Old Is Gold: How Indian Ayurvedic Nutrition Approaches Can Help Manage Childhood Diabetes

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Abstract: Nutrition is crucial for maintaining normal growth, development, and glycemic control in young people with diabetes (PwD). Undue restrictions cause nutrient deficiencies as well as poor adherence to meal plans. Widespread availability of low-cost, ultra-processed, and hyperpalatable food is further damaging. Most families struggle to find ways to provide nutritious, yet attractive, food with a low glycemic index (GI). India is one of the oldest continuous civilizations with a rich and diverse cultural and culinary heritage. Traditional dietary practices, including the centuries-old 'Thali' (meaning plate) concept, emphasize combinations (grains, lentils, vegetables, dairy, spices, prebiotics and probiotics, and fats) of local, seasonal, and predominantly plant-based ingredients. These practices ensure that all of the necessary food groups are provided and fit well with current evidence-based recommendations, including the International Society for Pediatric and Adolescent Diabetes (ISPAD) 2018 Guidelines. Techniques for the preparation, cooking, and preservation of food further impact the GI and nutrient availability. These practices benefit nutrient density, diet diversity, and palatability and thus improve adherence to meal plans and glycemic control. This narrative review describes the ancient wisdom, food composition, and culinary practices from across India which are still valuable today. These may be of benefit worldwide to improve glycemic control as well as quality of life, especially in PwD. Keywords: diabetes management; medical nutrition therapy; traditional Indian practices; ancient food wisdom; India; glycemic control; diabetes education; Indian Thali concept.

1. INTRODUCTION

India is one of the oldest continuous civilizations with diverse religions, cultures, traditions, socioeconomic strata, and agricultural practices living in harmony for millennia. The highly varied geography includes mountains, plains, deserts, tropical and subtropical forests, as well as a long coastline; from this geographical diversity comes an extensive biodiversity in plant species and food traditions. Diabetes, particularly type 1 diabetes, forces families to pay attention to food. Meal plans, timings, and discipline are key components in managing the intricate balancing act of a good glycemic control. The 2018 International Society for Pediatric and Adolescent Diabetes (ISPAD) Clinical Practice Consensus Guidelines recommend a diet "based on healthy eating principles suitable for all children and families, with the aim of improving diabetes outcomes and reducing cardiovascular risk" [5]. Post-prandial hyperglycemia interferes with tight glycemic control and contributes to the development of chronic complications. With increasing commercialization and availability of hyperpalatable foods with high glycemic index (GI), families struggle to ensure nutritious, yet attractive meals [6]. Parents also seek ways to vary dietary options for fussy children and adolescents. Further, type 1 diabetes is associated with a higher risk of celiac disease, which requires a glutenfree diet, considerably complicating dietary management. Working on the premise that people with diabetes (PwD) should have a healthy, balanced meal plan and that there is no special "diabetic diet" [7], this narrative review explores the benefits of traditional food practices from across different parts of India, with a special emphasis on low GI foods which will be useful in type 1 as well as type 2 diabetes.

2. HOW DID ANCIENT INDIA MANAGE A HEALTHY DIET?

A recent report of an excavation in a northwestern Indian state revealed multigrain, high-protein, handmade sweet balls (ladoo) prepared from wheat, barley, chickpea, and oilseeds from the 4000-year-old Harappan civilization [8], showing that this ancient culture had an understanding of balanced nutritional composition. The Vedic scholars developed the science of Ayurveda between 2500–500 BC for managing a healthy lifestyle Ayurveda comes from two words: ayus, meaning life and veda, meaning study or knowledge; hence 'Ayurveda' means knowledge of life. It not only encompassed detailed medical science, but also emphasized nutrition, exercise, and other aspects to promote physical, as well as mental, wellbeing,

strengthen immunity, and enable effective gut function . Food practices focused on function and flavor. The key principles included individualization to match the elements of existence, body types, professions, and the local and seasonal availability of ingredients, all while minimizing waste. Food would be season-specific (‘warming’ foods in winter and vice versa), based on the Ayurvedic concept that there is ‘nature’s wisdom’ in what is seasonally available [10]. Ideally, meals were supposed to have all six tastes: sweet, sour, salty, pungent or spicy, bitter, and astringent. The ancient culture realized that multiple constituents like herbs, spices, and other food components may work synergistically to produce a therapeutic effect . Traditionally, people in India sat down comfortably on the ground to have their meals along with the entire family.

3.MEDICAL NUTRITION THERAPY IN TYPE 1 DIABETES

Medical nutrition therapy (MNT) forms one of the pillars for the management of type 1 diabetes . The goals of MNT are to ensure normal growth and development, sustain adequate physical activity, maintain normal body mass index (BMI) for age and gender, maintain good glycemic control, and help prevent short-term and long-term complications. The meals should be balanced with the necessary micronutrients and macronutrients, adequate fiber, and fluids. The medical nutritional advice should address the child’s needs and the family’s cultural, social, and personal preferences. To optimize glycemic control in PwD, the focus should be on achieving a balance between food intake, metabolic requirements, energy expenditure, and insulin action profile. The ISPAD 2018 Guidelines recommend that carbohydrates should provide 45–50% of calories, fats < 35% (saturated fat < 10%), and proteins 15–20% . Families should be encouraged to eat the same food. The primary determinants of the dose of the pre-meal insulin bolus are the amount and type of carbohydrates in the meal, the GI, and GL. Low GI foods are preferred, except when a rapid rise in blood glucose (BG) is desired (e.g., exercise and hypoglycemia correction). Choosing low to moderate GI and GL foods over high GI and GL foods , maintaining consistency in carbohydrate quantity and quality, and matching insulin to carbohydrate intake help achieve better glycemic control . Low GI (<55) and low-to-moderate GL (<20) dietary patterns have also been shown to improve the lipid profile in individuals with moderately controlled type 1 and type 2 diabetes . Although low carbohydrate diets are sometimes attempted to improve glycemic control, they can be nutritionally inadequate, impair growth and development, increase the risk of disordered eating behaviors, increase hypoglycemia or potentially impair the effect of glucagon in hypoglycemia, and increase cardiovascular risk . Protein and fat intake also need to be considered for calculating the insulin dose as they impact insulin needs and alter the rate of absorption of carbohydrates. In those who have concomitant celiac disease, the meals must also be free of all traces of gluten. Maintaining optimum weight and preventing obesity is equally important for maintaining good glycemic control.

1. Traditional ways to lower glycemic index and improve the nutritive value of rice-based meals.

- Using hand-pounded rice: brown/red/black rice
- Using parboiled rice instead of polished white rice
- Using old (i.e., stored and aged) rice
- Using cooked rice that has been cooled overnight
- Combining rice with protein sources like pulses, yogurt, cottage cheese, egg, fish, poultry, meat
- Adding ghee or nuts and seeds in moderate amounts
- Combining rice with a variety of vegetables as a part of a mixed meal
- Squeezing lemon or adding tamarind to rice meals

Traditional ways to lower glycemic index and improve the nutritive value of wheat based meals.

- Using whole wheat flour and Khapli (Emmer) wheat
- Using broken wheat and larger grit semolina
- Mixing bran and pulse flours like gram flour, soya flour, or millet flour with whole wheat flour
- Adding grated or pureed vegetables, green leafy vegetables, herbs, and spices to whole wheat flour
- Kneading whole wheat flour with yogurt, whey, milk, leftover pulse curry, or vegetable curries

- Stuffing the chapati/paratha made from whole wheat flour with protein sources such as egg, minced meat, cottage cheese, pulses, and vegetables
- Adding fat in moderate amounts

Traditional ways to improve the nutritive value of meals using pulses.

- Using whole pulses or pulses with skin
- Using sprouted pulses (raw/steamed/ground/pureed)
- Adding pulses (and/or its flours) like soybean to grains like wheat, rice, and millets in meals and snacks
- Adding pulses to vegetables and meat curries
- Substituting cereals with pulses in snacks and meals e.g., in pancakes, roasted gram
- Consuming pulse-based spiced pastes (chutneys) with meals

4. COMMON INDIAN SPICES USED IN INDIAN COOKING.

Turmeric, cumin, black cumin, coriander, saffron, green cardamom, large cardamom, cinnamon, fenugreek seeds, black and white pepper, long pepper, mustard seeds, carom, bay leaves, nutmeg, mace, ginger, cloves, garlic, asafoetida, fennel, dried pomegranate seeds, nigella seeds, dried mango powder, various chillies, star anise

Other Considerations

Meal Timings

Ancient Indian texts consider food to be a major preventive and therapeutic tool. They prescribe eating proper amounts, at proper timings, sitting on the floor, and eating together as a family to ‘intensify the digestive fire’ . The ISPAD 2018 Guidelines similarly emphasize the importance of meal-time routines with limitations on snacking, to improve dietary quality and optimize glycemic outcomes. Regularity in mealtimes and routines where the child and family sit down and eat together help establish better eating practices and monitoring of food intake. This is associated with better glycemic outcomes. The Samhitas or Vedas advise finishing dinner before sunset, avoiding sleeping on a full stomach, along with very early rising (“with or before the sun”), and a short afternoon siesta. This was appropriate for the tropics and was a practical form of intermittent fasting. In communities where schools start early and close by early afternoon, this routine can be emulated by early waking, post-lunch nap, and early night meal, since late dinner or late bedtime have been shown to contribute to obesity. The mixed meal in a thali, with greens, complex carbohydrates, proteins, and healthy fats, can be adjusted to ensure smooth post-prandial glycemic excursions, which the insulin bolus can handle well. The child using pre-meal regular insulin may experience hypoglycemia after 2–3 h and would benefit from a mid-meal, portioned, moderate carbohydrate snack like fruit or a pulse-based snack (roasted or boiled pulse, pulse pancake etc.). Individuals on rapid-acting insulin could benefit from a mid-meal, portioned, low-carbohydrate snack such as peanuts, nuts and seeds, cottage cheese (stirfried/ grilled/with vegetables), yogurt, buttermilk raita, or egg. Many of the Indian snacks and beverages can be prepared in a low-carbohydrate form, which may not need a pre-meal insulin bolus.

Dairy Products

The consumption of dairy products has been traditionally encouraged across the country. Milk was consumed in various forms and was also used for obtaining fat (ghee) for cooking. Apart from being consumed plain, healthy additives like powdered nuts or spices improve the taste and nutritive value. Adding raw turmeric powder to milk was traditionally popular for enhancing immunity against infections and improving sleep quality; this is now popular globally as Golden Milk or Turmeric Latte. Curcumin is also known to be beneficial in type 2 diabetes . Buttermilk and fresh, homemade yogurt using live cultures, were part of all major meals and contributed proteins and other nutrients to meals. Yogurt and buttermilk are easy to digest (even by lactose-intolerant individuals) , provide hydration, and offer probiotic benefits. Yogurt-based drinks could be watery or thick and could be plain, salty, or spiced buttermilk; these drinks are low or moderate in calories. They are considered “cooling beverages”, which are useful in the hot summer, and before or after exercise. Indian cottage cheese/soft cheese (paneer), containing 20 g proteins, 12 g carbohydrate/ 100 g, is a very popular food item which has been used in a wide variety of Ways. Milk, yogurt, buttermilk, and paneer are excellent options for meal planning in diabetes, particularly type 1 diabetes.

Eggs, Fish, Poultry and Meat

Fish and other seafood are consumed regularly in the coastal areas and provide essential fatty acids and good quality protein. The meat most widely available is goat meat (mutton) and chicken, which is less fatty than beef, pork, or lamb meat . Being negligible in carbohydrates and high in protein, they have a limited impact on insulin doses and BG values in PwD when consumed in moderation. Eggs are a preferred choice as mid-meal snacks for children on rapid or fast-acting insulin.

Fats and Oils

It is important to have adequate fats in the diet, particularly for the growing child, to provide palatability, energy, and essential fatty acids especially fat-soluble nutrients. In PwD, the added fats also reduce the GI of the meal. However, in excess, fats impair glycemic control and cause obesity and dyslipidemia, increasing the risk of cardiovascular disease. The American Heart Association advises children to be given more polyunsaturated (PUFA) and monounsaturated (MUFA) fatty acids than saturated fats to reduce cardiovascular risk later in life . ISPAD 2018 Guidelines recommend replacing saturated fat with unsaturated fats by using lean meats, fish, low-fat dairy products, and changing to MUFA and PUFA cooking oils. Consumption of 80–120 g of oily fish (rich in n-3 fatty acids) is recommended once or twice a week .

Traditionally, the fat sources in Indian cooking were edible vegetable oils, ghee, and milk products, with a small percentage coming from meat and fish . The vegetable oils—mainly mustard, groundnut, sesame, and coconut oil—were mechanically pressed, preserving not only the fatty acid components and functional compounds, but also the flavor and overall quality of the oil. These traditional oils need to be re-emphasized as the medium for cooking as they have a good MUFA content. Mustard oil, with high n-3 ,and mixed vegetables) are easily prepared. Eaten in small quantities with steamed foods, they add micronutrients, beneficial probiotics and piquancy to meals.

Coconut oil is often vilified for its 91% saturated fatty acid content; similarly, clarified butter (ghee) is condemned as being a saturated fat. However, they are less atherogenic than animal and other plant fats like lard and vanaspati . The traditional adding of ghee to chapatis/steamed rice/idlis/dals flattens post-meal glucose spikes, apart from adding taste and aroma to the meal . Since certain dishes were meant to be prepared in specific oils, it was easy to use a combination of fats, and thus meet the requirements of all the essential fatty acids for complete nutritive value and cardiac health .

Marine fish such as salmon, sardines, or hilsa, which are particularly rich in eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are consumed in coastal areas. Though carbohydrates are the primary determinants of insulin doses, fat and total calories must also be considered when calculating pre-meal doses. It is easier to reduce post-meal spikes and enhance satiety by consuming some healthy fat in each meal.

Nuts and Seeds

A variety of nuts, such as cashews, almonds, walnuts, sesame, pistachio, and pine nuts, as well as the less expensive seeds, including melon, watermelon, pumpkin, cucumber, flaxseed, and peanuts, are commonly used. Roasted peanuts or foxnuts, and other seeds, can be eaten by themselves, mixed with other nuts, or added to gravies, salads, rice, drinks, tangy chutneys, or desserts. They are low in carbohydrates, and are a good source of MUFA, protein, fiber, and antioxidants. The range of low GI snacks made with lentils, nuts, and seeds are invaluable for PwD. Bengal gram, peanuts, or sesame seeds made into ladoos or bars (chikki) with jaggery/dates make excellent healthy desserts, especially before, during, and after vigorous play, or at bedtime, to prevent hypoglycemia.

Celiac Disease

Celiac disease is more common in people with type 1 diabetes. The diagnosis can be devastating for families, who fear the severe dietary restrictions. The variety of gluten-free options available in traditional Indian food ease the problem. These include rice, millets, maize, pulses, buckwheat, amaranth, and flours of raw banana or jackfruit. Vegetables and fruits, nuts and seeds, spices and chutneys, dairy products, eggs, and other non-vegetarian foods, can all be enjoyed in a gluten-free diet.

Festive Foods of India

India celebrates multiple festivals that are associated with festive foods—sweet and savory. These were usually season-specific, mostly using fresh ingredients. Many items have a low GI, and include healthy cereal-pulse combinations, nuts and seeds, pseudocereals, vegetables, and fruits. Preparations with ingredients like neem had medicinal qualities . However, dishes high in refined flour, sugar, salt, and fat have crept in. Their portion size must be kept small in a healthy diet. One way of doing this was serving these foods in small portions as offerings (prasad), along with moderate GI foods such as spiced gram, peanuts, green gram, or other pulses with coconut. Ripe bananas were also often given as prasad: the comparatively higher GI was particularly helpful after fasting. Similar principles can be followed during parties and functions, with wise choices, small portions, and covering extra carbohydrates, protein, and fat with adequate extra insulin and extra physical activity . Some examples of festive foods of India are provided in Supplementary Table

6. LIMITATIONS

This is not a systematic review of the literature. An attempt has been made in this narrative review to revisit traditional Indian food wisdom and healthy ancient culinary practices, discussing how the principles might be useful and applicable in children and adolescents living with type 1 or type 2 diabetes globally. Many common use practices do not have peer-reviewed evidence published to specifically support children with type 1 diabetes.

7. CONCLUSIONS

Traditional Indian food practices evolved over thousands of years and provide a holistic approach. The emphasis was to provide wholesome, balanced, nourishing meals, which were also visually appealing and palatable. Meal combinations were guided by scientifically sound principles, ensuring nutrient density and diet diversity. The traditional Indian Thali matches well with the current ISPAD Clinical Practice Guidelines for type 1 diabetes. Various cooking methods and meal combinations enhance the nutrient bioavailability and lower the GI, thus making it beneficial to both the general population and for people with diabetes. Many of these ancient traditions continue or are being revived. It would be helpful to incorporate these food concepts, combinations, and techniques in our daily lives. Diabetes care teams across the world can help people with diabetes, and their families, explore these options to improve glycemic control and quality of life. Some common, practical, simple suggestions for lowering GI are listed . The benefits of the Thali.