

Chapter 1

Ayurvedic Principles of Food and Nutrition: Translating Theory into Evidence-Based Practice

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1.1 Introduction

Much has been done so far in science to understand food and nutrition with the objective of defining healthy food, which can ultimately reduce the occurrence as well as the impact of disease. At this juncture of advancements made in the field of food science, a lot remains obscure and our understanding is incomplete. We know by virtue of our experience that the same food does not act the same in all people. There are differences among likes and dislikes of food; and likewise there are differences among people in the quantitative and qualitative requirements of food. Many of these mysteries surrounding food appear abstract because they defy explanation in terms of contemporary science. Fortunately, Ayurveda, the ancient science of healthy living, provides some reasonable explanations about the role of food in ensuring health. In this chapter, we will explore Ayurvedic wisdom regarding food and nutrition and determine how this knowledge can be understood in terms of science to make it most useful in evidence-based clinical practice.

1.2 Quantitative Understanding of Food in Ayurveda

Matrashi syata (eat in appropriate quantity) has been the principal motto of Ayurveda for those who wish to be healthy [1]. This emphasizes the fact that individuals must be aware of their own specific needs in terms of quantity of food. Ayurveda takes into account the quantity of food required by each individual. *Charaka samhita*, the foremost compendium of Ayurvedic medicine, dedicates a whole chapter to various quantity-related aspects of food [1].

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1.2.1 Appropriate Quantity of Food Required for an Individual at a Given Time

Matra (quantity) signifies the most appropriate quantity of food needed by an individual at a given time. Contrary to the serving size idea of modern nutrition, which recommends a certain portion of food depending on the individual's age and sex and on the type of food [2], the idea of *ahara matra* (food quantity) is more individualized, dynamic, and flexible. Instead of being based upon generic and fixed variables like a person's age and sex, as in modern nutrition, the Ayurvedic principle of *ahara matra* is more subtle and is based on a dynamic interplay of various consumer- and food-related factors that may vary on a daily basis. The individualization of *ahara matra* in Ayurveda is in stark contrast to modern nutrition, which proposes a more generic approach to food quantity.

1.2.2 Food Requirements May Differ Among People of the Same Gender and of Similar Age

Contrary to the conventional belief that food requirements may be generic as per age and sex, Ayurveda proposes that the food requirements of two people of the same age and gender can also vary considerably. Real life provides plenty of such examples. Some people need less food to remain healthy compared to other people of the same age and gender, who may require much more food.

1.2.3 Factors Determining the Quantitative Requirements of Food in a Person at a Given Time

There are consumer-related and food-related factors that determine the quantitative requirements of food for a given individual. The two key questions to ask are simply what food and for whom?

1.2.3.1 Consumer-Related Factors: Agni Bala

Among the consumer-related factors, *agni bala* (individual digestive and assimilatory capacity) is the principal factor determining the food quantity needed at a given time [3] *agni* signifies the metabolic status of a person and is assessed by the digestive and assimilatory functions of an individual operating at various levels. Depending on the level of its operation, *agni* can be identified as those factors

working at the digestive level (*jatharagni*), tissue level (*dhatvagni*), and metabolite level (*bhutagni*). Consumed food is acted upon initially through *jatharagni* for digestion followed by *dhatvagni* for its assimilation into tissues and finally by *bhutagni*, where individual metabolites are used for various intracellular activities. Ayurveda identifies *agni* as the principal factor responsible for a separation between the retainable (*saara*) from the excretable (*kitta*). A major function of *agni* at every level is to separate the retainable from the excretable of a consumed substance. The malfunction of any of these *agni* will lead to an incorrect production of either of these products and, ultimately, to disharmony. Food quantity should therefore be considered an *agni* that functions at every level to ensure the ultimate healthy fate of a consumed food.

Factors Determining *Agni Bala*

There are two major determinants of *Agni* in Ayurveda. Some are fixed or static for a particular person based upon his or her body type and are called *prakriti*; the others are dynamic and keep changing depending on the season, time of day, and age. Contrary to modern nutrition, Ayurveda does not consider gender a factor in the determination of required food quantity.

Body Type as a Determinant of Agni Bala

Prakriti is a genetic–epigenetic conceptualization of Ayurveda that personifies the genetic–epigenetic interplay of three major body types. These three body types are primarily the metabolic variants of individuals functioning variously at physical, physiological, and psychological levels [4]. Depending on their metabolic levels, three major body types may be categorized as follows: *Vata* are irregular metabolizers, *Pitta* are fast metabolizers, and *Kapha* are slow metabolizers [5].

Food Requirements According to Prakriti

Vata, for irregular metabolizers, require smaller, yet more frequent, quantities of food because they cannot cope with hunger. *Pitta*, the fast metabolizers, require large quantities of food per meal and need it more frequently because they also cannot cope with hunger and thirst. In contrast to these two, *Kaphai*, the slow metabolizers, require smaller quantities of food less frequently because they have a higher tolerance for thirst and hunger. There are several obvious implications of determining food requirements on the basis of *prakriti*. It can be used to determine the fasting tolerance of people who are fasting. Fasting has been a very popular form of religious ritual among Hindus and Muslims. Understanding an individual's *prakriti* can help in designing fasts depending on the person's tolerance without

compromising his or her physical or religious needs. A few more observations are in order regarding *prakriti* in relation to food. Aging is a differential phenomenon as some people age faster than others. Aging is determined primarily by metabolic activities taking place within cells. Clearly, a cell that is metabolically active will age earlier than other, less active cells provided no other protective mechanisms are at work to reverse the aging process [6]. For obvious reasons due to their higher metabolic turnover, *Pitta* people age faster than others. This phenomenon is beautifully noted in Ayurveda by observing that *Pitta* is characterized by increased hunger and thirst, an early graying and loss of hair, and increased mole formations. Contrary to this observation, *Kapha* is characterized by slow metabolic turnover, which is observed through lesser food and a greater tolerance for hunger. To arrest premature aging, it is important to balance food quantities appropriately in accordance with the individual *prakriti* without causing a food deficit or overload. The metabolic rate also determines individual differences among people. The concept of *prakriti* in Ayurveda suggests that every individual is distinct – physiologically, psychologically, and physically.

Dynamic Determinants of Agni

Like most other principles of Ayurveda, *Agni* is also a dynamic entity that varies depending on the age of the individual, the time of day, and the season of the year. Early age is characterized by a predominance of *Kapha* and therefore is marked by *mandagni*. It is a common observation that children are most fussy about food and their nutritional statuses are often compromised owing to poor food intake. Middle age is marked by a predominance of *Pitta* and hence is marked by *teekshnagni*. This is the time when we require a large amount of food at greater frequencies than in early or old age. Old age is characterized by a predominance of *Vata* and therefore is marked by *vishamagni*, causing an erratic appetite. This warrants careful decisions regarding food intake at every meal in old age, reflecting actual appetite and not the desire to consume food.

Age-related quantitative changes in food intake have scientific support as well. Known gastrointestinal (GI) changes occur in humans due to aging. Common changes are a decreased taste threshold, hypochlorhydria (low production of gastric acid in the stomach) due to atrophic gastritis, and decreased liver blood flow and size [7]. These changes reflect a reduced functional capability of the GI system and indicate a need for reduced quantities of food in the later stages of life.

Time of day also requires a careful consideration of food quantity. Morning is the time of *kapha*, and so food consumption should be lower, corresponding to *mandagni*. Therefore, a smaller breakfast is recommended. Daytime is marked by *pitta*, and so more substantial consumption is recommended to match *teekshnagni* of *pitta*.

Because evening is once again the period of *kapha*, food intake should be reduced at that time. A simple notion is that the daytime meal should be heavier than the morning and evening meals, and this is supported by the logic of Ayurveda.

The different seasons also affect the level of *agni* in the body and consequently affect requirements regarding food intake. Summer is marked by greater *vata* and, hence, requires smaller quantities of food compared to winter, when more food is recommended. It is for this reason that summer food should be lighter than winter food.

1.2.3.2 Food-Related Factors in the Determination of Quantity: Food Classification Based on Digestibility

Depending on the time needed for digestion, Ayurveda considers food as *guru* and *laghu*. *Laghu* refers to foods that take less time to digest. Examples of such foods are *shali* rice, *shastika* rice, and *mung*. On the other hand, *guru* foods are those that take more time to digest. Examples of such foods include those prepared from wheat (*pishta vikriti*), sugar (*ikshu vikriti*), or milk (*ksheer vikriti*). As a general rule, *guru* foods should be consumed in smaller quantities than *laghu* foods. According to Ayurveda, *laghu* foods are mainly composed of *vayu* and *agni*. Because of *agni*, they have the inherent property of stimulating digestion. A slightly excessive intake of *laghu* foods therefore will not cause problems. In contrast, *guru* foods are mainly composed of *jala* and *prithvi*. Because *Jala* has the property of countering *agni*, even a slight excess of this food may cause significant problems. To avoid such problems, *guru* foods should be consumed only partially.

1.2.4 Determining Whether Food Is Consumed in the Right Quantity

Anupahatya prakriti yatha kaalam jaram gacchati has been the observational method for knowing whether food is being consumed in the proper quantities. *Anupahatya prakriti* is that quantity of food that can be consumed without any adverse effects on the physical or physiological functions of an individual. *Yatha kaalam jaram gacchati* is that quantity of food that gets digested within a reasonable amount of time. As a consequence, if the proper quantity of food is consumed, one should not feel heavy or lethargic, and one should feel hungry at the appropriate time owing to the timely digestion of the consumed food.

1.2.5 Implications of Inappropriate Ahara Matra

An inappropriate quantity of food may lead to various undesired consequences. Besides commonly understood consequences such as under- or overnutrition, there can be a cascade of consequences related to excessive *ahara matra* identified as *Ama* and related pathogenesis. *Ama*, literally meaning *unripe*, is considered to be a byproduct of inefficient digestion at various levels of *Agni*. This has the property of clogging and clinging within pathways, resulting in a blockade and interruption in normal physiology.

1.2.5.1 *Ama* and Related Disorders

A huge number of clinical conditions having immunological or autoimmune bases are linked to *ama* pathogenesis. Overnutrition has been found to be an essential component of every pathogenesis related to *ama* [8]. Some common clinical conditions related to *ama* are as follows:

- Chronic skin conditions including eczema
- Lethargy, chronic fatigue syndrome
- Various joint and connective tissue disorders

Ama digestion therefore has become the foremost principle of treatment of such conditions in Ayurveda.

1.2.6 Contemporary Factors Driving Food Quantity

Many factors other than individual susceptibility and preferences also act synergistically in determining the quantity of food that is ultimately consumed. Regarding obesity, oversized meal portions may go undetected and seem normal in a certain context, eventually leading to overeating without being noticed. Some common factors involved in miscalculating food quantities are as follows:

- Variable size and weight of bread (eating the same number of slices of bread of variable weight)
- Variable size of spoons and bowls (measuring quantity through the number of spoons or bowls)
- Snacking between meals while thinking that one has had only two regular meals
- High-calorie food in smaller quantities thinking that one has consumed a lesser amount of food

1.3 Scientific Rationale of Quantitative Awareness of Food in Ayurveda

1.3.1 Sensory-Specific Satiety

Quantitative determination of diet in Ayurveda is primarily based upon a sensory-specific satiety (SSS) regulation system where one gradually loses the liking for a specific food after consuming it to the satiety level [9]. We recently have learned that SSS is a complex phenomenon with a number of attributes, including olfactory and gustatory reduction of pleasantness of a food following exposure to it for a certain amount of time [10]. It is also a volume-dependent factor, not component dependent one (Bell et al. 2003) [11].

1.3.1.1 Method of Intake and Sensory-Specific Satiety

A concentrated, undisturbed, and focused mealtime, without too many distractions and properly masticated food, helps us perceive SSS quickly and helps us in judging when to stop eating. As long as we can recognize SSS, overeating is not an issue. Ayurvedic principles on the methods of food intake, popularly called *Ashta ahara vidhi visheshayatana*, are definitive ways of recognizing SSS to identify the appropriate *ahara matra*.

1.3.2 Food Digestibility Index

Based on their digestibility status, foods may be grouped as follows:

- Rapidly digestible food
- Slowly digestible food
- Resistant food

When determining the quantity of a food to consume, its digestibility should be taken into account. Food that is simple and easy to digest may be consumed in larger quantities than food that is complex and, hence, more difficult to digest. The Ayurvedic concepts of *guru* (complex) and *laghu* (simple) foods contain a similar notion of digestibility.

1.3.2.1 Implications of Food Digestibility

Slowly digested starches (SDSs) have been 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 digested starches. Sandsa et al. [12] examined the postprandial metabolic and appetitive responses of a slowly digested starch [wax maize (WM)] and compared it with rapidly digested carbohydrate, a maltodextrin-sucrose mixture (MS). The results supported the idea that WM promotes sustained glucose availability in young, insulin-sensitive adults [12]. For their long yet slow release properties, slowly digested substances are recommended in smaller quantities compared to rapidly digested substances required to meet immediate energy needs.

1.3.2.2 Implications of Ayurvedic Concepts of Food Digestibility

The Ayurvedic concepts of *guru* and *laghu* foods may have special implications for various target groups looking for ideal food combinations. In debility after a prolonged disease where rapid replenishment of nutrients is required, a large quantity of *laghu* foods that are easily and rapidly digested and subsequently metabolized may be more suitable. In contrast, for an obese, a filling and satisfying *guru* food could suppress the hunger urge for a longer amount of time compared to other foods. In normal conditions, there should be a useful combination of *guru* and *laghu* foods in the diet.

1.4 Ayurvedic Principles of Food Preparation and Intake

1.4.1 Eight Points of Consideration in Reference to Food Preparation and Intake

Ashta ahara vidhi visheshayatana, or eight principles of food preparation and intake, was among the most important contributions of Ayurveda to wholesome eating. These eight components incorporate various measures in relation to food preparation, combination, storage, and consumption. What follows is a description of the important aspects of these eight principles of healthy eating.

1.4.1.1 Prakriti

The *prakriti* of a food represents the integral characteristics that are reflected through a set of opposing properties called *gurvadi guna* (*guru* = heavy, *adi* = etcetera). These properties primarily represent the elemental (*panchamahabhuta*) predominance of a food. The ultimate biological effects of food are therefore largely dependent upon the *prakriti* of the food. The following list shows these properties and their opposite features:

<i>Guru</i> (heavy)	<i>Laghu</i> (light)
<i>Sheet</i> (cold)	<i>Ushna</i> (hot)
<i>Snigdha</i> (smooth)	<i>Ruksha</i> (rough)
<i>Manda</i> (slow acting)	<i>Teekshana</i> (fast acting)
<i>Sthir</i> (stable)	<i>Sara</i> (movable)
<i>Mridu</i> (soft)	<i>Kathin</i> (hard)
<i>Vishada</i> (nonmucilagenous)	<i>Picchila</i> (mucilagenous)
<i>Slakshana</i> (fine)	<i>Khara</i> (coarse)
<i>Sthool</i> (gross)	<i>Sukshma</i> (subtle)
<i>Sandra</i> (concentrated)	<i>Drava</i> (liquid)

1.4.1.2 *Karana* (Properties Induced by Food Processing)

Karana are the properties that are induced in food through its processing. Various methods used to enforce new properties in foods include processing with water or heat; cleaning or washing; rotating; saturating with other liquids; storing and keeping in a special vessel.

1.4.1.3 *Sanyoga* (Properties Induced by Food Combination)

Food combination is also supposed to evolve new properties in foods that are otherwise not available in the independent components of the combination. These combinations may act through the mechanism of synergism or antagonism.

1.4.2 *Methods of Food Intake*

Ayurveda also proposes some specific protocols for food intake. These are enumerated as follows:

- Ushna* (hot)
- Snigdha* (smooth, lubricated)
- Mataravata* (in appropriate quantity)
- Jeerne* (once the previously consumed food is digested)
- Viryaviruddhama* (compatible)
- Ishte Deshe* (at appropriate place and in appropriate position)
- Ishta Sarvopakaranama* (satisfying all personal preferences)
- Nati Drutam* (slowly)
- Nati Vilambita* (not too slow)
- Ajalpan* (without talking)
- Ahasan* (without laughing)
- Tanmana* (with adequate concentration)

1.4.3 Implications of Observing the Methods of Food Intake

To observe SSS without getting perverted, Ayurvedic methods of food intake are essential. Observing these methods may help to trigger the neurohumoral aspect of food digestion so that SSS may remain fully functional. These methods can also help one to avoid certain foods and problems related to their consumption.

1.5 Qualitative Attributes of Food

In addition to the classification of food on the basis of its digestibility and appropriateness for human consumption, Ayurveda classifies foods on the basis of abstract qualitative attributes affecting the mind and body of the consumer. The three kinds of food, namely *Sata*, *Raja*, and *Tama*, are usually preferred by people of similar dispositions and temperaments. These foods tend to support the properties in accordance with their inherent qualities [13].

Among these three kinds of food, those that are fresh, smooth, stable, and pleasant in taste and appearance are *satvika* foods. This type of food is promotive of life, health, mental abilities, physical strength, and pleasure [14]. Examples of such foods are freshly prepared foods, fresh fruits, and milk. *Raja* foods are bitter, sour, salty, hot, spicy, and dry. A burning sensation is often experienced after the consumption of *raja* foods. *Raja* food may cause sorrow, grief, and disease [15]. Most junk and preserved food consumed today belongs to the *raja* category. Their harmful effects on health are obvious.

Contaminated, dried, spoiled, old, stale, and fermented foods are considered *tamasika*. These types of food cloud the mind and affect its proper functioning [16].

1.6 Translating the Food and Nutrition Theory of Ayurveda into Practice

Despite the many excellent and wholesome components in the Ayurvedic view of food and nutrition, due to a lack of evidence and a lack of objectivity, sometimes it seems too cumbersome to translate these ideas into practice. In terms of the single most important area of devising an individualized food plan for everyone, first we need to know definitely about an individual's *prakriti*. Until recently, there were no substantiated methods that could have drawn valid, unambiguous conclusions about healthy individuals' *prakriti* [17, 18]. With the development of a Prototype Prakriti Analysis Tool (PPAT), we are now hopeful that we will have the ability to make evidence-based determinations regarding the *prakriti* of an individual [19].

The Ayurvedic *prakriti* doctrine has an empirical, genetic component that is currently attracting more scientific attention, and it is becoming more widely

understood that all people have their own unique qualities with respect to the availability or expression of certain genes associated with specific metabolic functions. Human anatomy and physiology, and their neuro-psychological functions, may differ slightly with regard to these functions [20, 21]. It would be very interesting to determine whether or not a *prakriti* analysis could be conducted for use as a clinical tool to decipher human genome specifications in reference to variable human behavior and functions. If confirmed, this may find extensive applications in defining the substrates that may up- or downregulate the functions of specific genes in the promotion or suppression of the specific functions of those genes [22, 23].

Much remains to be done to define various abstract concepts of Ayurvedic nutrition to develop their evidence-based practical applications. Determining food quantity depending on an individual's digestive system and age and on the type of food chosen, season and time of day are another complex area requiring a lot of research before a firm conclusions can be drawn. Defining *guru* and *laghu* foods on the basis of their digestibility can best be approached by exposing various foods to various enzyme solutions and noting the reactions in a time-dependent manner. The total amount of time required to digest certain foods completely may give a clear indication regarding the *guru* or *laghu* status of a food. Such in vitro studies, although perhaps not fully addressing various confounding aspects of food digestion that occur in vivo, would at least provide some sort of idea about the possible nature of food and its digestibility.

Functional food is another domain where Ayurveda specializes. Various processed and unprocessed foods mentioned in Ayurveda are known for their special properties, often called their *prabhava*. It is surprising to see how Ayurveda may explain many processed and unprocessed foods on the basis of their physiological effects and the benefits they offer. What is required is to validate all the insights of Ayurveda in terms of contemporary science to obtain further confirmation of their effective and reliable use in maintaining human health.

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