

Chapter 3

Diet and Nutrition Concepts in Ayurveda: Gleaming into Opportunities for Evidence-Based Applications in Health Care

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3.1 Introduction

Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best external clinical evidence available through systematic research. It is, however, important to note that external clinical evidence can inform, but can never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision [1]. This aspect of evidence-based practice looks more apt to Ayurveda where a therapeutic individualisation in light of subjective variations plays a key role towards ultimate decision-making.

Ayurveda (*Ayu + Veda*) as science of life deals with almost every aspect of life to ensure a sustainable health. Its methods involve lifestyle improvements and dietary recommendations and also the therapeutic interventions aiming to promote harmony between spiritual, physical and material needs of a human contextual with the environment. Ayurveda proposes human health as an outcome of a harmonic balance between an individual and their environment [2].

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Individualisation in Ayurveda begins with the idea of individual body types (*prakriti*) and subtypes based on predominance of certain factors (*dosha*) presumed responsible in determining individual physical, physiological and mental aptitudes. *Prakriti* based upon *dosha* therefore forms the fundamental basis of Ayurvedic therapeutics, upon which its decisions are largely based.

As *dosha* are set to drive a specific kind of physiology, it has a differential aptitude to deal with different substrates. This is how, to make a balance of *dosha*, every one may have its own set of preferred food, which may not be shared equally by people of the same age or sex.

Ayurvedic concepts of food and nutrition are holistic and in harmony with the individual as well as with environment. On the contrary, modern understanding of food is elemental, generalised and symptomatic.

3.2 Food and Nutrition: Contemporary and Classical Viewpoints

3.2.1 Food Classification

Modern classification of food comprises of nutrients which help normal functioning of the body. Six major kind of nutrients identified are carbohydrates, fats, proteins, vitamins, minerals and water.

Carbohydrates are the main source of energy, meeting about 70% of the energy requirements. Excess carbohydrates are converted into fat and glycogen and accumulate in the body in the form of adipose tissue.

Fats or lipids are the concentrated form of energy in the food. Comparing to carbohydrates, lipids yield more energy on oxidation. About 30% of energy requirements are met by lipids. Excess of fats and lipids are stored as adipose tissue.

Proteins are structural constituents to cell membranes. The quality of protein depends upon the content of the amino acids, from which it is made up of. Proteins can be used as an alternative source of energy if other sources are insufficient.

Vitamins and minerals are accessory nutrients. Vitamins together with minerals regulate the biological processes. As constituents of enzymes, they catalyse biological reactions.

Water is an ideal vehicle for transporting dissolved nutrients and waste from the body. Apart from the direct intake of water, body needs of water are also met through the consumed food [3].

The Centers for Disease Control and Prevention (CDC) advocates knowledge of food groups in order to generate healthy eating plan. A healthy eating plan (balanced diet) helps in identifying calorie needs, quantity of each food group to be taken and to make healthy choices (Table 3.1) [4].

In Ayurveda, food is classified into 12 groups: grains, pulses, meat, vegetables, fruits, salads, wines, water, milk and milk products, sugar cane products, cooked

Table 3.1 CDC classification of food groups

Food groups	Examples
Grains	Whole wheat bread and rolls, whole wheat pasta, English muffin, pita bread, bagel, cereals, grits, oat meal, brown rice, unsalted pretzels and popcorn
Fruits	Apples, apricots, bananas, dates, grapes, oranges, grapefruit, grapefruit juice, mangoes, melons, peaches, pine apples, raisins, strawberries, tangerines and 100% fruit juice
Vegetables	Broccoli, carrots, collards, green beans, green peas, kale, lima beans, potatoes, spinach, squash, sweet potatoes and tomatoes
Fat-free or low-fat milk and milk products	Fat-free (skim) or low-fat (1%) milk or butter milk, fat-free or low-fat or reduced-fat cheese, fat-free or low-fat regular or frozen yogurt
Lean meats, poultry and fish	Beef, poultry, pork, game meats, fish, shellfish, select only lean; trim away visible fats; broil, roast or poach; remove skin from poultry
Nuts, seeds and legumes	Almonds, hazelnuts, mixed nuts, peanuts, walnuts, sunflower seeds, peanut butter, kidney beans, lentils and split peas

foods and accessory foods (e.g. oils and spices). It is noticeable that Ayurvedic classification of food group is wider in range and envelops all the possible food combinations [5].

Modern medicine and Ayurveda both recommend that food choices should be met as per individual needs and chosen from available variety. Modern science refers to this as individual calorie requirement, whereas Ayurveda refers to it as per individual *prakriti* and digestive capability [2, 4].

3.2.2 Understanding the Digestion Process

Ayurveda teaches that poor digestion is the primary cause of most diseases. *Ama* (toxin generated from undigested food in the stomach) is root to many of the gastrointestinal disorders. *Ama* can be created because of inappropriate combination of food, food contamination, excess food intake or a hypo-digestive state. If the digestive tract inadequately processes the intake loads, *ama* generates. *Ama* subsequently leaks into the system and settles at vulnerable places. Such weakened places are called *khavaigunya* (weak or defective spaces in the organs or tissues where *dosha* begin to settle and initiate subsequent pathologies). *Khavaigunya* can be created in many ways including physical or emotional injury, inherited disorders or unhealthy lifestyle choices. This weakening concept is akin to weak immune system in the modern science. It is a common knowledge that every individual has inherent capability of immune system and hence posses different sensitivity to weather and food.

The strength of digestive fire, called *agni* (biological energy to metabolise nutrients in the body for absorption and complete assimilation without generating much waste), determines an individual's appetite. Adequate digestive fire promotes better appetite. *Agni* regulates digestion, absorption and metabolism of nutrients to transform them into cellular structures. The subtle energy of *agni* transforms the molecules of food

into the substrates of the cell. If the *agni* is improper, the digestion, absorption and metabolism of nutrients will be improper, leading to poor nourishment and *ama* generation. *Ama* eventually coats cells, creates cellular confusion and causes dull, inadequate and lethargic feeling.

Modern science does recognise poor digestion process due to poor release of digestive juices but does not relate it with any body type indications like BMI etc. for individual appreciation. Though it specifically defines digestive metabolism of proteins, carbohydrates and fats clearly, their effect on a combined diet is not so particular.

3.2.3 Eating Principles

Ayurveda identifies individual body constitution as the factor determinant to the appropriateness of a particular diet for a person. This emphasises the fact that one single diet cannot suit every individual. The United States Department of Agriculture (USDA) has also taken cognisance of the fact that one size does not fit all. *My Pyramid* program (now named Choose My Plate) offers personalised eating plans and interactive tools to help an individual planning one's food choices based on specific dietary guidelines [6].

Ayurveda also has defined its dietary guidelines as follows.

3.2.3.1 Appropriate Quantity

Ayurveda stresses substantially for a differential approach towards quantity (*matra*) determination of food in individual cases. Contrary to the generic quantity measurement system based upon calorie requirements in defined age and sex groups, Ayurveda defines it more clearly in terms of individual metabolic status. Ayurveda presumes that a quantitatively appropriate diet is essential for health and that quantity is determined by the *agni* (*Charaka Samhita Sutra Sthana 5/3*) [7]. Quantitative determination of diet in Ayurveda is primarily based upon a sensory specific satiety (SSS) regulation system where one transiently loses the liking for a specific food after consuming it to the satiety level.

In contemporary context, we know that there are many factors which actually drive the food quantity determination, applying on a case-to-case merit. In reference to obesity, we have seen that distorted meal portions and size have eluded the perception of normal food size in general context (variable size of bread, spoons and bowls) which eventually leads to overeating without getting noticed [8].

A quantity may exceed the SSS limits here in presumption that one has not eaten well. Very interestingly, sensory-specific desire (SSD) also plays a role in quantitative determination of food. Foods in a definitive food group share the sensory attribute and thereby act cumulatively on SSS index. This explains how reaching to satiety with one food stops the desire of having the food from the same group again. SSD operates

differently among adults and children. Among adults, this is found to be group specific, whereas among children, this is more food specific. This is how children may suffer with overeating more often than adults [9].

This is evident that to avoid food quantity related troubles, we need to have a cognisance of SSS unaffected by other factors which may alter the consumed food quantity. Ayurveda recognises this cognisance as *anuphatya* (the quantity of food which does not cause a trouble in physical and physiological functions).

A food quantity determination also has a qualitative bearing. The food which is simple and easy to get digested may be taken in quantities bigger than the food which is complex to get digested. Ayurveda thereby proposes a *guru* (complex) and *laghu* (simple) classification of food. Contemporary knowledge of food elaborates about the differential quantities of food required in reference to various food groups. The idea is to supplement adequate amount of components from each group as per its requirement in the body to arrive at a complete food. At no point in time, however, does it talk about an intra-group quantification of foods as per their digestibility.

Within every major food group like carbohydrate, protein and fat, there are variable items which vary on account of their digestibility. Starch, for example, can be categorised into three basic groups: rapidly digestible starch (RDS), slowly digestible starch (SDS) and resistant starch (RS) [10].

Slowly digestible starches are found to blunt the postprandial increase and subsequent decline of plasma glucose and insulin concentrations, leading to prolonged energy availability and satiety, compared to more rapidly digestible starch. Sandsa et al. [11] examined the postprandial metabolic and appetitive responses of a slow-digestible starch (wax maize, WM) and compared it with rapidly digestible carbohydrate, a maltodextrin-sucrose mixture (MS). The result supported that WM provides sustained glucose availability in young, insulin-sensitive adults [11].

For their long yet slow release properties, slowly digestible substances are recommended in lesser quantity when compared to rapidly digestible substances required to meet the immediate requirements of energy. Similar distinctions are also made among the protein category where amino acid composition and digestibility are found to affect critically the net nutritional value of a protein. Contrary to the rapid amino acid release as is observed in rapidly digestible protein, slowly digestible proteins are recommended less on account of amino acid losses post-ileum. Amino acids passing beyond ileum are largely consumed by faecal microorganisms and therefore become unavailable to human metabolism [12].

Ayurvedic perspective of *guru* and *laghu* food may have special implications among various target groups while designing an ideal food combination. For example, in debility where a rapid replenishment is required, a large quantity of *laghu* food with a rapid digestibility and subsequent metabolism may be more suitable comparing to a well-fed obese where a filling and satiating *guru* food may be more apt to suppress the hunger urge for longer time comparing to other foods.

Interestingly, Ayurveda describes an elaborate list of foods which are classified either as *laghu* or *guru*. They, however, are required to be cross-checked through controlled enzymatic hydrolysis and protein digestibility corrected amino acid score (PDCAAS) to generate evidences for their rational clinical applications.

3.2.3.2 Avoidable Food and Food Recommended for Occasional and Regular Use

Preserved foods, for their nutritional deficits or antinutrient properties, are not recommended for regular consumption in Ayurveda. Pork, beef, fish, curd, *yava* (barley) and *mash* (black bean) are also accounted among the foods which are not recommended for regular use. On the contrary, some special varieties of rice (*sasti*, *sali*), cow's milk, goose berry (*amla*), rock salt (*saindhava lavana*), clarified butter (*ghee*) and cow pea (*munga*) are recommended for their regular use. We are not yet fully aware of the health promotive and restorative properties of many among such regular components of Ayurvedic foods. Their exploration and subsequent application therefore in Ayurvedic clinical practice may have larger health care implications than are presently perceived. A regular selection of diet is also a matter of personal selection as Ayurveda perceives. The food which does not generate such diseases, which are yet unborn (*ajatanam vikaranam anutpattikara*) and which maintains health (*swasthyam ye nanuvartate*) is considered ideal and should be consumed regularly. This is clear that this choice allows us to be variable as per our liking and susceptibility towards a particular food group. A food individualisation besides a generalisation among categories of frequently recommended foods (FRF), occasionally recommended food (ORF) and not recommended food (NRF) seems to have formed the basis of Ayurvedic food science.

3.2.3.3 Food in Reference to Seasons

India, the birthplace of Ayurveda, has been blessed with a variety of seasons comprising mainly of winter, summer and rain. Ayurveda interestingly links the climatic variations of these seasonal groups with corresponding changes in human physiology. Seasons, therefore, are linked with the dominance of corresponding *dosha* activity marking the flaring up of season-specific pathologies. To prevent such seasonal pathologies, Ayurveda advises a definitive code of food intake besides many other instructions to keep one healthy. Seasonal variability among the disease epidemiologies is a well-observed fact [13]; however, little work has been done to identify these epidemiological variations in reference to the corresponding changes in the human physiology. A seasonal variation in reproductive, physiological and immunological behaviour in mammal is an observed fact [14, 15].

Pajman [13] noticed that the respiratory tract infection-related sepsis is significantly more common in winter compared to their incidence in fall. This clearly gives us an inference of reduced immunity during extreme weather compared to more cosy weather. Ayurveda beautifully charts a seasonal scaling up and down of body resistance and innate immunity in reference to summer and winter. In reference to innate immunity, the seasons are classified as *adana* (the period of scaling down) and *visarga* (the period of scaling up), where the former is composed of late winter to summer and the latter of rain till early winter. Changes in physiological and immune functions are well defined in reference to a change in weather.

An appearance or disappearance of pathogens, environmental changes and host behaviour are considered responsible for seasonal epidemiological changes. Besides seasonal variables like temperature, humidity and food availability, photoperiod or a light-dark cycle has also been proposed to play a role in seasonal variability of host responses [16].

Ayurvedic seasonal food preferences typically address to the seasonal compromises in order to rebalance them, favouring a sustainable health maintenance. A lot of work, however, would be required to bring this hypothesis of ‘*seasonal disease prevention through an effective dietary modification*’ into an evidence-based reality.

Incidentally, Ayurveda has given enough flexibility to its dietary concepts by accepting that dietary substances are adaptable if they are regularly used (*oaksatmya*). Similarly, it also advocates a tapering method to allow changes into an existing dietary schedule with new ones. A *padanshik* (change in fractions and phases) order is beautifully elaborated in Ayurveda to enable such changes during the transition of seasons without causing an unwarranted illness because of a dietary transition.

3.3 Ayurvedic Diet: Classical Viewpoint

Ayurveda identifies that the physical body and the food are both composed of same five basic elements: earth, water, fire, air and space. If prepared and taken in correct proportion of their taste, food creates a natural balance between these essential elements within the body. The six tastes, sweet, salty, sour, pungent, astringent and bitter, are said to have unique elemental compositions, rendering them *dosha* specific.

3.3.1 Considerations to Decide Food Suitability

Ayurveda defines eight qualities while determining the best use of food to a particular person:

- (a) *Natural quality of food* – Every food has its natural quality which affects the digestion process, and it is more nutritive in its natural form. Some foods like pulses are heavy, having complex molecular structure (take longer time in digestion), while others, like fruits, are light, having simple molecular structure (easily digestible).
- (b) *Processing of food* – Processing changes the natural shape and form of the food and renders it safe and palatable. Processing includes steps like cooking, steaming, roasting, baking, etc. Food processing requires a sense of discrimination in the blending of flavours, as well as of textures, colours and shapes. Sprouting, fermentation and combining different foods in a meal are ways to get the maximum nutritive value from some of our foods. Preservation of its maximum nutritive value should remain the principle behind any food processing.

Table 3.2 Effect of cooking on foods

Cooking
Improves the flavour and palatability of the foods
Makes the food more digestible
Enhances the availability of some nutrients, for example, trypsin inhibitors present in protein foods is destroyed by cooking, which makes the trypsin freely available in the body
Destroys bacteria, thus making the food safe for consumption. This also improves the keeping quality of the food

Appropriate cooking has definite advantages, as mentioned in Table 3.2 [17]. Ayurveda explicitly explains food processing by defining the amount of heat and water required to make a particular food. By changing a processing method, the ultimate qualities of prepared food can also get changed.

- (c) *Combination of food* – Certain foods, when combined together, increase their nutritive value. Various food products are combined or supplemented to enhance the nutritive value of the total offering. However, it should be a proper combination so that it does not cause any complication during digestion, absorption and metabolism of nutrients and not further lead to metabolic disorder [18]. Ayurveda further explains various foods which may have a deleterious effect if combined together. These foods are called *viruddha-ahara* (incompatible diet) and are said to be avoided for their disease-causing potential. Food compatibility may further be defined in reference to individual susceptibility also. A food which is suitable to one individual may not be equally suiting to some other having a different *prakriti*.
- (d) *Habitat and climate of food* – Food should be natural to the climate and habitat where it is being eaten. The foods that naturally appear in winter normally have warm properties. Likewise, the natural summer foods contain good amount of water to keep the body cool. One of the biggest reasons why one should opt for seasonal foods is because they are full of antioxidants that are so good for health. Antioxidants fight free radicals and prevent various disorders [18].
- (e) *Time and disease state during food intake* – Time of food intake and the state of mind and body during intake are also very important. The food intake should be based on the favouring food products (*pathya*) which may offer tranquillity to mind and body in normal state and pathogenic dissociation in disease state. This consideration essentially includes the food required to be avoided (*apathya*) in certain specific conditions. Time (duration between each meal in a day) is based upon the number of frequency per meal in a day, probably based on the physiological condition.

This holistic concept does not find an overbearing reference in modern science.

- (f) *Rules of Use* – Eating order should be guided by digestive sequence of food to offer a better digestion. (One can draw reference to three-course meal culture, popular in Western world. A typical three-course meal starts with a starter, followed by a main course, and ends with dessert.) Simply put, first in the eating sequence is light food which promotes *agni*, so that by the time one eats the

main course, his *agni* is in full flame to digest the complex protein and fat structures. *Dipana* in Ayurveda are like the starters which ignite the *agni*. This is followed by *pachana* which can subsequently help in digestion.

- (g) *User* – Ayurveda puts a great emphasis upon user for maximisation of beneficial effects of diet. A food therefore is required to be individualised. If the food layout and aroma does not generate a neuro-humoral response, *agni* will remain low and hence digestion will remain poor [2].

3.3.2 *Balanced Diet: Classical and Contemporary Views*

In Ayurveda, the concept of balanced diet, is a harmonious combination of six food qualities and six food tastes with due consideration of five elements. It is proposed that a person who includes all the six tastes in his food enjoys good health.

Ayurvedic dietary principles do not limit the quantity or variety of food that can be eaten. As a result, such a diet is not likely to be deficient in any nutrients, assuming that the person is eating enough calories through selection of a wide variety of foods [4].

The *My Pyramid* education framework provides specific recommendations for making food choices that will improve the quality of an average diet. These recommendations are interrelated and should be used together. Taken together, they will result in the following changes from a typical diet [19]:

- Increased intake of vitamins, minerals, dietary fibre and other essential nutrients, especially of those that are often low in typical diet
- Lowered intake of saturated fats, trans fats and cholesterol and increased intake of fruits, vegetables and whole grains to decrease risk from some chronic diseases
- Calorie intake balanced with energy needs to prevent weight gain and/or to promote a healthy weight

The recommendation in this education framework falls under four overarching themes:

- *Variety* – eat foods from all food groups and subgroups
- *Proportionality* – eat more of some foods (fruits, vegetables, whole grains, fat-free or low-fat milk products) and less of others (foods high in saturated and trans fats, added sugars, cholesterol, salt and alcohol)
- *Moderation* – choose forms of food that limit intake of saturated and trans fats, added sugars, cholesterol, salt and alcohol
- *Activity* – be physically active every day

There is a commonality in approach for variety of intake, but healthy diet in modern science is more exclusive rather than inclusive, as in Ayurveda.

In contemporary science, there is no reference of balancing of tastes altogether [19].

3.4 Special Diets

Both modern science and Ayurveda recognise the need of special food for immunologically compromised people. Ayurveda supplements to these thoughts by adding concepts of *pathya* and *apathya*.

3.4.1 Concept of Pathya–Apathya

A food which is beneficial for our body is *pathya*. The contrary is *apathya*. It is further pointed out that there is no rule of thumb to decide upon *pathya* or *apathya*. It depends upon many factors like time, place, season and individual suitability. *Charaka* outlines six factors to decide upon *pathya* and *apathya*. They are quantity (*matra*), time (*kaal*), mode of preparation (*kriya*), habitat (country/place), body constitution (*deh*) and physiological status (*dosh*) [2]. These concepts have been explained above.

Food as a medicine can literally be supplemented with the fact that certain foods contain chemicals which have proven disease-preventing history [20]. Disease-preventing phytochemicals, present in plant food, are shown in Table 3.3 [21]. Properties of functional foods are shared by several phytochemicals present in plant foods [22]. It is interesting to note that several nutrients like vitamin E (tocopherol), provitamin A (β -carotene), ascorbic acid and selenium also have disease-preventing and health-promoting potential, just like phytochemicals. Evidences are piling up for greater possibilities of using food as medicine in many intractable conditions where medicine alone does not suffice to help. Expanding upon the Ayurvedic concept of *pathya-apathya*, a type 2 diabetes reversal is claimed recently by Lim et al. [23]. Using a dietary intervention alone, this study claimed normalisation of beta cell function in association with decreased pancreas and liver triacylglycerol [23]. This study gives similar inferences to those the author observed in a pilot study upon five patients [24]. There are more compelling evidences showing preventive as well as remedial role of diet in obesity and type 2 diabetes [25]. Many dietary ingredients to the Indian conventional diet have been identified for their beneficial roles in various diseases, particularly to diabetes. *Momordica charantia* (*karvellaka*), a highly acclaimed *pathya* for *prameha*, (Ayurvedic synonym for diabetes) is found to contain an insulin-like peptide called foetidin, momordicin or charantin (polypeptide p-insulin). It is postulated that this mimics or improves insulin action at the cellular level or even exhibits extra-pancreatic action [26]. Various mechanisms involved behind its antidiabetic action are proposed as enhanced insulin secretion by pancreas, reduced glycogenesis in liver tissue, enhanced peripheral glucose utilisation and increased serum protein levels [27]. *Piper nigrum* (*marica*) seeds, a common ingredient in Indian kitchen, are also found to have a hypoglycaemic effect. This is also found effective against complications arising due to glycation and glycooxidation of proteins and membranes [28]. *Ocimum sanctum* (*tulasi*) is a household name in India. Besides its medicinal usage, it is conventionally used as daily religious offerings and also as flavouring agent to Indian milk tea. Tulasi leaves are

Table 3.3 Disease-preventing phytochemicals in plant food

Specific food groups	Main health-promoting chemical	Useful in prevention of
Whole cereal, grains	Dietary fibre, tocopherols	Cancer, diabetes, cardiovascular disease, hypercholesterolaemia
Vegetables, fat	α -linoleic acid, linoleic acid, tocopherols ^a	Cancer, diabetes, cardiovascular disease, hypercholesterolaemia
Palm oil	Tocopherols, tocotrienols ^a , carotenoids	Cancer, heart diseases, atherosclerosis, cataract, pulmonary diseases, muscle injury
Yellow or green leafy vegetables, yellow fruits	Carotenes ^a , ascorbic acid ^a , dietary fibre, omega-3 fatty acids	Cancer, heart diseases, atherosclerosis, cataract, pulmonary diseases, muscle injury
Rice bran oil	Sterols, PUFA	Hypercholesterolaemia, diabetes, cardiovascular disease
Linseed oil, fish oil, flax seed oil	Omega-3 fatty acids	Hypercholesterolaemia, diabetes, cardiovascular disease
Spices, fenugreek seeds	Gums, curcumin, eugenol, capsaicin	Cancer, cardiovascular disease, detoxification of drugs and toxins

^aAnti oxidants

found to stimulate insulin secretion from the β cells via physiological pathways [29]. Curcumin, the yellow phenolic curcuminoid present in turmeric, is reported to have a wide range of biological activities. It delays galactose-induced cataract in rats [30] and also exhibits very high lipid-soluble antioxidant action and may be helpful in diabetes [31]. *Curcuma longa* root also contains Rumarin, used for its antipruritic activity and may be helpful in reducing itching sensations in those with hyperglycaemia [32, 33]. *Trikatu* is a phytocombination (*Piper longum*, *Piper nigrum* and *Zingiber officinale*) that increases bioavailability by promoting rapid absorption from the gastrointestinal tract, or preventing metabolism/oxidation during first passage through the liver after being absorbed, or a combination of these mechanisms, helping improve most drugs' therapeutic activity [34]. Their bioenhancing role has recently been proposed for combining them with various known pharmacological molecules to increase the bioavailability of the latter and hence reducing their dose requirements to produce desired therapeutic effects [35].

The concept of '*diet in disease*', however, still needs a thorough probing to bring these scattered observations and inferences on a larger scale to establish their applicability in various disease conditions on a practically adaptable model.

3.4.2 Body Acclimatisation as a Food Recipient

Detoxification of the body or acclimatisation of the body as a food recipient has been practised in ancient and modern world. A weakened body (weakened by virtue of age or disease or digestive power) is always acclimatised to normalcy through a ritual from simple (easy to digest) to complex (difficult to digest) foods. Panchkarma is a very popular Ayurvedic ritual for detoxification of the body. After

performing the panch-karma, the subject is kept on a specific dietary regimen (*samsarjana*) consisting of rice preparations first, from *peya* preparations (almost liquid preparations) to *anna* (semi solid preparations) to *vilepi* (solid preparations). The ritual is from easy to complex food to adapt and improve the body's digestive powers slowly but systematically.

After the rice preparation, the subject is given pulse preparations called *yush*. Again, the first one to be adopted here is *akrit yush* (*dal* without frying) followed by *krit yush* (*dal* with frying).

Once these two courses are over, only then is the subject exposed to *mans rasa* (animal protein). The *mans rasa* can again be in *akrit* and *krit* sequence. After sequencing the food in the given order, the person may finally be allowed to take full meal consisting of wheat.

We can find these adaptation examples in baby foods, which are the most acknowledged type of feeding mechanism for newborn infants. They are first kept on mother's milk as natural recipients and then on infant food followed by weaning food. Rice-based weaning food are always recommend for infants first, up to a certain age, followed by wheat-based weaning foods. The logic is the same – from simple to complex food in terms of digestibility and in terms of strengthening of the digestive system to deal with more complex foodstuffs.

3.4.3 Food, Age and Lifestyle

Traditional wisdom has always guided different food combinations and processing techniques to enhance the nutritive value of food. In modern science, food fortification is used for maintaining and enhancing the nutritional status of foods. Food fortification or supplementation is also used as a tool to provide essential nutrients to people with compromised metabolic conditions or to people with specific nutritional requirements. For example, high-protein foods are not given to old-age people as their ability to digest complex food gets slower with time. Sportspeople would require protein-rich diet. A rich diet (high in calorie, protein, fat, calcium, iron) is recommended for pregnant and lactating women. Impacts of adequate diet during pregnancy are obvious and evident. They not only reduce the pregnancy-related complications but also add to the health of newborn in the form of their improved weight [22]. In disease condition, dietary modifications not only control the disease condition but also help in recovery of the patient.

Modern science acknowledges that lifestyle is one substantial reason for diseases. Lifestyle diseases include metabolic syndrome and cancer. There are considerable epidemiological evidences suggesting that adequate lifestyle including exercise and dietary modification would lower the risk for these diseases [36]. Diabetes is the best-described lifestyle disease. In 2005, 17 million people were diagnosed with diabetes in the USA, while another one third remained undiagnosed. By 2050, the USA alone will have around 48 million people with diabetes. In 2004, India had an estimated 37.76 million diabetics – 21.4 million in urban areas and 16.36 million in rural areas [37, 38].

Indian habitual diets are predominantly based on plant and animal foods like cereals, pulses, green vegetables and fats. They generally are good sources of bio-active phytochemicals, particularly dietary fibre, vitamin E, omega-3 fatty acids, carotenoids and phenolic compounds. Studies carried out during the past two to three decades have shown that these phytochemicals have an important role in preventing chronic diseases like cancer, diabetes, coronary heart disease and hyperlipidaemia. Table 3.3 shows a list of disease-preventing phytochemicals in plant foods [21].

3.5 Pitfalls and Opportunities

While Ayurveda essentially scores over modern science for being more inclusive, there is a clear complexity in the nature of defining it. Few of the examples are:

- (a) There are seven types of *prakriti* that can have infinite combinations based on the proportion of each *dosha* present. Again, *vikriti* factors also should be taken into account. What may be nurturing to one may be harmful to another. This complexity would mean literally an individual food pyramid (akin to My Pyramid program by USDA) for each person.
- (b) Within the subgroups of food lists, preferences have not been provided for seasonality and conditions of growing.
- (c) Quantity is not based on calories but on the power of digestion and fullness of stomach [5].

Clearly, it generates probing thoughts like:

- (a) How will a common man decipher his *prakriti*? With every person having a *tridoshic* complexity, it seems impossible until met with a trained doctor on a regular basis.
- (b) Every aspect related with food has been given consideration. However, their relative importance has not been defined.
- (c) Dietary quantification in relation with *prakriti* is lacking in specificity.
- (d) How do we define mental state of a person who is eating or who is preparing food?

3.6 Opportunities for Creating Evidence Basis

From the complexity lies the opportunity for investigation and creation of evidence basis. We have observed that Ayurvedic viewpoints, when tested against modern scientific knowledge, stand the testimony as a better and inclusive source of knowledge. At some places, this correlation has strong evidence basis and at other places, found logical [39–41]. However, in general, we find them more at the abstract level without enough guidelines for their applications onto individuals.

Clearly, there are opportunities for further data collection and analysis to establish the evidence basis to achieve the following at the least:

1. Bringing objectivity to the methods of observation with the help of modern diagnostic tools to create definitive determinants for *prakriti* identification
2. Establishing quantitative relationship in between factors affecting *prakriti* and diet of a person using population survey techniques
3. Creating a season-*prakriti*-diet matrix, based on the common knowledge of food groups
4. Methods of raw material selection and their preparation with the current knowledge of active ingredients present in them which have curing properties, etc.

These studies would help create evidence basis to achieve some of the desired objectives as follows:

1. Decide on relevancy of the ancient text vis-à-vis modern practices and make it more contemporary
2. Decide upon preparations since a lot of raw materials have changed their character, owing to soil erosion, global warming and gene modifications for better yield desires
3. Make it more user-friendly and result-oriented
4. Make it more safe with respect to risk of heavy metals, chemical fertiliser and pesticides

There is an urgent need to bring relevance to such a scripture for the new-age human being and his contemporary lifestyles. This fact has recently been recognised by a leading Indian agency, The National Institute of Nutrition (NIN). NIN has come out with its new 'Dietary Guidelines for Indians – A Manual', and the 'Guideline No. 9' is considered the most important for the changing lifestyle of Indians. When NIN came out with its first manual in 1998, it had several guidelines except this one. The economic transition has changed the lifestyles of people. It was taken for granted people would anyway give their body some physical exercise 15 years ago. This, however, is not happening, was a glooming observation made by NIN scientists [42]. Interestingly, besides a wholesome nutrition, physical exercise has also been given due importance in Ayurveda for the purpose of a composite health.

Clearly, there are lots of such probing thoughts in Ayurvedic understanding of food and nutrition and their contemporary relevance in modern context, which need to be considered for objective evaluation, to bring their benefit into the clinical reality. This work is a small step towards this direction.

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