

Use of Diabetes Specific Formula PRACTICE ISSUE EVIDENCE SUMMARY

Best Practice Issue:	
Do adults or children with type 1 or type 2 diabetes who require tube feeding or supplemental feeding have better blood glucose control with the use of Diabetes Specific Formula (DSF) compared to standard formula?	
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Date of Final Approval:	To be Reviewed:
Purpose:	
<p>Goal: To provide recommendations regarding the use of Diabetes Specific Formulas (DSF) in adults or children with type 1 or type 2 diabetes for the following:</p> <ul style="list-style-type: none"> • as a sole source of nutrition • as supplementary oral nutrition <p>Settings: All (primarily Acute and Long-term care)</p> <p>Users: Registered Dietitians (RD's)</p> <p>Patients/residents/clients: Adults with type 1 or type 2 diabetes</p>	
Definitions:	
Oral Nutrition Supplement (ONS): formula that is used in addition to consumption of other food or as the sole source of nutrition. Oral nutrition supplements can be fed by mouth or via tube.	
Diabetes Specific Formula (DSF): formula that offers less total carbohydrate as well as a variation in the type of carbohydrate to assist in reducing post prandial blood glucose rise.	
Guidelines:	
<p>Because the studies available for review are generally small and of limited power, the evidence to unequivocally recommend the use of diabetes specific formula is correspondingly limited. The author group has used the following agreed upon information to make recommendations:</p> <ol style="list-style-type: none"> 1. Nutrition support in the absence of adequate medical management will have limited impact. 2. Optimal glycemic control is fundamental to the management of diabetes. 3. Both type 1 and type 2 diabetes are defects in the response to food, particularly carbohydrate (CHO). The associated hyperglycemia is both the most characteristic symptom and the cause of downstream sequelae. 4. Dietary CHO is the main dietary determinant of blood glucose and consistency shows the greatest reduction in postprandial and overall glucose concentrations as well as A1C. 5. Tube feeding, meal-replacement and oral nutritional supplement prescriptions for all people with diabetes should be consistent with goals of the Canadian Diabetes Association 2013 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (CDA/CPGs). 	

Recommendations:

Therefore; the author group concludes that for adult patients with type 1 or type 2 diabetes, there is sufficient evidence to recommend the use of formulas that:

1. meet CDA/CPGs for nutritional management of diabetes or
2. are modified in carbohydrate type and amount based on clinicians individualized assessment for:
 - goal of management
 - degree of hyperglycemia/need to optimize the effect of glucose-lowering medications
 - presence of wounds or infection
 - tolerance and preference

There is insufficient evidence to comment on the use of DSF in children.

The Enteral Contract 2015 Diabetes Working Group recommends a product that meets CPGs when used as a sole source of nutrition. We further recommend that diabetes specific formulations are available so that dietitians and health care professionals have appropriate products for blood glucose management based on individual assessment of adults with type 1 and type 2 diabetes. Patients with transient hyperglycemia who have not been diagnosed with diabetes may also benefit from the use of these products.

Based on expert opinion and usual practice considerations for the use of DSF should include:

1. Adequacy of oral intake
2. Acceptance/tolerance of the formula
3. Degree of hyperglycemia and variability of blood glucose
4. Optimal medical management

Please refer to Appendix 1. Comparison of Nutritional Products to Clinical Practice Guidelines

Evidence Review:

According to the Canadian Diabetes Association 2013 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada, diabetes mellitus is a metabolic disorder characterized by the presence of hyperglycemia due to defective insulin secretion, defective insulin action or both. In Canada alone, 6.8% of the population or 2.4 million people have diabetes. Diabetes presents many challenges to the individual, health care providers and the healthcare system. Diabetes is currently treated by lifestyle management (i.e. diet, exercise, limited alcohol and smoking cessation), medications (oral and injectable) and insulin.

Nutrition therapy is the cornerstone of care and consistency in carbohydrate intake, spacing and regularity in meal consumption may help control blood sugars. The macronutrient distributions should be flexible within the recommended ranges and will depend on individual treatment goals and preferences. Of specific concern for this review is whether adults with diabetes (type 1 or 2) who require enteral or supplemental feeding have better blood glucose control with the use of carbohydrate modified formula compared to standard formulas.

Enteral Formulas

Alish, Garvey, Hegazi, Hustead, Maki, and Mustad (2010) evaluated a diabetes-specific enteral formula on glycemic variability in patients with type 2 diabetes. Two different protocols were used in this study. In protocol 1, postprandial glycemia and insulinemia were measured in 22 subjects with diabetes fed a diabetes-specific formula (DSF) or standard formula (SF). In protocol 2, continuous glucose monitoring was used to assess glucose levels in 12 enterally fed patients with diabetes receiving the standard formula followed by the diabetes-specific formula continuously for 5 days each. The findings indicated that in the postprandial response protocol (1), the DSF resulted in lower positive areas under the postprandial curve and peak glucose and insulin levels. In protocol 2 using continuous glucose monitoring, glycemic variability was lower with continuous administration of the DSF than the SF. Also, administration of the DSF resulted in lower mean glucose concentrations during feeding and lower insulin requirements than the SF. Grade B

A systematic review and meta-analysis looking at enteral nutritional support and the use of diabetes-specific formulas for patients with diabetes was completed by Elia et al. in 2005. A total of 23 studies (comprising 784 patients) of oral supplements (16 studies) and tube feeding (7 studies) were included in the review. The majority of the studies compared DSF with standard formulas (SF). Compared with SF, DSF significantly reduced postprandial rise in blood glucose (6 RCT's), peak blood glucose concentration (2RCT's) and glucose area under curve (4RCT's). There was no significant effect on HDL, total cholesterol, or triglyceride concentrations. In, addition, individual studies reported a

reduced requirement for insulin (26-71% lower). This systematic review showed that short- and long-term use of DSF as oral supplements and tube feeds were associated with improved glycemic control compared with SF, and if such nutritional support is given long term, this may have implications for reducing chronic complications of diabetes, such as cardiovascular events. Grade C

Critically Ill

Charney and Hertzler (2004) review article discussed the management of blood glucose and diabetes in the critically ill patient receiving enteral feeding. Enteral formulas should be chosen by patient characteristics, clinical condition, calorie requirements and avoiding over feeding which can worsen metabolic control. Most "standard" polymeric formulas contain approximately 50% carbohydrate, 30-35% fat and 15-20% protein. However there are wide variations in type, amounts and sources of carbohydrate in enteral products. Polymeric formulas contain some combination of oligosaccharides, starches, polysaccharides, corn syrup or fructose. The fat sources are usually high in omega 3 fatty acids that do not have adverse immunosuppressive effects. High fat feeds may slow gastric emptying. Specialty formulas marketed to patients with diabetes are based on research that higher monounsaturated fats and lower carbohydrate compositions will enhance blood glucose management and lipid control. Unfortunately the research is not consistent that specialty formulas are more beneficial than standard formulas. Fibre has been added to some enteral formulas with the thought that some soluble fibre sources can slow absorption from the small intestine, improving glycemic control. However, most available formulas do not contain >15g of fibre/1000mL due to the increased viscosity. They concluded specialty formulas for diabetes have not consistently shown improved outcomes compared with standard formulas. Therefore, they concluded that at this time, it is appropriate to use standard formulas to initiate feedings in most patients with blood glucose abnormalities with close monitoring and use of insulin, which is the key, to maintain blood glucose control and avoid complications. Grade B

Mesjo, Alonso, Escribano, Leiba and Gonzalez have compiled guidelines for specialized nutritional and metabolic support in critically ill patients. The recommendations have been formulated by an expert panel with broad experience in nutrition and metabolic support in critically ill patients and were drafted between October 2009 and March 2011. The studies analyzed encompassed meta-analysis, randomized control trials, observational studies, systematic review and updates in MEDLINE from 1966-2010, EMBASE from 1991-2010 and Cochrane Database of Systematic Reviews up to 2010. All discrepancies were discussed and consensus was reached. To achieve normal blood glucose levels (defined as <150 mg/dl or <8.3 mmol) insulin is often required. There are varying recommendations as to the characteristics for the macronutrient composition and breakdowns. The final recommendations included; monitor blood glucose (BG) values, maintain BG , 150 mg/dl or < 8.3 mmol, treat with insulin if above those goals, continuous insulin perfusion protocols to avoid variable BG and risk for hypoglycemia, early enteral nutrition (within 24-48 hours of admission) after hemodynamically stable and energy requirements should be met without over nutrition. There were no recommendations about the type of enteral formula. Grade C

Carbohydrate-Modified Tube-Feeding Formulas

Voss, Maki, Garvey, Hustead, Alish, Fix, and Mustad (2008) compared glucose, insulin and GLP-1 responses in subjects with type 2 diabetes who consumed a standard nutritional formula, a slowly digested carbohydrate diabetes formula having a lower monounsaturated fat to omega 3 ratio, and a reduced carbohydrate formula rich in monounsaturated fatty acids. Venous blood samples were collected at 30, 45, 60, 90, 120, 180 and 240 minutes post consumption. This study demonstrated that diabetes specific formulas result in different metabolic responses compared to standard formulas in people with T2DM. Compared with a standard formula both diabetes specific formulas were associated with a reduction in blood glucose response of nearly twice that of the standard formula. Postprandial blood glucose response is related to overall glucose control and is significantly affected by the amount and type of carbohydrate and the rate of carbohydrate digestion. Grade A.

Discussion:

Due to the small number of studies and small sample size, the author group is providing guidance and information for dietitians to assess and choose a product that meets the nutritional and glycemic needs of patients/residents/clients. The literature is further limited by a lack of consistency in the source and amount of carbohydrate and other macronutrients. Furthermore, medical management is a variable beyond RD scope of practice. The tools of our practice are manipulation of dietary constituents to maximize blood glucose control therefore availability of standard and specialized formulas to achieve this goal are required.

There is insufficient evidence to make any specific formula recommendations for children with type 1 or type 2 diabetes. As per the CDA/CPGs, all children with type 1 or type2 diabetes should be referred to a diabetes team with pediatric experience. The author team recommends that the dietitian(s) on the pediatric diabetes team select any necessary formulas based on individualized assessment including growth and the need for glycemic control.

Summary:**Products:**

Of the products reviewed in appendix 1, only the following meet all nutritional criteria as per CDA/CPG:

- Jevity 1.2
- Glucerna

The products that closely meet the criteria with the exception of being low in dietary fibre:

- Isosource HN Fibre
- Ensure with Fibre

As ONS if dietary protein intake is inadequate or protein needs are increased

- Boost Diabetic

In summary, there is insufficient evidence to unequivocally recommend the use of DSF. However it is the opinion of the expert review group to have DSF available to be used at clinician discretion based on individualized assessments.

References:

Alish, C.J., Garvey, T., Hegazi, R.A., Hustead, D.S., Maki, K.C., and Mustad, V.A. (2010). A Diabetes Specific enteral formula improves glycemic variability in patients with type 2 diabetes. *Diabetes Technology & Therapeutics*. 12.6, June, 419-425.

Alonso, C.V., Carmona, T.G., and Diaz, M.J. (2011). Chapter 10: Guidelines for specialized nutrition and metabolic support in the critically-ill patient. Update. Consensus SEMICYUC-SENPE: Hyperglycemia and diabetes mellitus. *Nutr Hosp.*, 26(2), 46-49.

Canadian Diabetes Association (2013). Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. *Canadian Journal of Diabetes*, April, 37 (1).

Charney, P., and Hertzler, S.R. (2004). Management of Blood Glucose and Diabetes in the Critically Ill Patient Receiving Enteral Feeding. *Nutr Clin Prac.*, 19, 129-136.

Elia, M., Ceriello, A., Laube, H., Sinclair, A.J., Engfer, M., Statton, R.J. (2005). Enteral Nutritional support and use of DM-specific formulas for patients with DM: Systematic review/meta-analysis. *DM Care* 28(9), Sept., 2267-2279

Mesjo, A., Alonso, C. V., Escribano, J.A., Leiba, C.O., and Gonzalez, J.C. (2011). Guidelines for specialized nutritional and metabolic support in the critically-ill patient. Update. Consensus SEMICYUC-SENPE: Intro and Methodology. *Nutr Hosp.*, 26(2), 1-6.

Voss, A.C., Maki, K.C., Garvey, T., Hustead, D.S., Alish, C.A., Fix B., and Mustad, V.A. (2008). Effect of two carbohydrate-modified tube-feeding formulas on metabolic responses in patients with type 2 diabetes. *Nutrition*. 24, 990-997.

Comparison of Nutritional Products to Clinical Practice Guidelines

Nutritional Supplement (available size) (Cal/ml)		Carbohydrate ♦ 45-60%	Protein 15-20%	Fat 20-35%	Fibre ■ 15-25g/1000 Kcal or 25-50g/day	Meets CPGs Y/N/Reason
Jevity 1.2 (235 ml) (1.2 Cal/ml)	g/1000 Kcal	141g	46g	32g	18g	(Y) Meets all criteria
	% ●	53%	19%	29%	—	
Isosource 1.5 (250 ml) (1.5 Cal/ml)	g/1000 Kcal	112g	45g	43g	5g	(N) Low CHO, High Fat, Low Fibre
	% ●	44%	18%	38%	—	
Isosource HN Fibre (250 ml) (1.2 Cal/ml)	g/1000 Kcal	131g	44g	35g	10g	(N) Low Fibre
	% ●	51%	18%	31%	—	
Ensure High Protein (235 ml) (0.96 Cal/ml)	g/1000 Kcal	138g	53g	27g	0g	(N) High Protein, No Fibre
	% ●	55%	21%	24%	—	
Ensure Fibre (235 ml) (1.06 Cal/ml)	g/1000 Kcal	150g	38g	31g	14g	(N) Low Fibre
	% ●	57%	15%	28%	—	
Resource 2.0 (237 ml) (2.0 Cal/ml)	g/1000 Kcal	110g	40g	44g	0g	(N) Low CHO, High Fat, No Fibre
	% ●	43%	17%	40%	—	
Boost Diabetic ▲ (237 ml) (0.8 Cal/ml)	g/1000 Kcal	88g	85g	38g	16g	(N) Low CHO, High Protein
	% ●	33%	34%	33%	—	
Resource Diabetic ▲ (250 ml) (1.06 Cal/ml)	g/1000 Kcal	90g	60g	44g	11g	(N) Low CHO/Fibre, High Protein/Fat
	% ●	36%	24%	40%	—	
Glucerna Nutritional Drink ▲ (237 ml) (0.95 Cal/ml)	g/1000 Kcal	120g	49g	36g	18g	(Y) Meets all criteria
	% ●	47%	20%	33%	—	
Glucerna 1.0 Cal for Tube Feeding▲ (235 ml) (1.0 Cal/ml)	g/1000 Kcal	98g	43g	55g	14g	(N) Low CHO/Fibre, High Fat
	% ●	34%	17%	49%	—	
Nepro (237ml) (1.8 Cal/ml)	g/1000 Kcal	89g	45g	54g	7g	(N) Low CHO/Fibre, High Fat
	% ●	34%	18%	48%	—	

♦ Higher value if CHO derived from low glycemic index and high fibre foods

● Not all CHO contributes to energy due to fibre content

■ Fibre includes: "dietary fibre", "inulin" and "guar gum" per product guides

▲ Contains >10% CHO from Fructose (CDA CPGs recommend <10% or <60g per day)