Frequency of blood sugar monitoring should be increased to adjust medication especially if on insulin. Monitoring should be performed before *sahur*, 2-4 hours after *sahur*, mid to late noon, before *berbuka*, and 2-4 hours after *berbuka*.

Individuals with blood glucose < 3.0 mmol/L or symptoms of hypoglycemia should break their fast (*batal puasa*) immediately and be managed appropriately.

Individuals should be advised that neither the finger-prick for self monitoring of blood glucose nor injecting oneself with insulin will break the fast (*batal puasa*) (Omar, 1984).

After *Ramadan*, the patient's therapeutic regime will need to be changed back to what it was previously. An overall evaluation will also be required especially with regards to glycemic control and change in weight.

Appendix 18 shows the algorithm on treatment for T2DM during *Ramadan*.

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Appendix 1 - Examples of Moderate and Vigorous Physical Activity

Moderate Activities (3-6 METS) (3.5-7.0 kcal/min)	Vigorous Activities (>6.0 METS) (>7kcal/min)
Brisk walking (5-7 km/hr)	Jogging or running
Cycling (8-15 km/hr)	Cycling (>15 km/hr) or cycling uphill
Stationary bicycle (moderate effort)	Stationary bicycle (vigorous effort)
Aerobic dancing (moderate impact)	Aerobic dancing (high impact)
Yoga	Roller skating
Walking up and down stairs	Jumping rope
Dancing e.g. line, ballroom	Dancing energetically
Recreational swimming	Swimming – steady paced laps
Golf , wheeling or carrying clubs	Most competitive sports – football, futsal, basketball, badminton, tennis
Sports like tennis, table tennis, basketball, badminton, <i>sepak takraw</i> with moderate effort	
Housework – scrubbing floor on hands and knees, mopping the floor, hand washing & waxing car, walking and carrying large items <25 kg, or general tasks requiring considerable effort	Heavy housework
Childcare- actively playing with children, walking with child in stroller, carrying a child <25 kg up flight of stairs	Vigorous playing with children
Gardening – manually cutting grass, trimming trees, carrying pots, planting, digging	Heavy gardening e.g. heavy shoveling, or carrying large heavy items

Source: Adapted from Ainsworth et al., 1993

Appendix 2 - Dietary Fiber Content of Common Foods

High Fiber (5+ g)	Medium Fiber (2-4 g)	Low Fiber (<2 g)
Starchy Foods & Cereals Multiwholegrain fibremeal bread, 1 slice	Rye bread, 1 slice Whole-wheat, 1 slice Whole-wheat pasta, ½ cup	Hamburger/ hotdog bun, ½ Plain dinner roll, 1 small White bread, 1 slice
Cereals (ready-to-eat) All bran R, ½ cup 100% bran R, ½ cup	Shredded Wheat R, 1 biscuit	Rice Krispies R, ⅔ cup Special K R, 1 cup Corn flakes, ⅔ cup
Cooked cereals Oat bran, 1 cup	Oatmeal, 1 cup	
Grains Barley, cooked, ½ cup	Bran, natural 1 tbsp Brown rice, cooked, ½ cup Wheat germ, 1 tbsp	White rice, cooked, ½ cup
Cookies/crackers Rye crackers, 1 triple	Oat cakes, 2	Soda crackers, 6 pieces
Pastas Whole-wheat pasta, 1 cup		Macaroni, noodles Spaghetti, cooked, ½ cup
Starchy vegetables Dried beans, peas, legumes, cooked, ½ cup	Corn, canned, whole kernel, ½ cup Corn-on-the-cob, 1 small Potato, whole, cooked, with skin, ½ cup Sweet potato with skin, ½ cup Yam, cooked, ½ cup cubes Miso, paste, 3 tbsp	Corn, canned creamed, ½ cup Potato, whipped, no skin, ½ cup Potato, whole, no skin, ½ cup
Fruits Apple, raw with skin, 1 medium Figs/dates, 10 Kiwi fruit, 2 medium Mango, 1 medium Pear, raw, 1 medium Prunes, dried, 5	Apple, raw, no skin, 1 medium Orange, raw, 1 small Raisins, 2 tbsp Prune juice, 1 cup	Grapes, 8 Honeydew melon, 1 slice Pineapple, raw, 1 slice Watermelon, 5" triangle Most fruits and vegetable-based juice (apple, orange) 1 cup

Appendix 2 - Dietary Fiber Content of Common Foods

High Fiber (5+ g)	Medium Fiber (2-4 g)	Low Fiber (<2 g)
<p>Vegetables Green peas, fresh, frozen or canned, ½ cup Snowpeas, 10 pods</p>	<p>Bean sprouts, ½ cup Beans, string, ½ cup Broccoli, ½ cup Carrots, raw, ½ cup Eggplant, ½ cup Ladies fingers, ½ cup Vegetables, mixed, ½ cup</p>	<p>Asparagus, cooked, 6 spears Cabbage, raw, 1 cup Lettuce, iceberg, 1 cup Cauliflower, raw, ½ cup Celery, raw, ½ cup Cucumber, raw, ½ cup Mushrooms, raw, ½ cup Mustard greens, fresh cooked, ½ c Spinach, raw, 1 cup Tomatoes, raw, 1 cup</p>
<p>Nuts & seeds Almonds, 1 oz</p>	<p>Peanut butter, smooth, crunchy, 2 tbsp Peanuts (15), 1 oz Sunflower seeds, with kernels, 2 tbsp Watermelon seeds, 2 tbsp Sesame seeds, 2 tbsp</p>	<p>Coconut, 2 tbsp Walnuts, 2 tbsp</p>

Source: Adapted from American Dietetic Association, 2000

Appendix 3 - CHO Exchange for Sugars and local kuih

Each item below contains 15 g of CHO (1 CHO exchange)

Honey	:	1 tablespoon level (21g)
Kaya	:	3 tablespoons level (30g)
Jam	:	1 tablespoon level (21g)
Sweets	:	1-2 pieces
Sugar (brown)	:	3½ teaspoons level (18g)
Sugar (white)	:	3 teaspoons level (15g)
Rose syrup	:	3½ teaspoons level (18g)
Condensed milk	:	2 tablespoons level (30g)
Cocoa/malt -based powder	:	1 ½ tablespoons level (18g)

Local kuih	Weight (g) per piece	Sugar content (g) per piece	Teaspoon Equivalent to 1 teaspoon level (5g)
Bingka ubi kayu	70 – 90	18 – 25	4 ¼
Kuih koci	40 – 50	10 – 13	2 ¼
Kuih keria	55 – 65	10 – 13	2 ¼
Lepat pisang	65 – 75	10 – 13	2 ¼
Kuih kosui	70 – 80	10 – 13	2 ¼
Kuih seri muka	110 – 120	10 – 13	2 ¼
Onde-onde	25 – 45	8 – 10	2
Kuih kasturi	120 – 135	8 – 10	2
Doughnut (plain)	45 – 55	7 – 10	1 ¾
Pudding jagung	70 – 80	7 – 10	1 ¾
Apam	45 – 50	6 – 8	1 ½
Kuih lapis	120 – 140	5 – 7	1 ¼

Source: National Coordinating Committee on Food and Nutrition (NCCFN), 1999

Appendix 4 - Carbohydrate Content of Common Malaysian foods

Foods	Serving	Calories (kcal)	CHO content (g)	Approx. CHO Exchanges* *1 CHO food exchange = 15g
Cooked rice	1 bowl (159g)	207	48	3
Roti canai	1 piece (95g)	301	46	3
Chappati	1 piece (100g)	300	47	3
Curry mee	1 bowl (450g)	549	55	4
Fried noodles (mee/ mee hoon)	1 plate (30g)	281	41	3
Bread (white/ wholemeal)	1 slice (30g)	70	15	1
Biscuits, unsweetened	2 pieces (18g)	80	14	1
Curry puff	1 piece (40g)	128	17	>1
Potato	1 medium (90g)	90	16	1
Dhal (raw)	½ cup (98g)	98	64	4
Full cream milk	1 cup (250ml)	187	18	1
Low fat milk	1 cup (250ml)	131	12	1
Skim milk powder	4 tablespoons (28g)	100	16	1
Condensed milk, sweetened	2 tablespoons (40g)	126	21	1.5
Apple/orange	1 medium (114g)	40	9	<1
Banana (pisang mas)	1 small (50g)	40	9	<1
Star fruit	1 medium (260g)	56	11	1
Durian local	5 small seeds (189g)	64	12	1
Langsat/grapes/ longan	8 small (233g)	52	12	1
Guava	½ fruit (100g)	50	11	1
Watermelon/ papaya/ pineapple	1 slice (160g)	56	11	1
Mango	1 small (100g)	50	11	1

Source: Tee ES, Mohd Ismail N, Mohd Nasir A, et al. Nutrient Composition of Malaysian Foods. Institute for Medical Research (IMR). Kuala Lumpur, 1997.

CEREALS, GRAIN PRODUCTS AND STARCHY VEGETABLES

Each item contains 15 g carbohydrate, 2.0 g protein, 0.5 g fat and 75 calories

Cereals, Grain & Bread	
Rice, white unpolished (cooked)	½ cup or 1/3 chinese rice bowl
Can be exchanged for	
Rice porridge	1 cup
Kway teow	½ cup or 1/3 chinese rice bowl
Mee hoon	
Tang hoon	
Spaghetti	
Macaroni	
Mee, wet	1/3 cup
Idli	1 piece (60 g)
Putu mayam	1 piece (40 g)
Thosai, diameter 20 cm	½ piece
Chappati, diameter 20 cm	1/3 piece
Bread (wholemeal, high fiber, white/brown)	1 slice (30 g)
Plain roll	1 small (30 g)
Burger bun	½ piece
Pita bread, diameter 6"	½ piece
Oatmeal, cooked	¼ cup
Oats, uncooked	3 rounded tablespoons
Muesli	¼ cup
Flour (wheat, rice, atta)	3 rounded tablespoons

Biscuits (plain, unsweetened) e.g. cream crackers, Ryvita	3 pieces
Small thin, salted biscuits (4.5 x 4.5 cm)	6 pieces
Starchy vegetables	
*Baked beans, canned	1/3 cup
*Lentils	1/3 cup
(*Contains more protein than other foods in the list i.e. 5 g/serve)	
Corn kernel (fresh/canned)	½ cup
Peas (fresh/canned)	½ cup
Sweet potato	½ cup (45 g)
Tapioca	
Yam	
Breadfruit (sukun)	1 slice (75 g)
Pumpkin	1 cup (100 g)
Corn on the cob, 6 cm length	1 small
Potato	1 small (75 g)
Potato, mashed	½ cup
Water chestnut	4 pieces
1 cup is equivalent to 200 ml in volume 1 cup = ¾ chinese rice bowl (11.2 cm in diameter x 3.7 cm deep) Tablespoon refers to dessertspoon level (equivalent to 2 teaspoons)	

Appendix 5 - Food Groups and Exchange Lists

FRUITS

Each item contains 15 g carbohydrate and 60 calories

Fruits	
Orange	1 medium
Can be exchanged for	
Banana	1 small (60 g)
Apple	1 medium
Custard apple (buah nona)	
Star fruit	
Pear	
Peach	
Persimmon	
Sapodilla (ciku)	
Kiwi	
Hog plum (kedondong)	6 whole
Mangosteen	2 small
Plum	2 small
Duku langsung	8 pieces
Grapes	
Langsat	
Longan	
Water apple (jambu air), small	
Lychee	5 whole

Rambutan	5 whole
Pomelo	5 slices
Papaya	1 slice
Pineapple	
Watermelon	
Soursop (durian belanda)	
Guava	½ fruit
Cempedak	4 pieces
Jack fruit (nangka)	4 pieces
Prunes	3 pieces
Dates (kurma), dries	2 pieces
Raisin	20 g
Durian	2 medium seeds
Mango	½ small

LEAN MEAT, FISH AND MEAT SUBSTITUTE

Each serving of meat and substitutes contain 7 g protein. These foods contain varying amounts of fat and energy, but negligible carbohydrate.

	CHO (g)	Protein (g)	Fat (g)	Energy (kcal)
Lean meat/Meat substitute	0	7	4	65
Fish/ shellfish	0	7	1	35

Lean Meat	
Chicken (raw, without skin)	½ drumstick
Can be exchanged for	
Lean meat (all varieties)	1 small serve (40 g)
Poultry (young)	40 g raw/30g cooked
Egg (hen)	1 medium
Soya bean curd (taufua)	½ piece (60 g)
Soya bean curd (soft, tauhoo)	¾ piece (90 g)
Soya bean curd, sheet (Fucok)	1 ½ sheets (30 g)
Tempeh	1 piece (45 g)
Cheese, cheddar	2 thin slices (30 g)
Cottage cheese	¼ small cup

Fish, Shellfish	
Fish (e.g. ikan kembong, selar)	½ piece (40 g)
Fish cutlet	¼ piece (40 g)
Squid	1 medium (40 g)
Crab meat	¼ cup
Lobster meat	
Prawn meat	
Cockles	20 small
Prawn	6 medium
*Beans & lentils are good sources of protein but they also contain carbohydrate.	

Appendix 5 - Food Groups and Exchange Lists

MILK

These foods contain varying amount of carbohydrate, fat and protein depending on which type of milk is chosen

	CHO (g)	Protein (g)	Fat (g)	Energy (kcal)
Skimmed (1% fat)	15	8	trace	90
Low fat (2% fat)	12	8	5	125
Full cream	10	8	9	150

Fresh cow's milk	1 cup (240 ml)
UHT fresh milk	1 cup (240 ml)
Powdered milk (skim, full cream)	4 rounded tablespoons or 1/3 cup
Yogurt (plain/ low fat)	¾ cup
Evaporated (unsweetened)	½ cup

FAT

Each item contains 5 g and 45 calories. Some of the foods in the list, e.g. nuts and seeds also contain small amounts of carbohydrate and protein besides fat.

Oil (all types)	1 level teaspoon (5 g)
Can be exchanged for	
Butter, margarine	1 level teaspoon
Mayonnaise	
Shortening, lard	
Peanut butter (smooth or crunchy)	2 level teaspoons
Cream, unwhipped (heavy)	1 level tablespoon
Cream cheese	
Salad dressing	
Cream, unwhipped (light)	2 level tablespoons
Coconut, shredded	
Coconut milk (santan)	

Non-dairy creamer, powder	2 level tablespoons
Almond	6 whole
Cashew nut	6 whole
Walnut	1 whole
Peanut	20 small
Sesame seed	1 level tablespoon
Watermelon seed (kuachi) with shell	¼ cup

Appendix 6 - ADI Levels of Non-Nutritive Sweeteners

Non-nutritive sweeteners (NNS) approved in the United States by the Food and Drug Administration

Name (chemical name)	Times sweeter than sucrose	ADI ^a and EDI ^b	Use in foods
Acesulfame K (5,6-dimethyl-1,2,3,-oxathiazine-4(3H)-dioxide) (66)	200	ADI: 15 mg/kg BW ^c EDI: 0.2 - 1.7 mg/kg BW	Approved for general use, except in meat and poultry. Combines well with other NNS; stable at baking temperatures.
Aspartame (L-aspartyl-L-phenylalanine methyl ester) (68)	160 – 220	ADI: 50mg/kg BW EDI: 0.2 – 4.1 mg/kg BW	Approved for general use. Degrades during heating.
Luo han guo extract (cucurbitane glycosides, mogroside II, III, IV, V, VI) (70)	150 – 300	ADI: No ADI determined EDI: 6.8 mg/kg BW	GRAS ^d . Intended for use as a tabletop sweetener, a food ingredient, and a component of other sweetener blends.
Neotame (N-[N-3,3-dimethylbutyl]-L-a-aspartyl]-L-phenylalanine-1-methyl ester)	7,000 – 13,000	ADI: 18mg/kg BW EDI: 6.8mg/kg BW	Approved for general use, except in meat and poultry. To date, little used in food processing.
Saccharin (1,1-dioxo-1,2-benzothiazol-3-one) (14)	300	ADI: Prior sanctioned food ingredient; no ADI determined EDI: 0.1 – 2 mg/kg BW	Limited to < 12 mg/fl oz in beverages, 20 mg/serving in individual packages, or 30 mg/serving in processed food.
Stevia (steviol glycosides, rebaudioside A, stevioside) (74)	250	ADI: (determined by JECFA ^e) 4 mg/kg BW EDI: 1.3 – 3.4 mg/kg BW	GRAS ^d . Intended for use as a sweetener in variety of food products such as cereals, energy bars, and beverages and as a tabletop sweetener.
Sucralose (trichlorogalactosucrose) (20)	600	ADI: 5 mg/kg BW EDI: 0.1 – 2.0 mg/kg BW	General use; heat stable for cooking and baking.

^aADI – acceptable daily intake

^bEDI – estimated daily intake

^cBW – body weight

^dGRAS – generally recognized as safe

^eJECFA – Joint Expert Committee on Food Additives

Source: Academy of Nutrition and Dietetics, 2012

Table 1: Glycemic Index (GI) for local Malaysian foods

Food Categories	Low GI (≤ 55)	Intermediate GI (56-70)	High GI (>70)	
Rice	-	Coconut rice (<i>Nasi lemak</i>) Fried rice Herbal ponni rice Red rice varieties	66 59 65 \pm 2.8 57-60	Brown rice varieties Fragrant rice varieties White rice varieties
	-	Multi-grains bread Oat bran varieties Wholemeal bread with oatmeal	56-58 61-67 67 \pm 6.9	Wholemeal bread varieties White bread varieties
	-	-	-	Fried macaroni Fried meehoon Fried rice noodles Rice noodle (<i>kuih teow</i>)
	-	-	-	Pineapple
Fruit	Durian Watermelon Banana (<i>pisang brangan</i>)	Papaya	55 \pm 3 55 \pm 3 55 \pm 12	82 \pm 4
	-	-	-	-
Tuber Dough/ Kuih	Currypuff	Doughnut	54	Sweet potato <i>Roti canai</i> and dhal curry Sandwich (sardine)
	-	-	-	77 \pm 12 71 73
Cereals and grains	Dumpling (lotus seeds) Dumpling (red bean)	-	55 \pm 5.1 51 \pm 3.2	Dumpling (curry chicken) Sago porridge
	-	-	-	80 \pm 15.5 116
Beverages	-	-	-	<i>Teh tarik</i> 78

Source: Adapted from Barakatun Nisak et al., 2005; Barakatun Nisak et al., 2009; Hishamuddin et al., 2005; Lee et al., 2005; Nik Shanita, 2004; Robert et al., 2006; Robert et al., 2008.

Appendix 8 - Guide to suitable MRPs

Calories	190 to 250 calories	For MRPs fewer than 200 calories, add an extra 15-20 g of carbohydrates (about 100 calories) by including fat-free light yogurt, low-fat wholegrain crackers, fresh fruit or fat-free milk. Raw or cooked non-starchy vegetables (which are low in calories but contribute extra fiber, vitamins and minerals) may be eaten with any of the MRPs.
Protein	10 to 15 grams	Adequate protein promotes health and mealtime fullness.
Carbohydrate	14 to 34 grams	To slow the rate blood glucose (sugar) rises after a meal, look for the first carbohydrate listed in the ingredients to be maltodextrin or tapioca dextrin rather than refined sugars, such as sucrose, corn syrup, high-fructose corn syrup or brown rice syrup.
Dietary Fiber	3 to 6 grams	
Total Fat	5 to 8 grams	The primary fat source should be unsaturated fat from vegetable oils rather than saturated fat, such as partially hydrogenated oil, palm oil or coconut oil. All MRPs should be trans-fat free.
Cholesterol	0 to 20 mg	
Sodium	100 to 300 mg	
Vitamins and minerals	Look for 50 to 100% of the Dietary Reference Intake.	
Avoid products containing stimulants, such as caffeine, ginseng, guarana and ephedra.		

Source: Diabetes Care and Education Dietetic Practice Group, American Dietetic Association, 2007

MENU FOR WEIGHT REDUCTION WITH MEAL REPLACEMENT PRODUCT (MRP)

Meals	1200 calorie meal plan with 2 MRP daily		1500 calorie meal plan with 1 MRP daily	
	Food & drinks	Quantity	Food & drinks	Quantity
Breakfast	MRP (250 calories) Fruit *	1 portion 1 serving	Oats + almonds Fruit*	6 dsps 1 dsp 1 serving
Lunch	Rice Asam pedas fish + Boiled lady fingers Stir fry spinach Fruit *	1 cup 1 palm size 5 small ½ cup 1 serving	Mihun Lean chicken Sawi Bean sprouts Clear chicken soup Fruit *	1 cup 1 palm size ½ cup ½ cup 1 cup 1 serving
Afternoon tea	Wholemeal biscuits Plain coffee + skim milk	3 pieces 1 cup 2 dsps	Wet popiah Plain tea + skim milk	1 medium piece 1 cup 2 dsps
Dinner	MRP (250 calories) Fruit *	1 portion 1 serving	MRP (250 calories) Fruit *	1 portion 1 serving
Supper	Nil		Wholemeal biscuits	3 pieces

Dsp – dessertspoon, tsp – teaspoon 1 cup = 200ml fluids

*Refer to fruit exchange list

Appendix 10 - Recommended Exercise for Those with Diabetic Complications

Diabetes Complication	Contraindicated exercise	Recommended exercise
Diabetic Retinopathy- Moderate non-proliferative to Proliferative	Weight-lifting, jogging, boxing, high-impact aerobic, racquet sports, competitive sports, sit-ups, bending over with head lower than waist, Yoga, scuba diving, Valsalva-like maneuver and other exercise resulting in jarring or rapid head motion.	Walking, stationary cycling, swimming without diving, low-impact aerobic, endurance exercise.
Peripheral Neuropathy	Treadmill, prolonged walking, jogging, step-exercise and high-impact forms of exercise.	Swimming, cycling, rowing, arm-chair exercise and other non-weight bearing exercise like water aerobic.
Peripheral Vascular Disease	Exercise that provokes pain e.g. prolonged walking jogging. Walking program is contraindicated for those who experience pain while resting or during the night (indication of severe peripheral vascular disease).	Interval walking training, swimming, stationary cycling, arm-chair exercise Weight-bearing activities (e.g. walking) are preferred, although non-weight-bearing activities may allow for longer duration and higher intensity exercise.
Cardiovascular disease	Heavy lifting, weight lifting, boxing, jogging, high-impact activities, competitive sports, activities that induce Valsalva maneuvers.	Check with physician.
Overt Diabetic Nephropathy	Same as cardio-vascular recommendation. Although aerobic activities are preferred, the ability to perform the activities depends on the degree of kidney impairment. These individuals usually have low functional and aerobic capacity.	Low level interval work with gradual progression if tolerated. Walking, swimming, cycling.
Autonomic neuropathy	Avoid exercise in extreme temperature, high intensity exercise, activities that involve rapid changes of body position.	Stationary cycling, water aerobics, arm-chair exercise.

Source: Flood L & Constance A, 2002; Funnel et al., 1998 and Sigal et al., 2006.

The table below suggests the frequency of SMBG according to the various modes of treatment.

Mode of treatment	Breakfast		Lunch		Dinner	
	Pre	Post	Pre	Post	Pre	Post/ pre-bed
Diet only	√	√		√		√
Oral Anti-Diabetic Agent	√	√		√		√
Insulin	√	√	√	√	√	√

√ Recommended timing of SBGM

√ Optimal timing of SBGM

Source: Clinical Practice Guidelines, Management of Type 2 Diabetes Mellitus (4th edition), Ministry of Health, 2009.

Drug & Principle site of action	Drug	Reducing in Fasting Plasma Glucose	Reduction in HbA1c (%)	Special instruction
<p>Sulfonylureas Stimulate insulin secretion from pancreatic beta cells</p>	<p>Gliclazide (Diamicon) Gliclazide MR (Diamicon MR) Glibenclamide (Daonil) Glimepiride (Amaryl) Glipizide (Mintdiab)</p>	<p>3.3 - 3.9 mmol/L (60-70 mg/dL)</p>	<p>0.8 - 2.0</p>	<p>Take ½ hour before meals except Glimepiride & Gliclazide MR which can be taken just before meal.</p>
<p>Biguanides Decrease hepatic gluconeogenesis, stimulate glycolysis, increase insulin action in muscle & fat.</p>	<p>Metformin (Glucophage) Metformin XR (Glucophage XR)</p>	<p>2.8 - 3.9 mmol/L (50-70 mg/dL)</p>	<p>1.5 - 2.0</p>	<p>Take with meals or immediately after</p>
<p>Dipeptyl peptidase-4(DPP-4) Enzyme Inhibitors Increase & prolong active incretin (GLP-1 & GIP), thus increases insulin release & decreases glucagon levels in the circulation in a glucose-dependent manner.</p>	<p>Sitagliptin (Januvia)</p>	<p>0.6 - 1.3 mmol/L (10-24 mg/dL)</p>	<p>0.6 - 1.0</p>	<p>Take with or without meals</p>
<p>Thiazolidinediones (TZD) Increase sensitivity of peripheral tissues to insulin action.</p>	<p>Rosiglitazone (Avandia) Pioglitazone (Actos)</p>	<p>1.4-2.8 mmol/L (25-50 mg/dL)</p>	<p>0.5 - 1.5</p>	<p>Take with or without meals</p>

<p>Alpha Glucosidase Inhibitor Reduce intestinal absorption of starch, dextrin & disaccharides, reducing the rise in plasma glucose.</p>	<p>Arcabose (Glucobay)</p>	<p>1.9-2.2 mmol/L (35-40 mg/dL)</p>	<p>0.7 – 1.0</p>	<p>Take with the 1st bite of each main meal</p>
<p>Meglitinides Stimulate endogenous insulin secretion more rapidly but less sustained.</p>	<p>Repaglinide (Novonorm) Nateglinide (Starix)</p>	<p>3.6-4.2 mmol/L (65-75 mg/dL)</p>	<p>0.5 - 2.0</p>	<p>Take before or up to ½ hour before meals.</p>
<p>Incretins mimetics Enhance glucose dependent insulin secretion by the pancreatic beta cell, suppress inappropriately elevated glucagon secretion & slow gastric emptying.</p>	<p>Exenatide (Byetta)</p>	<p>0.3-0.6 mmol/L (5-10 mg/dL)</p>	<p>0.4 – 0.9</p>	<p>Subcutaneous injection within 1 hr before morning & evening meals</p>
<p>Combination ODA</p>	<p>Rosiglitazone & Metformin (Avandamet) Metformin & Glitbenclamide (Glucovance) Sitagliptin & Metformin (Janumet)</p>	<p>NA</p>	<p>NA</p>	<p>Take with food</p>

NA- not available

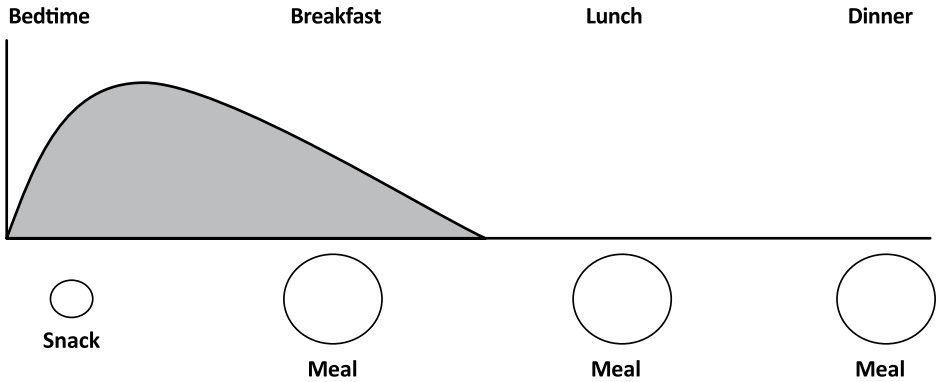
Source: MIMS, 2008 and Clinical Practice Guidelines, Management of Type 2 Diabetes Mellitus

(4th edition), Ministry of Health, 2009.

Insulin preparation	Onset of action	Peak action	Duration of action	Timing of insulin
Fast Acting				
Rapid Analogue Aspart (Novorapid) Lispro (Humalog)	5 – 15 minutes	1 – 2 hours	4 – 6 hours	5 -15 minutes before meals
Human Regular Actrapid Humulin R	30 – 60 minutes	2 – 4 hours	6 – 10 hours	30- 60 minutes before meals
Intermediate Acting				
Human NPH Insulin Insulatard Humulin N	1 – 2 hours	4 – 8 hours	10 – 16 hours	Pre-breakfast/ Pre-bed
Long acting				
Basal Long Acting Analogue Glargine Detemir	1 – 2 hours	Flat	~ 24 hours	Same time everyday at anytime of the day
Premixed Insulins				
Mixtard 30/70 Humulin 30/70	Biphasic onset and peak		10 – 16 hours	30 – 60 minutes before meals
BIAsp 30/70 Humalog mix 25/75				5 – 15 minutes before meals

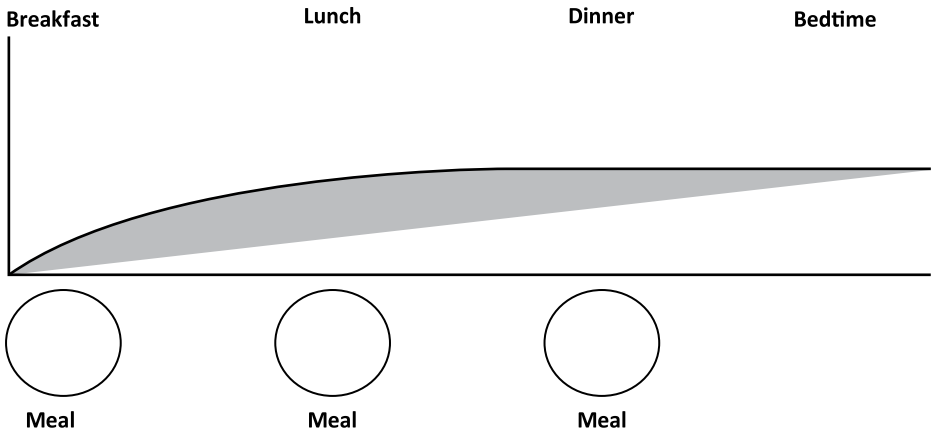
Source: Clinical Practice Guidelines, Management of Type 2 Diabetes Mellitus (4th edition), Ministry of Health, 2009.

Oral agents + bedtime insulin - Intermediate Acting Insulin



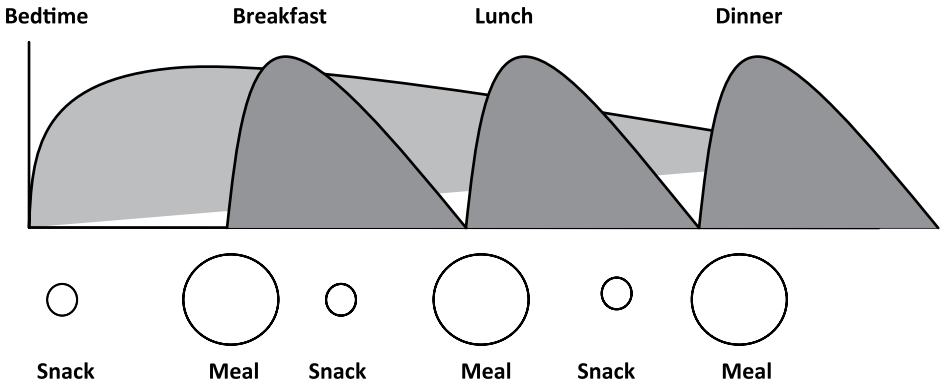
- May need 3 main meals according to individuals energy requirement
- Snack may be an option

Oral agents + Once daily Basal Long Acting Insulin



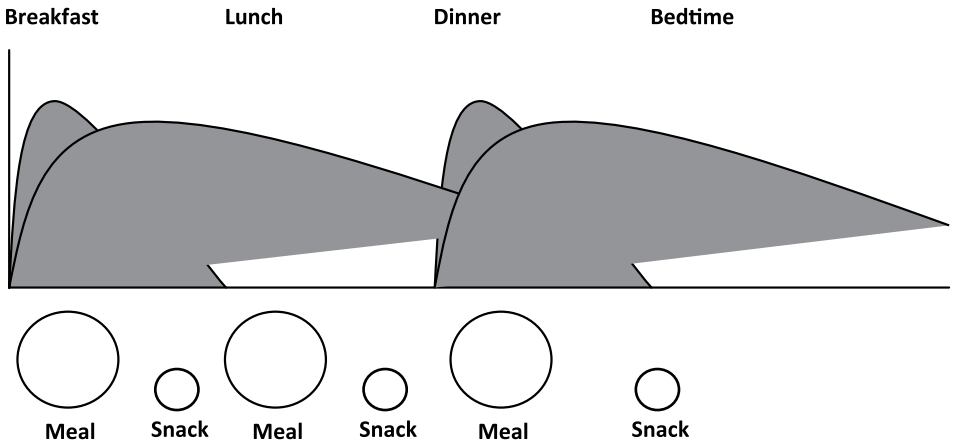
- May need 3 main meals according to individuals energy requirement
- Snack may be an option

Basal Bolus Insulin Regime



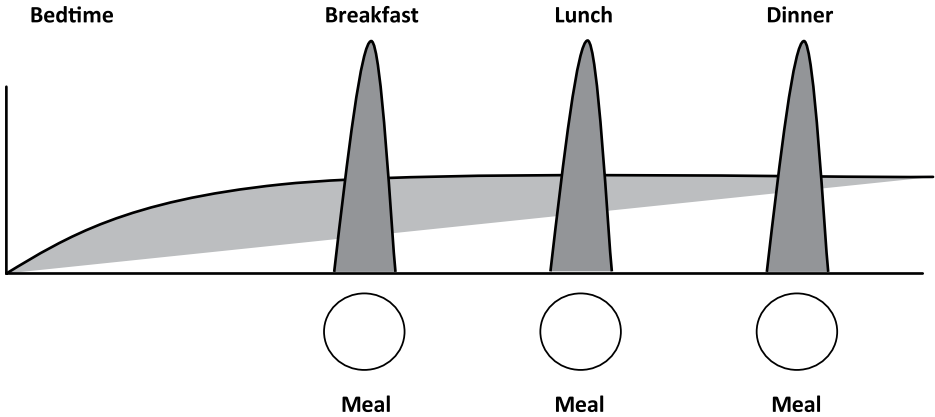
- May need 3 main meals according to individuals energy requirement
- Snack may be needed

Twice Daily Premixed or Combination Intermediate with Short Acting Insulin



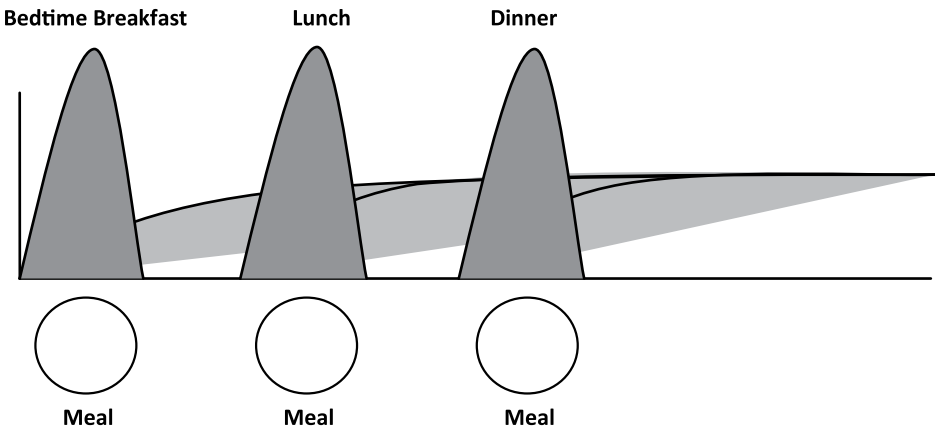
- May need 3 main meals according to individuals energy requirement
- Snack may be needed

Rapid Acting and Long Acting Basal Insulin



- May need 3 main meals according to individuals energy requirement
- Snack may be optional, if added may need extra insulin injection

Premixed Insulin Analogue

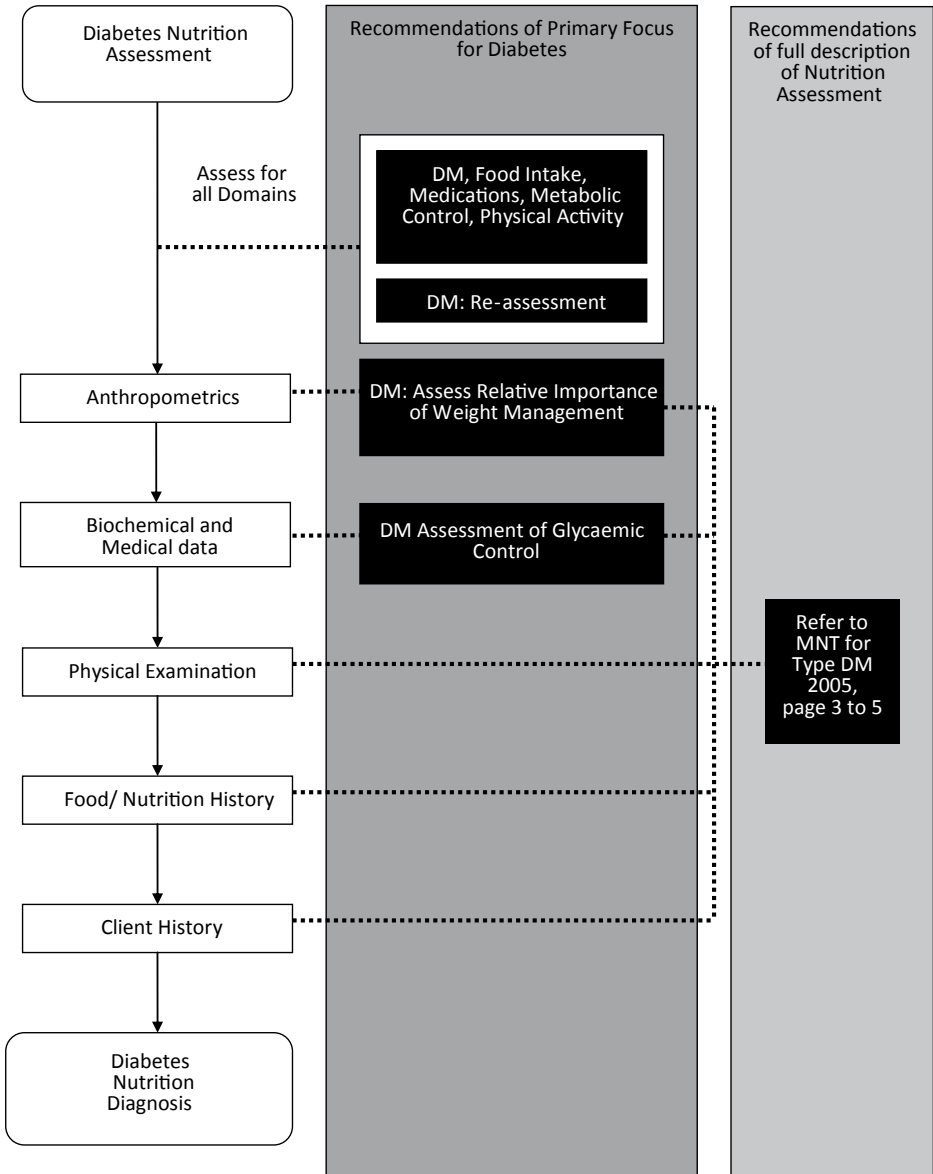


- Some patient may need 3 times insulin injections when blood glucose levels are high during lunch hour. But most of the individuals may need 2 times insulin injections.
- May need 3 main meals.
- Snack is not recommended.

Appendix 15 - Alcoholic beverages: calorie, carbohydrate and food exchange values

Beverage	Serving size (ml)	Calories (per serving)	Carbohydrate (g/serving)	Alcohol (g/serving)	Food exchange
Distilled liquors					
Whiskey	60	138	0	21.8	3 fat
Vodka (80 proof)	60	128	0	15	3 fat
Rum (80 proof)	45	96	0	15	2 fat
Wines					
Red	120	84	0.5	11.2	2 fat
Rose	120	84	0.4	11.2	2 fat
White	120	80	0.8	11.2	2 fat
Beer					
Regular	240	96	8.8	8.7	½ CHO + 1½ fat
Light	360	100	4.8	11.6	2 fat
Cocktails					
Daiquiri	120	224	8	28.1	½ CHO + 4 fat
Manhattan	120	256	3.6	37	5 ½ fat
Martini	120	252	0.3	18.5	5 ½ fat

Source: USDA, 1987



Source: Academy of Nutrition and Dietetics (AND) American Dietetics Association (ADA) Evidence Analysis Library. Diabetes Mellitus Type 1 & 2 Evidence-Based Nutrition Practice Guideline. Available at: <http://andevidencelibrary.com/topic.cfm?cat=3255> (Accessed: 2 December 2012c).

Table 2: Components of Initial Nutrition Assessment

Component	Assessments
Anthropometric Data	<ul style="list-style-type: none"> • Obtain current height, weight and body mass index (BMI) measurement* • Obtain weight history, recent weight changes and weight goals* • Assess growth rate and weight gain (children, adolescents and pregnant women)*
Biochemical Data	<ul style="list-style-type: none"> • Obtain fasting plasma glucose and HbA_{1c} * • Obtain 2 hour post prandial (2 HPP) glucose • Obtain fasting lipid profile (total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides) * • Determine blood pressure* • Urinalysis, ketone and protein • Renal function test (urea, creatinine) • Microalbuminuria screen • Obtain full blood count (i.e. Hemoglobin) especially for the pregnant and renal cases
Clinical Data	<ul style="list-style-type: none"> • Determine type of diabetes* • Assess current diabetes regimen (diet alone, type/dosage/schedule of insulin or oral anti-diabetes medication) and compliance* • Overall health status and prognosis* • Frequency, severity and cause of hypoglycemia and hyperglycemia* • Obtain drug history/current drugs other than diabetes (e.g. lipid lowering drugs, steroids or drugs which are known to affect blood glucose (Appendix 12) • Obtain history of the use of traditional medicine • Past medical history/family history (diabetes, diabetes complications, cardiovascular disease, metabolic syndrome, surgical history etc)
Dietary Evaluation	<ul style="list-style-type: none"> • Determine previous dietary instruction and practice* • Obtain complete nutrition history (using one or a combination of the 24hr recall/usual food intake/food frequency and pattern of intake)* • Determine fluid consumption (for the elderly) • Determine food, cultural and health beliefs • Determine food availability and personal preferences • Assess appetite, tolerance of oral intake and food allergies/intolerances • Assess feeding issues (e.g. chewing, swallowing, sense of smell/taste/diarrhea/constipation) • Determine use of vitamin/mineral, nutritional supplements or special food products • Assess alcohol/tobacco use • Determine frequency/choices when eating out*

Nutritional Assessment

Exercise/ Functional Ability/ Physical Activity	<ul style="list-style-type: none"> • Determine activity level and exercise habits* • Determine level of functional ability and recent changes • Assess ability to feed self and needs for assistance
Psychosocial and economic issues	<ul style="list-style-type: none"> • Assess socio economic factors & educational background* • Assess living situation, cooking facilities, family situation (e.g. who prepares meals, for how many people) • Determine employment (type of job, working hours) • Determine social/leisure/travel/routine activities
Knowledge, attitudes and motivation	<ul style="list-style-type: none"> • Assess basic knowledge of diabetes mellitus* • Assess basic knowledge level of dietary treatment for patient's mode of treatment (MNT alone, MNT + insulin/Oral Diabetes Agent)* • Determine patient's willingness and ability to learn and make appropriate changes* • Assess basic survival skills (i.e. how to treat and prevent hypoglycemia) and diabetes self-management*
Follow-up plan	<ul style="list-style-type: none"> • Provide record keeping forms (food, exercise, self-monitoring blood glucose) to be completed prior to next visit • Determine follow-up plans: within 3 months

*Assessment must be initiated at the first visit. However, data collection may be staggered over several sessions pending on resources and availability.

SOURCE: Adapted from ADA, 2004 and Pastor (1996)

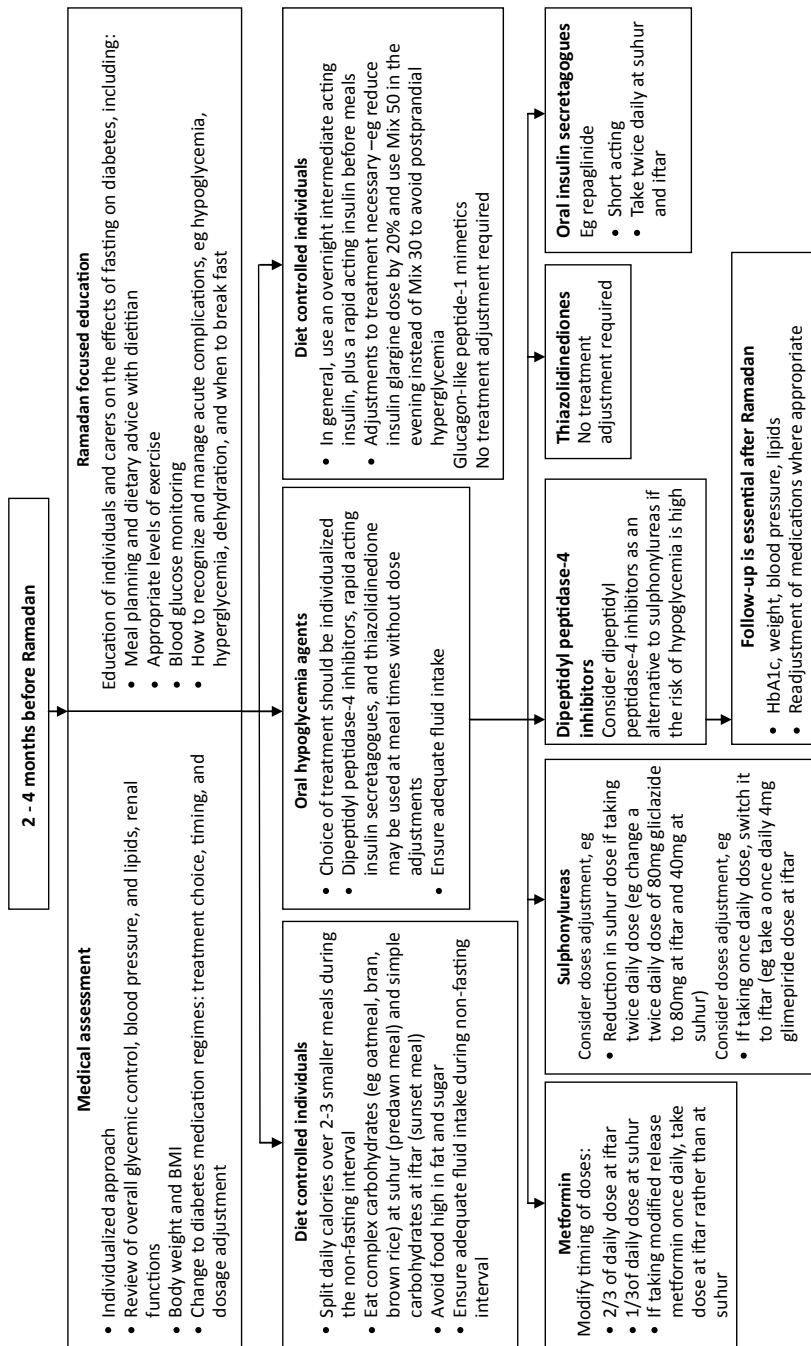
Table 3: Components of Follow-up Nutrition Assessment

Component	Assessments
Anthropometric Data	<ul style="list-style-type: none"> • Assess height and weight changes • Growth and weight gain (children, adolescents and pregnant women)
Clinical Data	<ul style="list-style-type: none"> • Review frequency, causes and severity of hypoglycemia • Assess symptoms of poorly controlled diabetes • Reported symptoms suggesting development diabetes complications • Drug/insulin compliance or change of medication • Review changes in medical status and recent/planned therapies
Biochemical Data	<ul style="list-style-type: none"> • Review any new and updated laboratory data • Review blood pressure reading • Review results of SMBG (self monitoring blood glucose) • Review HbA1c
Dietary	<ul style="list-style-type: none"> • Assess understanding of initial nutrition information and food/meal plan • Assess changes in patient's food intake and/or appetite and barriers to changes
Exercise	<ul style="list-style-type: none"> • Review and reinforce activity level or exercise habits
Follow-up	<ul style="list-style-type: none"> • Recommended second follow-up visit within 1 month if goals not achieved • If goals have been met, recommend ongoing nutrition care within 6 months • For pediatric and pregnant individuals, closer monitoring is necessary

Appendix 17 - Common Nutrition Diagnoses (Problems) Related to Diabetes Mellitus

A. Intake	B. Clinical	C. Behavioral-Environmental
<ul style="list-style-type: none"> • Excessive Energy Intake • Excessive Fat Intake • Inappropriate Intake of Food Fats • Inadequate Carbohydrate Intake • Excessive Carbohydrate Intake • Inappropriate Intake of Types of Carbohydrates • Inconsistent Carbohydrate Intake • Inadequate Fiber Intake 	<ul style="list-style-type: none"> • Overweight / Obesity • Involuntary Weight Gain • Food Medication Interaction • Involuntary Weight Loss • Altered GI Function • Altered Nutrition-related Laboratory value (i.e. glucose) 	<ul style="list-style-type: none"> • Food and Nutrition-related Knowledge Deficit • Not ready for Diet / Lifestyle Changes • Self-Monitoring Deficit • Limited Adherence to Nutrition – related Recommendations • Physical Inactivity • Disordered Eating Pattern • Impaired Ability to Prepare Food/Meals

Source : International Dietetics and Nutritional Terminology (IDNT) Reference Manual, 4th Edition. Academy of Nutrition & Dietetics, 2013.



An Approach to Oral Treatment of Type 2 Diabetes during Ramadan for Individuals Planning To Fast (Hui et al, 2010)

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