



Evolution of Diabetes Medical Nutrition Therapy: Updates on Guidelines and New Insights

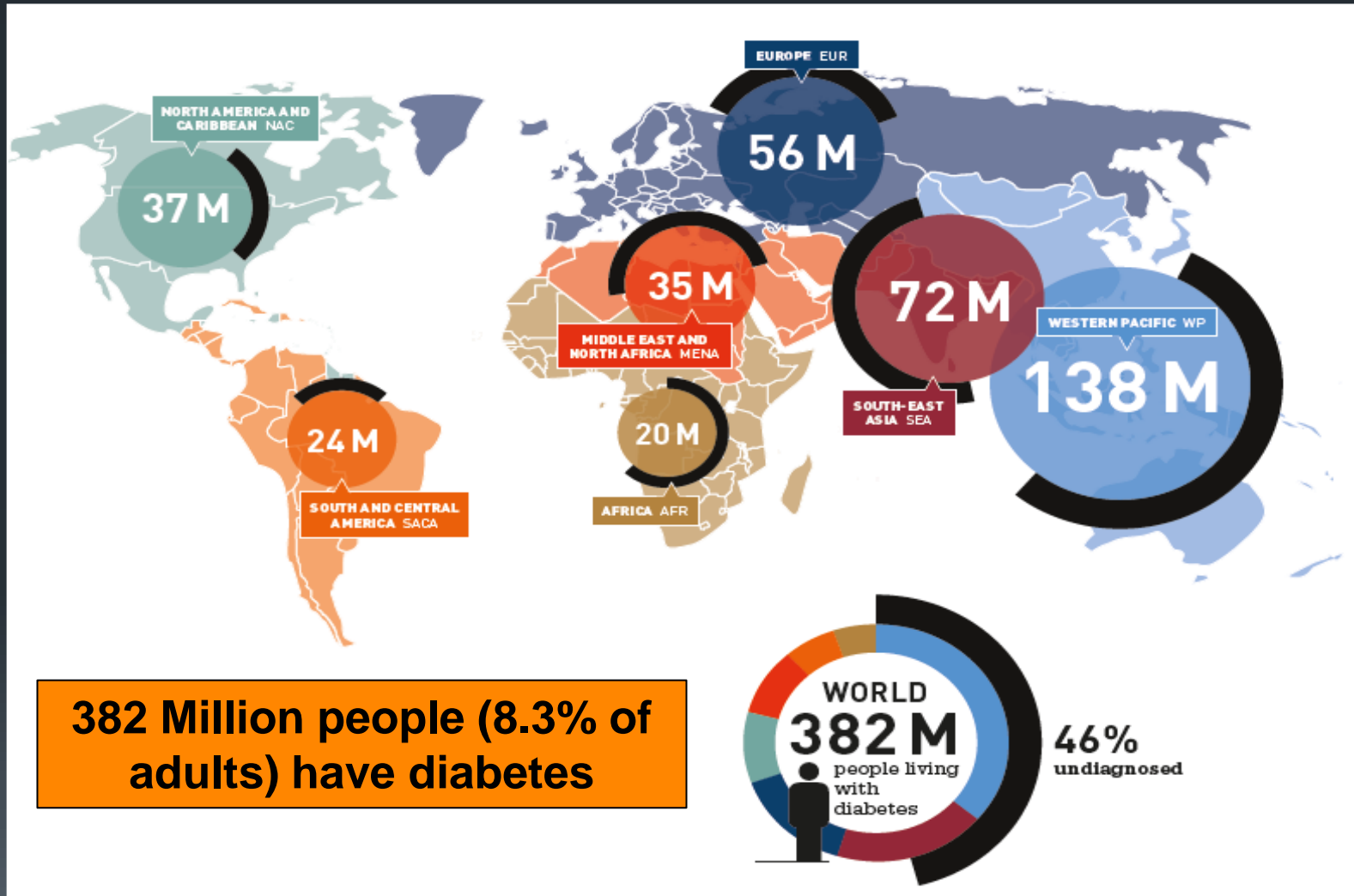
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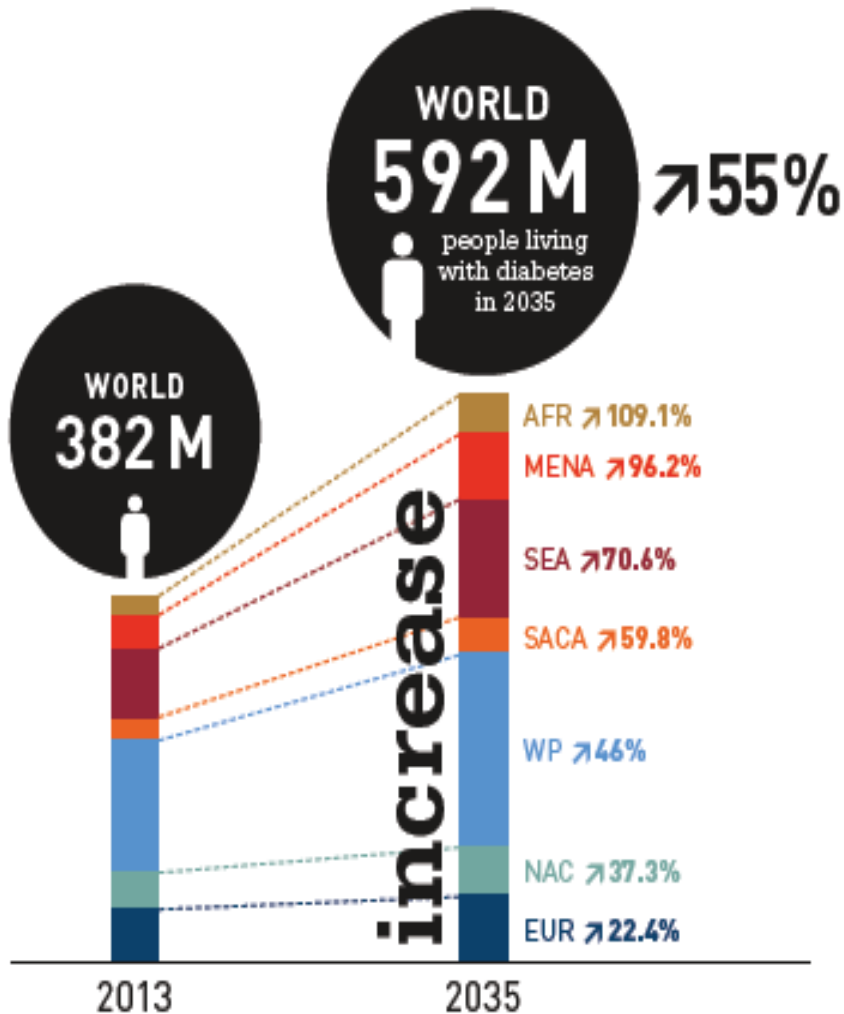
Pro-Cardio Heart Disease and Stroke Prevention Centre (Hong Kong)

Chairlady of Hong Kong Dietitians Association

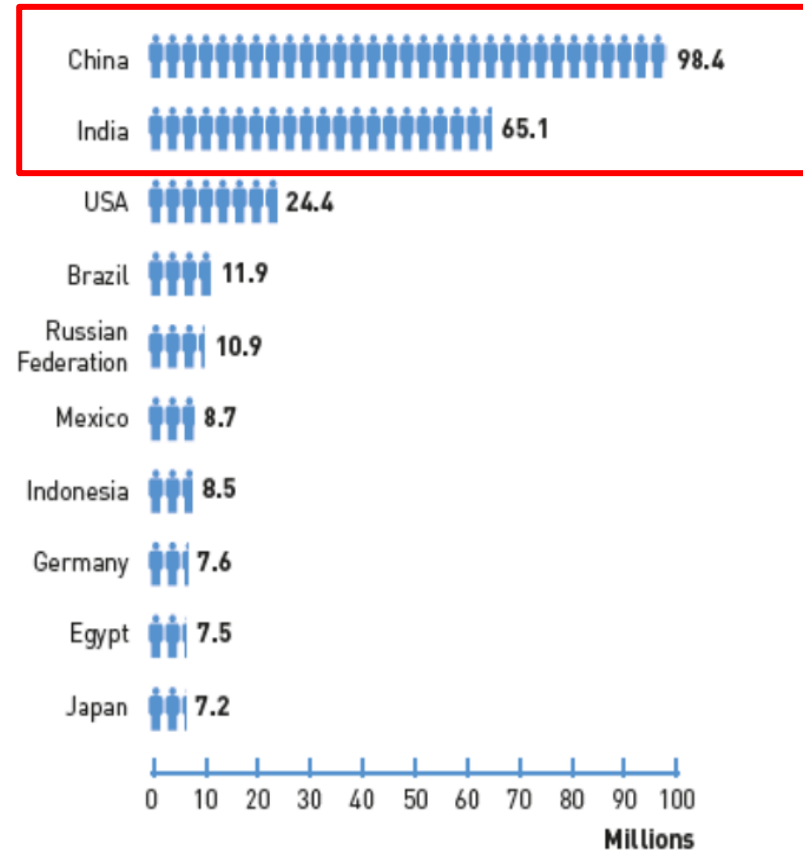
Global Prevalence of Diabetes Mellitus



Diabetes is a huge and growing problem



Top 10 countries/territories of number of people with diabetes (20-79 years), 2013



GOOD FATS vs BAD FATS



NO SUGAR

HIGH PROTEIN DIETS

low-GI



MEDITERRANEAN DIET

VEGETARIAN DIET

HIGH CARBS
OR
OR
OR
LOW CARBS

I am diabetic

GLASBERGEN

“Which ‘sensible diet’ do you want me to follow?
I found 123,942 of them on the internet!”

Outline



1. Background
2. Updates on the MNT guidelines for diabetes
 - American Diabetes Association 2014
 - MNT for hospitalized DM patients
3. Updates on the beneficial role of diabetes specific formula on diabetes control
4. Updates on prevention of diabetes

Goals of MNT that apply to individuals at risk for diabetes or with pre-diabetes (ADA 2008)

- To decrease the risk of diabetes and cardiovascular disease (CVD) by promoting healthy food choices and physical activity leading to moderate weight loss that is maintained.
- Goals of MNT that apply to individuals with diabetes:
 1. Achieve and maintain
 - Blood glucose levels in the normal range or as close to normal as is safely possible
 - A lipid and lipoprotein profile that reduces the risk for vascular disease
 - Blood pressure levels in the normal range or as close to normal as is safely possible
 2. To prevent, or at least slow, the rate of development of the chronic complications of diabetes by modifying nutrient intake and lifestyle
 3. To address individual nutrition needs, taking into account personal and cultural preferences and willingness to change
 4. To maintain the pleasure of eating by only limiting food choices when indicated by scientific evidence

Goals of MNT that apply to adults with diabetes (ADA 2014)

- To promote and support healthful eating patterns, emphasizing a variety of nutrient dense foods in appropriate portion sizes, in order to improve overall health and specifically to:
 - HbA1c < 7%
 - BP < 140/80 mmHg
 - LDL < 100 mg/dl (2.6 mmol/L)
 - TG < 150 mg/dl (1.7 mmol/L)
 - HDL > 40 mg/dl (men) (1.0 mmol/L);
> 50 mg/dl (women) (1.3 mmol/L)
 - Achieve and maintain body weight goals
 - Delay or prevent complications of diabetes

Goals of MNT that apply to adults with diabetes (ADA 2014)

- To address individual nutrition needs based on personal and cultural preference, health literacy and numeracy, access to healthful food choices, willingness and ability to make behavioral changes, as well as barriers to change.
- To maintain the pleasure of eating by providing positive messages about food choices while limiting food choices only when indicated by scientific evidence.
- To provide the individual with diabetes with practical tools for day-to-day meal planning rather than focusing on macronutrients, micronutrients, or single foods.

2011 Guideline for Management of Post-Meal Glucose in Diabetes (IDF)



- Post-meal hyperglycemia has direct detrimental affect on CVD (1+)
- Evidence suggests that reducing post meal plasma glucose excursions, perhaps more important for achieving HbA1c goals.
- **Therefore, hyperglycemia is harmful and should be addressed.**

Effective therapies in controlling post meal plasma glucose:

- Diet with a low glycemic load are beneficial in improving glycemic control (1+)
- Several classes of pharmacologic agents preferentially lower post meal plasma glucose (1+)

**Target of post meal glycemic control: <160 ml/dl (< 9.0 mmol/L)
as long as hypoglycemia is avoided.**

Ceriello A at al. Arch Intern Med 164: 2090-2095, 2004

Nathan DM at et. Diabetes 2006; 29:1963-1972

<http://www.idf.org/2011-guideline-management-postmeal-glucose-diabetes>

History of DM MNT macronutrients prescription

| Year | Carbohydrates (% TEI) | Protein (% TEI) | Fat (% TEI) |
|-------------|--------------------------------------|--------------------|----------------|
| Before 1921 | Very low calorie and starvation diet | | |
| 1921 | 20 | 10 | 70 |
| 1950 | 40 | 20 | 40 |
| 1971 | 45 | 20 | 35 |
| 1986 | ≤ 60 | 12-20 | < 30 |
| 1994 | * | 10-20 | *+ |
| 2002 | 60-70 (CHO + MUFA ++) | 15-20 | *+ |

* Based on nutrition assessment and treatment goals, which differ with each patient

+ < 10% from saturated fat.

++ CHO: carbohydrates: MUFA: monounsaturated fatty acids

Source: American Diabetes Association

| Nutrient | ADA (2008) | EASD (2004) | Diabetes UK (2003) | CDA (2008) |
|-------------------------------------|---|---|---|---|
| Carbohydrates | <input type="checkbox"/> Individualized <input type="checkbox"/> No < 130g/d | <input type="checkbox"/> 45-60 % TEI | <input type="checkbox"/> 45-60 % TEI | <input type="checkbox"/> 45- 60 % TEI |
| Protein | 15-20% TEI | 10-20 % TEI | < 1 g/kg BW | 15-20 % TEI |
| Fat | Individualized | < 35 % TEI | < 35 % TEI | ≤ 30 % TEI |
| Saturated fat | < 7 % TEI | < 10 % TEI (SFA + trans fat) | < 10 % TEI (SFA + trans fat) | ≤ 7 % TEI |
| Trans Fat | Minimized | < 8 % TEI if LDL ↑ | | Minimized |
| Cholesterol | < 200 mg | <300mg | N/A | < 200mg |
| Mono-unsaturated fatty acids | Individualized | 60-70 for CHO + cis MUFA individually tailored | 10-20 % TEI cis MUFA | Should be in the meal plan when possible |
| Poly-unsaturated fatty acids | Individualized N-3: fish intake 2 or more servings weekly | ≤ 10 % TEI 2 – 3 servings oily fish weekly | N – 6 < 10 % TEI N – 3: fish intake 1 -2 servings weekly | < 10 % TEI (food rich in N-3 and plant oils) |
| Glycemic Index (GI) | <input type="checkbox"/> GI and GL provide a modest additional benefit | <input type="checkbox"/> Emphasized low GI foods | <input type="checkbox"/> Emphasized low GI foods | <input type="checkbox"/> Choose low GI foods more often |
| Dietary Fiber | <input type="checkbox"/> 14g/1000kcal dietary fiber/d | <input type="checkbox"/> 40g/d (20g dietary fiber/1000kca/d) <input type="checkbox"/> about ½ should be from soluble fiber | <input type="checkbox"/> N/A | <input type="checkbox"/> 25-50g dietary fiber/d |
| Sugars | <input type="checkbox"/> Sucrose can be substitute for other CHO source | <input type="checkbox"/> < 10% TEI from sucrose) (up to 50g/day | <input type="checkbox"/> < 10% TEI sucrose | <input type="checkbox"/> < 10% TEI sucrose |

ADA MNT guidelines highlights

- 1) Energy Balance
- 2) Carbohydrates (CHO)
- 3) Sugars
- 4) Artificial Sweeteners
- 5) Glycemic Index
- 6) Dietary Fiber
- 7) Protein
- 8) Fats
- 9) Sodium
- 10) Alcohol
- 11) Vitamins & Herbal Supplements
- 12) Macronutrient Distribution
- 13) Eating pattern

ADA Evidence Grading System for Clinical Practice Recommendations

| Level of Evidence | Description |
|-------------------|---|
| A | Clear or supportive evidence from adequately powered well-conducted, generalizable, randomized controlled trials Compelling nonexperimental evidence |
| B | Supportive evidence from well-conducted cohort studies or case-control study |
| C | Supportive evidence from poorly controlled or uncontrolled studies Conflicting evidence with the weight of evidence supporting the recommendation |
| E | Expert consensus or clinical experience |

Effectiveness of MNT for Diabetes

- Nutrition therapy is recommended to all people with type 1 and 2 diabetes as an effective component of overall treatment plan (A)
- Individuals who have diabetes should receive individualized MNT as needed to achieve treatment goals, preferably provided by RD familiar with components of diabetes MNT (A)
- MNT provided by RD can:
 - ↓ 5-8% total fat intake
 - ↓ 2-4% saturated fat intake
 - ↓ 232-710 kcal/day
 - ↓ 11-13% TG
 - ↓ 7-22% LDL -C
 - ↓ 7-31% total cholesterol
 - **HBA1c: T1DM: ↓ 0.3 to 1.0% T2DM: ↓ 0.5 to 2.0%**

Energy Balance

- Overweight/Obese T2DM adults
 - Reduce energy intake while maintaining a healthful eating pattern to promote weight loss. (A)
- Modest weight loss may provide clinical benefits, especially to those at early stage of diabetes.
 - To achieve modest weight loss, intensive lifestyle interventions (MNT counselling, physical activity, behavior change) with on going support is recommended. (A)

Carbohydrate (A)

- The amount of CHO and available insulin may be the most important factor influencing glycemic response after eating and should be considered when development of eating plan. (A)
- Consumption of sucrose-containing foods (isocaloric substitution) should be minimized to avoid displacing nutrient dense food choices. (A)

Carbohydrate (B)

- Monitor CHO intake by CHO counting/experienced based estimation, remains the key strategies. (B)
- CHO should mainly comes healthy sources such as vegetables, fruits, whole grains, legumes, dairy products. (B)
- Use of nonnutritive sweeteners (NNS) has the potential to reduce overall calorie and CHO intake if substituted for calorie sweeteners without compensation by intake of additional calories from other foods sources. (B)
 - Still little evidence on the use of NNS on weight reduction & reduction of CVD risk.

Carbohydrate (B)

- Sugar sweetened beverages (both sweetened by sucrose or HFCS) should be limited or avoided to reduce risk of weight gain and worsening of CVD risk profile. (B)
- Fructose consumed as “free fructose” (i.e. naturally occurring in fruits) may results in better glycemic control VS sucrose. (B)

Carbohydrate (C)

- Evidence is inconclusive for ideal amount of CHO intake for people with diabetes. Therefore, individualization is suggested. (C)
- Substituting low GI load foods for high GI load foods may modestly improve glycemic control. (C)
 - Difficult to make conclusion due to complexity of diet in studies
 - Difficult to discern the affect of fiber.
 - ?? CVD risk reduction?

Carbohydrate (C)

- Fructose consumption no more than 12% TEI is not likely to have negative effect on triglycerides. (C)
- People with diabetes should consume at least the amount of fiber an whole grains recommended for the general public. (C)
 - 14 g/1000 kcal
 - 25g/day for adult women; 38g/day for adult men.

Protein

- Low protein diet is not necessary for those with diabetic kidney diseases as it does not alter glycemic measures, CVD risk or glomerular filtration rate. (A)
- Protein intake for T2DM might increase insulin response without increasing plasma glucose concentration; therefore CHO sources high in protein should not be used to treat or prevent hypoglycemia. (B)
- Inconclusive to recommend an ideal amount of protein for glycemic control or CVD outcome for diabetic patient without kidney diseases. Therefore should Individualized (C).
 - Protein recommendation for healthy eating is 15% - 20% of TEI.

Fats (1)

- Fat quality appears to be far more important than quantity. (B)
 - MUFA rich eating pattern may benefit glycemic control and CVD risk factors; therefore shall be recommended. (B)
 - Benefit of omeg-6 PUFA remains unclear.
- Evidence is inconclusive for an idea amount of fat intake for people with diabetes; therefore should be individualized (C).
 - Acceptable macronutrient distribution range for total fat is 20-35% of TEI (IOM) with no upper limit.
 - Moderate intake of fat to be consistent with their goals to lose or maintain weight.

Fats (2)

- The amount of dietary saturated fat, cholesterol and trans fat for people with diabetes is the same as that recommended for general population. (C)
 - Saturated fat < 10% of TEI
 - Trans fat intake as little as possible
 - Cholesterol < 300 mg/day
- Use of omega-3 supplements for diabetes are NOT supported by current evidence for the prevention or treatment of CVD events. (A)
- Increase intake of omega 3 from fish and ALA from plant sources are recommended due to their benefits on heart health and other positive health outcomes.(B)
- To consume fatty fish at least twice weekly is also appropriate for people with diabetes. (B)

Fats (3)

- Individuals with diabetes and dyslipidemia may be able to modestly reduce total and LDL cholesterol by consuming 1.6 – 3 g plant stanols or sterols per day typically found in enriched foods. (C)
 - Academy of Nutrition and Dietetics and American Heart Association recommend people with dyslipidemia to have 2 – 3 g of plant stanols/sterols per day.
 - A few studies specify the effect of plant stanols/sterol on diabetic patients. The beneficial effect occurs to both hypercholesterolemic patients with or without diabetes.

Sodium

- The recommendations for the general population to reduce sodium to less than 2,300 mg/day is also appropriate for people with diabetes (B).
- For individuals with both diabetes and hypertension, further reduction in sodium intake should be individualized (B).
- Some studies show < 1,500 mg /day sodium intake might increase mortality in both T1DM and T2DM.
- Should consider food palatability, availability and additional cost to “low sodium ”products.
- Recommended to consume more fresh foods, less processed foods. Use less salty condiments and more herbs and spices.

- *Nutrition Therapy Recommendations for the Management of Adults with Diabetes. Diabetes Care. 2013*
- *Thomas MC et al. FinnDiane Study Group. The association between dietary sodium intake, ESRD and all cause mortality in patients with type 1 diabetes. Diabetes Care 2011. 34:861-866.*
- *Ekinci El et al. Dietary salt intake and mortality in patients with type 2 diabetes. Diabetes Care 2011; 34:703-709.*

Alcohol

- Alcohol consumption may place people with diabetes at increased risk of delayed hypoglycemia, especially if taking insulin or insulin secretagogues. Education and awareness regarding the recognition and management of delayed hypoglycemia is warranted (C).
 - Should consume alcohol with foods to minimize the risk of nocturnal hypoglycemia.
- If adults with diabetes choose to drink alcohol, they should be advised to do so in moderation (E).
 - 1 drink \leq women; 2 drinks \leq Men
 - Excessive amount of alcohol (\geq 3 drinks/day) consumed on a consistent basis may contribute to hyperglycemia.



Micronutrients and Herbal supplements

- Routine supplementation with antioxidants such as vitamin E, C and carotene, is not advised due to lack of evidence of efficacy and concern related to long term safety (A).
- There is no clear evidence of benefit from vitamin and mineral supplementation in people with diabetes who do not have underlying deficiencies (C).
- There is insufficient evidence to support routine use of micronutrient such as chromium, magnesium and vitamin D and the use of cinnamon or other herbs to improve glycemic control in people with diabetes. (C)



Macronutrient Distribution and Eating Pattern

- No ideal percentage of CHO, protein, fat for all people with diabetes. (B)
- Macronutrient distribution should be based on individualized assessment of current eating patterns, preferences and metabolic goals. (E)
- A variety of eating patterns (e.g. vegetarian, DASH, low CHO diet, Mediterranean diet, low fat) are acceptable for the management of diabetes. Personal preferences (e.g. tradition, culture religion, health beliefs and goals, economics) and metabolic goals should be considered when recommending one eating pattern over the other. (E)

Leading International Diabetes Nutrition Guidelines

| Nutrient | American Diabetes Association (2014) | European Association for the Study of Diabetes (2004) |
|------------------------------------|---|---|
| Energy balance | <ul style="list-style-type: none"> ▪ Reducing energy intake while maintaining a healthy eating pattern to promote weight loss for overweight or obese adults | <ul style="list-style-type: none"> ▪ Reduced caloric intake to loose or maintain bodyweight in people with BMI >25 kg/m² |
| Optimal mix of macronutrients | <ul style="list-style-type: none"> ▪ No an ideal percentage of calories from carbohydrate, protein, and fat | <ul style="list-style-type: none"> ▪ N/A |
| Protein | <ul style="list-style-type: none"> ▪ No ideal amount, individualized goals | <ul style="list-style-type: none"> ▪ 10-20 % TEI |
| Total fat | <ul style="list-style-type: none"> ▪ Individualized, fat quality appears to be far more important than quantity | <ul style="list-style-type: none"> ▪ ≤ 35 % TEI |
| Saturated fat acids (SFA) | <ul style="list-style-type: none"> ▪ < 10% TEI | <ul style="list-style-type: none"> ▪ < 10 % TEI (SFA + trans fat) ▪ < 8% TEI if LDL ↑ |
| Trans Fat | <ul style="list-style-type: none"> ▪ Minimized | |
| Cholesterol | <ul style="list-style-type: none"> ▪ < 300 mg/ day | <ul style="list-style-type: none"> ▪ < 300mg / day |
| Monounsaturated fatty acids (MUFA) | <ul style="list-style-type: none"> ▪ MUFA-rich eating pattern is recommended | <ul style="list-style-type: none"> ▪ 10-20% TEI |
| Polyunsaturated fatty acids (PUFA) | <ul style="list-style-type: none"> ▪ Individualized ▪ N-3: fish intake ≥ 2 servings/ week | <ul style="list-style-type: none"> ▪ ≤ 10 % TEI ▪ 2 – 3 servings oily fish weekly |
| Carbohydrates (CHO) | <ul style="list-style-type: none"> ▪ Individualized ▪ Substituting low GL foods for higher GL foods may modestly improve glycemic control | <ul style="list-style-type: none"> ▪ 45-60 % TEI ▪ Emphasized low GI foods |
| Glycemic index (GI) | | <ul style="list-style-type: none"> ▪ < 10% TEI from sucrose (up to 50g/d) |
| Sugar (Sucrose) | | <ul style="list-style-type: none"> ▪ < 10% TEI from sucrose (up to 50g/d) |
| Dietary Fiber | <ul style="list-style-type: none"> ▪ 14g dietary fiber /1000kcal/d | <ul style="list-style-type: none"> ▪ 40g/d (20g dietary fiber /1000kcal/d), 50% soluble fiber |



MNT for hospitalized DM patients

Inpatient MNT aims to optimize glycemic control and to provide adequate calories to meet metabolic demands, address individual needs based on personal food preferences, and provide a discharge plan for follow up care.

MNT for hospitalized DM patients

- Malnutrition is common in hospitalized patient. 40% prevalence in ICU. It associated with:
 - Body mass depletion
 - Poor wound healing
 - Impaired immune function
 - Impaired ventilatory drive and weakened respiratory muscles
 - Longer hospital stay
 - Increased infectious morbidity and mortality
- Inpatient hyperglycemia in patients with or without diabetes is associated with an increase risk of adverse outcomes (e.g. immunosuppression, CVD events, thrombosis, platelet abnormalities, brain ischemia etc.)

Glycemic Targets for Intensive Care and non-critical care patients

| | ADA 2004 | ACE 2004 |
|--------------------------------|--|--|
| Intensive Care unit | <ul style="list-style-type: none"> • Keep close to < 110 mg/dl (< 6.1 mmol/L) if possible • Generally < 180mg/dl (< 10 mmol/L) | <ul style="list-style-type: none"> • Maintain blood glucose \leq 110 mg/dl (< 6.1 mmol/L) |
| Non-Critical Care Units | <ul style="list-style-type: none"> • Pre Meal: < 110 mg/dl (6.1 mmol/L) • Post prandial: <180mg/dl (< 10 mmol/L) | <ul style="list-style-type: none"> • Pre Meal: \leq 110 mg/dl (6.1 mmol/L) • Post prandial: \leq 180mg/dl (< 10 mmol/L) |

- Boucher J. et al. Inpatient Management of Diabetes and Hyperglycemia: Implications for Nutrition Practice and the Food and Nutrition Professional. American Diabetic Association 2007: 107: 105-111
- Clement S et al. Management of diabetes and hyperglycemia in hospital. Diabetes Care 2004: 27:553-591.
- American College of Endocrinology Position Statement on Inpatients Diabetes and Metabolic Control. Endocrine Practice. 2004; 10: 77-82.

MNT for hospitalized DM patients

- Referral to RDs is very important. MNT preferably provided by RDs familiar with component of diabetes MNT.
- It is essential for RDs to:
 - Establish screening criteria for dietitian referrals
 - Identify nutrition-related issues
 - Implement and maintain standardized diet orders
 - Integrate blood glucose monitoring results with nutrition care plans
 - Standardized discharge follow up orders for MNT and post discharge education if necessary.

MNT for hospitalized DM patients

- MNT for inpatient diabetes very challenging due to:
 - Presence of acute illness
 - Poor appetite
 - Inability to eat
 - Catabolic stress (increased energy need)
 - Variation in DM medications
 - Erratic schedule of diagnostic tests or treatments
 - NPO status
 - Surgery schedule

MNT for critically ill DM patients

- Energy requirement for critically ill patients:
 - Normal weight: 25 – 30 kcal/kg/day (1,800 to 2,000 kcal per day) *
 - Obese (BMI > 30) : 11 - 14 kcal/kg/day
- Carbohydrate : ~200g per day evenly divided between meals
(based on 1,800 – 2,000 kcal diet) * *may need individualization*
- Protein: 1.2 -2.0 g/kg/day ; ≥2.0 g/kg/day for BMI 30-40 and ≥2.5g/kg/day for BMI 40.
- Consistent CHO diabetes meal-planning system is encouraged even there is no ideal system.

| Consistent CHO meal plan | VS | Patient controlled DM Diet |
|---|----|--|
| No difference in mean daily BG, frequency of severe hyperglycemia, or adherence to diet. | | |
| <ul style="list-style-type: none">• Required less clinical resources• Less hypo events | | <ul style="list-style-type: none">• More satisfaction on food selections |

- Gosmanov A & Epierez G. *Medical Nutrition Therapy in Hospitalized Patient with Diabetes. Curr Diab Rep. 2012 February; 12(1):93-100.*
- *Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) Journal of Parenteral and Enteral Nutrition Volume 33 Number 3 May/June 2009*

MNT for hospitalized DM patients

■ Enteral Nutrition VS Parenteral Nutrition

- PN has been associated with gut mucosal atrophy, overfeeding, hyperglycemia and increase risk of infectious complications and increased mortality in critically ill patients.
- Enteral nutrition is the preferred route for nutrition support as it's more physiological, can avoid central –catheter related complications from PN, trophic effect on gastrointestinal cells and less cost.

■ Diabetes Specific vs. Standard Enteral Formulas

- Lower CHO, Higher MUFA and fiber
- A number of outpatient and inpatient studies in T2DM subjects have reported the use of DM specific formulas better glycemic control and a trend towards lower HbA1c and lower insulin requirements.

- Gosmanov A & Epierez G. *Medical Nutrition Therapy in Hospitalized Patient with Diabetes*. *Curr Diab Rep*. 2012 February; 12(1):93-100.
- Hise and Fuhrman. *PRACTICAL GASTROENTEROLOGY*. MAY 2009
- Boucher J. et al. *Inpatient Management of Diabetes and Hyperglycemia: Implications for Nutrition Practice and the Food and Nutrition Professional*. *American Diabetic Association* 2007: 107: 105-111

Table 1

Composition of standard and diabetes-specific enteral formulas commonly used in hospitalized patients

| | Calories (kcal/mL) | Carbohydrate (g/L) | Fat (g/L) | Protein (g/L) | Manufacturer |
|---------------------------|--------------------|--------------------|-----------|---------------|-------------------------------|
| Standard formula | | | | | |
| Jevity® 1.0 Cal | 1.0 | 155 | 35 | 44 | Abbott Nutrition ^a |
| Nutren® 1.0 | 1.0 | 127 | 38 | 40 | Nestle Nutrition ^b |
| Osmolite® 1.2 Cal | 1.2 | 158 | 39 | 55 | Abbott Nutrition |
| Jevity® 1.2 | 1.2 | 169 | 39 | 56 | Nestle Nutrition |
| Fibersource® HN | 1.2 | 160 | 39 | 53 | Nestle Nutrition |
| Isosource® 1.5 Cal | 1.5 | 170 | 65 | 68 | Nestle Nutrition |
| Jevity® 1.5 | 1.5 | 216 | 50 | 64 | Nestle Nutrition |
| Diabetes-specific formula | | | | | |
| Glucerna® 1.0 Cal | 1.0 | 96 | 54 | 42 | Abbott Nutrition |
| Nutren® Glytrol® | 1.0 | 100 | 48 | 45 | Nestle Nutrition |
| Glucerna® 1.2 Cal | 1.2 | 115 | 60 | 60 | Abbott Nutrition |
| Diabetisource® AC | 1.2 | 100 | 59 | 60 | Nestle Nutrition |
| Glucerna® 1.5 Cal | 1.5 | 133 | 75 | 82 | Abbott Nutrition |

^aAbbott Park, IL^bGlendale, CA

MNT for hospitalized DM patients

■ Parenteral Nutrition

- PN induced hyperglycemia may be associated to increased risk of infections and hospital complications.
- Macronutrient composition of PN for diabetes:
 - Dextrose ~ 2 g/kg per day
 - Lipids ~ 0.7 – 1.5 g per day
 - Amino acids ~ 1.3-1.5 g/kg
- Avoid overfeeding as it might lead to hyperglycemia.

- Gosmanov A & Epierez G. *Medical Nutrition Therapy in Hospitalized Patient with Diabetes. Curr Diab Rep. 2012 February; 12(1):93-100.*
- Boucher J. et al. *Inpatient Management of Diabetes and Hyperglycemia: Implications for Nutrition Practice and the Food and Nutrition Professional. American Diabetic Association 2007: 107: 105-111*

MNT for hospitalized DM patients

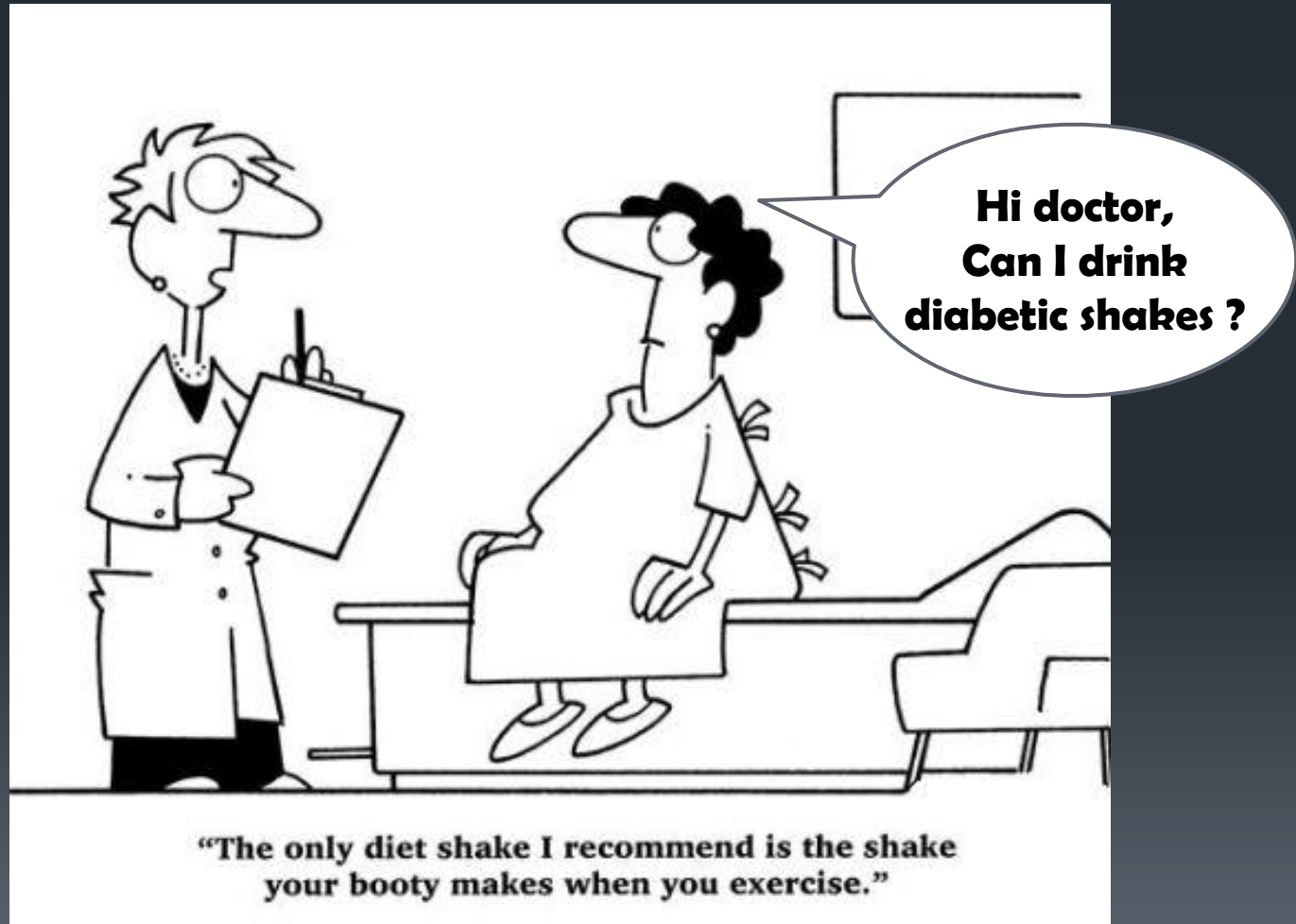
- Continuous or intensify insulin adjustments might be needed.
- Lipid emulsion based on soy bean oil which is rich in omega 6 PUFA might exaggerates inflammatory response during stress and trauma, immunosuppression and impaired neutrophil and macrophage function and even BP elevation.
- Suggested to use olive-oil based lipid emulsion?

- Gosmanov A & Epierez G. *Medical Nutrition Therapy in Hospitalized Patient with Diabetes. Curr Diab Rep. 2012 February; 12(1):93-100.*
- Boucher J. et al. *Inpatient Management of Diabetes and Hyperglycemia: Implications for Nutrition Practice and the Food and Nutrition Professional. American Diabetic Association 2007: 107: 105-111*

DM Inpatient monitoring

- Select glycemic target goals for patients with diabetes and hyperglycemia
- Order bedside capillary point-of-care testing as the preferred method for guiding ongoing glycemic management during nutrition support.
- **Recommend schedules for point-of-care testing:**
 - Before meals and at bedtime in patients who are eating, or
 - Every 4 to 6 hours in patients who are NPO or who are receiving continuous enteral feeding
- Provide diabetes and nutrition education before discharge

Updates on the beneficial role of diabetes specific formula on diabetes control



Enteral Nutritional Support and Use of Diabetes-Specific Formulas for Patients With Diabetes

A systematic review and meta-analysis

- Meta-analysis of 23 studies (19 RCTs, 3 CCT's 1 CT) (784 patients)
 - Oral supplements (16 studies)
 - Tube feeding (7 studies)
- Objective
 - Determine benefits of nutritional support and diabetes-specific formulas in patients with diabetes
 - Diabetes - specific (higher MUFA (40-50%) & fiber, lower CHO (35-40%), fructose (up to 15%) vs. standard formulas
 - Various nutritional status and settings (well nourished, malnourished, hospital, outpatient, home)

Enteral Nutritional Support and Use of Diabetes-Specific Formulas for Patients With Diabetes

A systematic review and meta-analysis

Results:

- Diabetes-specific vs. standard formulas
- Significant reduced
 - postprandial rise in blood glucose by 18.5 mg/dl (1.03 mmol/l)
 - peak blood glucose by 28.6mg/dl (1.59 mmol/l)
 - glucose area under curve by 143.3 mg/dl (7.96 mmol/l/min), i.e. by 35%
 - requirement for insulin (26-71%)
- Fewer incidences of UTI, pneumonia and fever in one study (long-term care residents)
- No significant differences on HDL, total cholesterol, triglyceride, mortality

Enteral Nutritional Support and Use of Diabetes-Specific Formulas for Patients With Diabetes

A systematic review and meta-analysis

Conclusions:

- Diabetes-specific formulas are associated with improved glycemic control compared to standard formulas
- Improvement is shown in both short- and long-term use
- Long-term use may be implicated in reducing chronic complications (e.g. CV events)
- Further studies needed on long term effect of diabetes-specific formula on the management, clinical outcomes, and quality of life of malnourished patients with diabetes.

Efficacy and Tolerance of a Diabetes Specific Formula in Patients with Type 2 Diabetes Mellitus: an Open Label, Randomized, Crossover Study

SEEMA GULATI^{1,2,3}, ANOOP MISRA^{1,2,3,4,5}, RAVINDRA M. PANDEY⁶, KRITI NANDA^{1,2,3}, VIVEK GARG⁷, SANJEEV GANGULY⁷, LORENA CHEUNG⁸

1. Diabetes Foundation (India), SDA, New Delhi, India, 2. National Diabetes, Obesity and Cholesterol Diseases Foundation (N-DOC), SDA, New Delhi, India, 3. Center of Nutrition & Metabolic Research (C-NET), SDA, New Delhi, India, 4. Fortis C-DOC Center for Excellence for Diabetes, Metabolic Disease and Endocrinology, New Delhi, India, 5. Fortis Flt. Lt. Rajan Dhall Hospital, Center for Internal Medicine, New Delhi, India, 6. All India Institute of Medical Sciences (AIIMS), 7. Nestlé India Limited, 8. Nestlé Health Science, AOA region.

Primary objective:

To evaluate the efficacy of a diabetes specific formula – a nutritional supplement, in maintenance of blood glucose level in patients with T2DM.

Presented at American Diabetes Association's 73rd Scientific Sessions, June 21-25, 2013 in Chicago, Illinois.

Efficacy and Tolerance of a Diabetes Specific Formula in Patients with Type 2 Diabetes Mellitus: an Open Label, Randomized, Crossover Study

Secondary objectives:

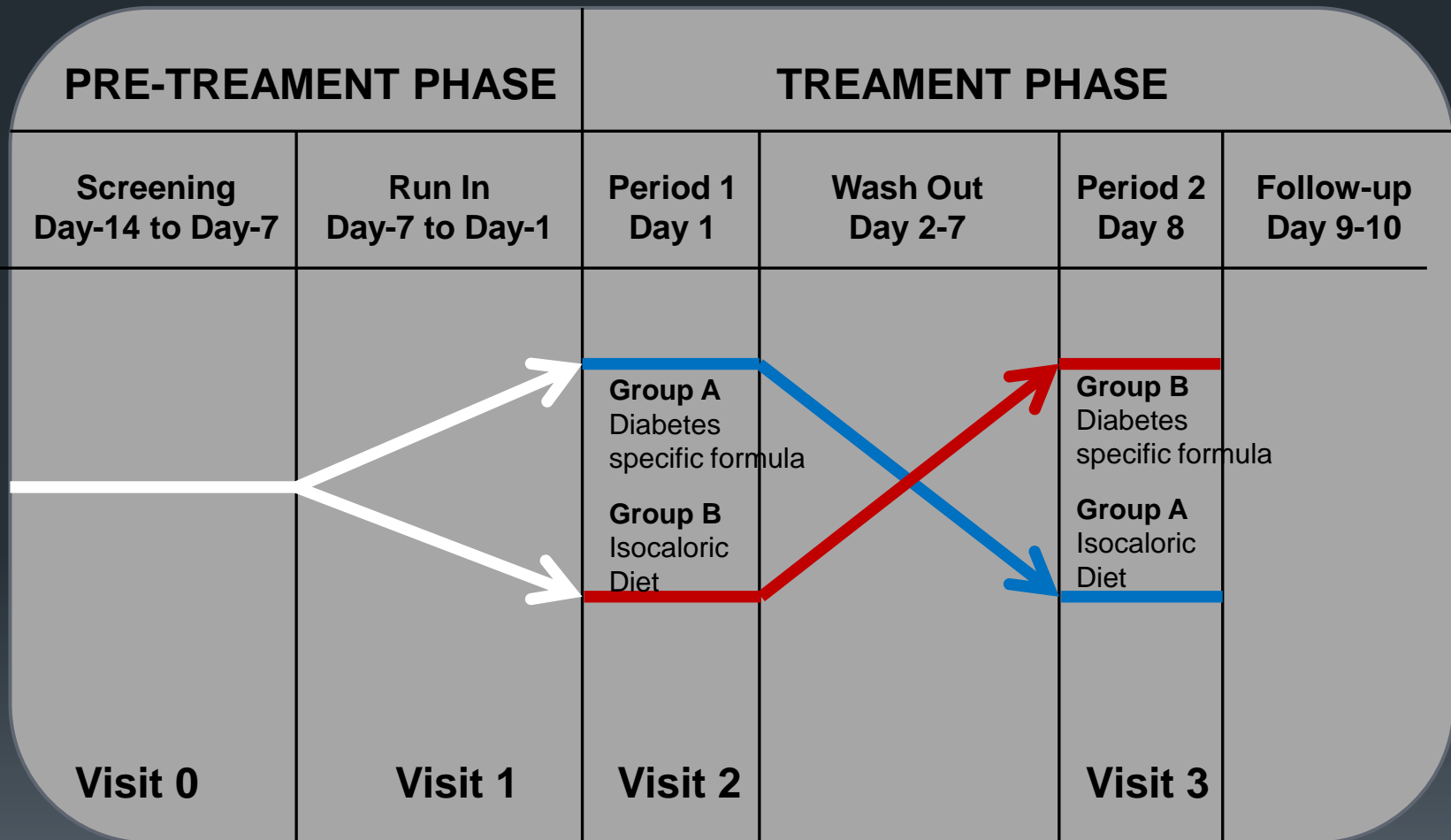
- Evaluate the efficacy of a diabetes specific formula in maintenance of insulin level in patients with T2DM.
- Evaluate the change in postprandial triglycerides level in blood after intake of a diabetes specific formula.
- Evaluate the safety and tolerability of a diabetes specific formula in patients with T2DM.
- Assess the subjective sensations of hunger, satiety, and other appetite sensations.

Methods

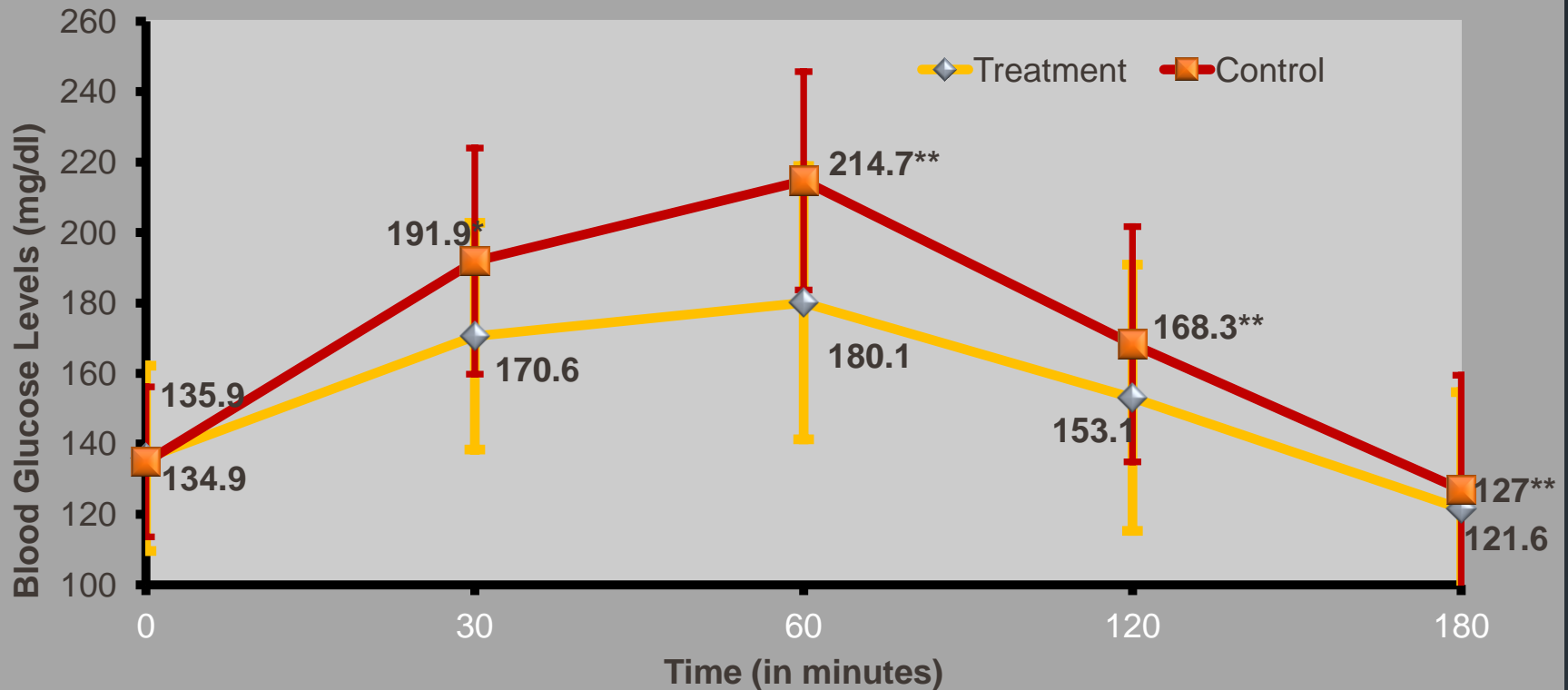
An open label, randomized, crossover, single center pilot study was conducted at a tertiary care center (*Fortis-CDOC Centre of Excellence for Diabetes, Obesity, Metabolic Diseases & Endocrinology, New Delhi, India*).

- 40 T2DM patients; 35-60 years old
- The study consist of a Pre-treatment Phase (2 weeks) and a Treatment Phase (10 days)
- Run in period – on diet and exercise regime for one week then randomized to one of the study group:
 - A. Treatment (Group A)** - Diabetes specific formula, which has a low glycemic index, 50% high quality whey protein, a fat blend with low saturated fatty acids/high monounsaturated fatty acids and is rich in dietary fiber.
 - B. Control (Group B)** - Isocaloric diet (Cornflakes and milk).
- At the end of washout period the crossover of the study groups was done during Period 2 (Day 8).

Figure 1 : Study Design



Area Under Curve(AUC) for Blood Glucose[^]

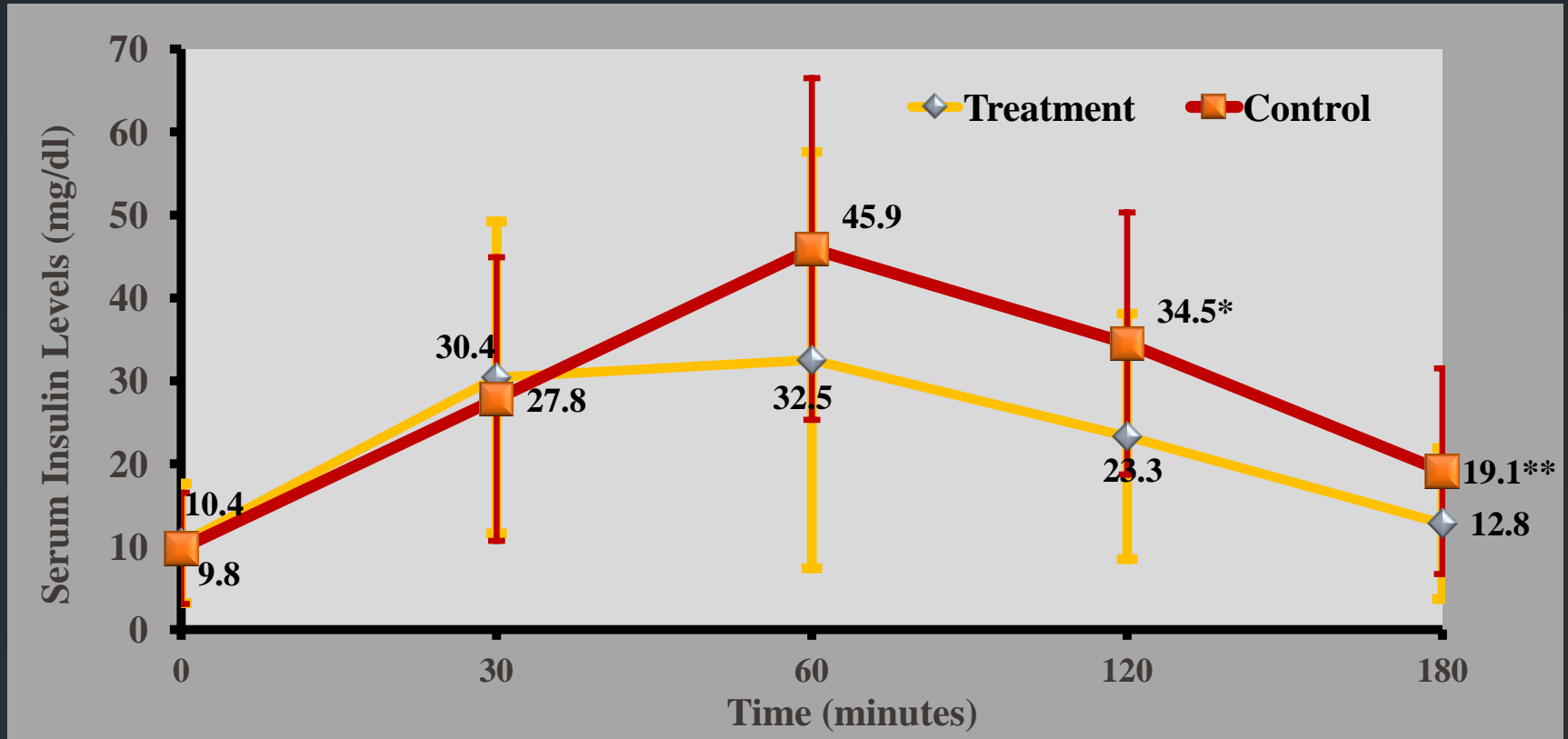


* $p \leq 0.0026$ ** $p \leq 0.0001$

[^] Based on mean value

- The postprandial glucose response i.e. Area Under Curve (AUC) at 30, 60, 120, & 180 min was significantly lower with Treatment as compared to Group B ($p=0.0003, 0.0001, 0.0001, 0.0001$, respectively)
- The maximum concentration (C_{max}) for glucose attained by Treatment was significantly lower as compared to Control (Group B) ($p < 0.05$)

Area Under Curve(AUC) for Serum Insulin^^



* $p < 0.0032$ ** $p < 0.0004$

^^Based on median value

- The AUC for the serum insulin levels from baseline was also lower for Treatment at 120 and 180 min respectively as compared to Control (Group B) ($p = 0.0321$, 0.0004 respectively)
- The maximum concentration (C_{max}) for insulin attained by was lower as compared to Control (Group B) ($p = 0.1254$).

Conclusion



- The present study shows that the diabetes specific formula in T2DM was well-tolerated and had a well-balanced energy distribution with lesser postprandial glucose and insulin excursion than isocaloric diet.
- The intake of the study formula can play a significant role in the nutritional management of T2DM with better maintenance of post-meal blood glucose levels compared with an isocaloric diet.

- *Ramachandran A, Ma RC, Snehalatha C. Diabetes in Asia. Lancet. 2010 Jan 30;375(9712):408-18.*
- *International Diabetes Federation. 2011 guideline for management of post-meal glucose in diabetes. International Diabetes Federation; Brussels: 2011*

Updates on Prevention of Diabetes



Prevention and management of type 2 diabetes: dietary components and nutritional strategies

Sylvia H Ley, Osama Hamdy, Viswanathan Mohan, Frank B Hu

Lancet 2014; 383: 1999–2007

- T2DM is strongly related to obesity, especially central obesity.
- Meta-analysis of prospective cohort studies shows that high waist circumference is stronger than the risk associated with a high BMI.
- Lifestyle modification involving calorie restriction and exercise to promote weight loss (DPP) can reduce risk of conversion to diabetes in patients with IGT by 58%.

- Vazquez G et al. Comparison of body mass index, waist circumference, and waist/hip ratio in predicting incident diabetes: a meta analysis. *Epidemiol Rev* 2007; 29: 115-28.
- Knolwer WC et al. Reduction in the incident of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002; 346: 393-403..

Prevention and management of type 2 diabetes: dietary components and nutritional strategies

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- Aim to lose 5 – 10% of current weight.
- Gradual weight loss of 0.5 – 1 kg per week
- Standard weight loss diet to reduce calorie intake by 500 - 1000 kcal per day
- VLCD and meal replacement can produce impressive short term results but limited value in long term weight loss regimen.
- At least 30 minutes of moderate physical activity on most days of the week.

Prevention and management of type 2 diabetes: dietary components and nutritional strategies

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| | ↓ risk of DM | ↑ risk of DM |
|---|---|--|
| Fat | <ul style="list-style-type: none"> • Plant-based fat • Replacement of saturated fat with omega 6 PUFA • ? Omega 3 | <ul style="list-style-type: none"> • Animal fat |
| Carbohydrates | <ul style="list-style-type: none"> • Cereal fiber • Fiber from fruits • Low GI and GL diet • Proportion does not matter | <ul style="list-style-type: none"> • White rice |
| Vitamins and minerals | <ul style="list-style-type: none"> • ↑ Circulating Vitamin D3 (more physically active) | <ul style="list-style-type: none"> • ↓ Magnesium • ↑ Higher intake of haem-iron |
| Individual foods and food groups | <ul style="list-style-type: none"> • Fruits and vegetables • Fish and seafood (Asian countries) • Nuts (esp. walnut) • Dairy products (esp. yogurt) | <ul style="list-style-type: none"> • Red meat • Processed meat • Fish and seafood (Western countries) |

| | | |
|--|--|--|
| • <i>Diabetologia</i> 2001; 44:805-17 | • <i>Diabetes Care</i> 2011; 34:2116-22 | • <i>BMJ</i> 2012; 344:E1454. |
| • <i>Am J Clin Nutr</i> 2001;73:1019-26 | • <i>Plos One</i> 2012;7:e41641. | • <i>Am J Clin Nutr</i> 2011;94:1088-96. |
| • <i>Arch Intern Med</i> 2007; 167:956-65. | • <i>Diabetes Care</i> 2013; 36:1422-28. | • <i>BMJ</i> 2010; 341: c 4229. |

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| | ↓ risk of DM | ↑ risk of DM |
|------------------------|--|--|
| Beverages | <ul style="list-style-type: none"> • Substitution with water, tea, coffee • Moderate alcohol consumption (24g/day for women; 22 g/day for men) . • Coffee (both caffeinated and decaffeinated). | <ul style="list-style-type: none"> • Sugar sweetened beverages • Excessive alcohol consumption (> 50g/day in women; >60g/day in men) |
| Dietary pattern | <ul style="list-style-type: none"> • Mediterranean diet¹ • Extra virgin olive oil (↓40%)¹ • Nuts supplementation (↓18%)¹ • DASH diet ² • Vegetarian diet ³ • Moderately low carb high in plant base protein diet⁴. | <ul style="list-style-type: none"> • Low carb high animal fat diet |

1. Ssales Salvado J et al. Prevention of diabetes with Mediterranean diets; a subgroup analysis of a randomized trial. *Ann Intern Med* 2014; 160: 1-10.
2. Liese MD et al. Adherence to the DASH diet is inversely associated with incidence of type 2 diabetes; the insulin resistance atherosclerosis study. *Diabetes Care* 2009; 32: 1434-36.
3. Tonstad S et al. Vegetarian diets and incidence of diabetes in the Adventist Healthy Study – 2. *Nutr Metab Cardiovasc Dis* 2013; 23: 292-99.
4. Halton TL et al. Low-carbohydrate-diet score and risk of type 2 diabetes in women. *Am J Clin Nutr* 2008; 87: 339-46.

Take Home Messages (1)

- NO standard meal plan or eating pattern works universally for all people with diabetes.
- All about individualization based on health goals, personal and cultural preferences, health literacy, access to healthful choices, readiness, willingness and ability to change.
- Lifestyle modification program involving frequent contact with a multidisciplinary team is very important.
- Hyperglycemia management in DM Inpatient is very important.
- Enteral nutrition is the preferred route for nutrition support for DM inpatient.
- Diabetes specific formulas used as oral supplements or enteral feeds may help improve post prandial blood sugar level.

Take Home Messages (2)

- Weight reduction by intensive lifestyle modification remains the key strategies for the prevention of diabetes or even reversals of pre-diabetes
- Foods that might reduce the risk of diabetes include intake of high quality fats (plant base, omega 6 PUFA, omega 3 PUFA), intake of fiber, low GI foods, fruits, vegetables, nuts, low fat dairy, fish and seafood (Asian style), moderation intake of coffee and alcohol.
- A variety of eating patterns (e.g. vegetarian, DASH, low CHO diet, Mediterranean diet, low fat, low GL) are acceptable for the management of diabetes.



Thank You !

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**Control
Diabetes**