

Underutilized Fruits Role in Nutritional Importance of Indian Tribals: A Review

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ABSTRACT

Tribal people of India are severely malnourished along with multiple nutrient-deficiency disorders due to ignorance about importance of fruits and vegetables in their diets. The tribal areas are full of biodiversity having natural vegetation which is not harnessed fully. Due to which a wide gap is formed between health and optimal use of natural sources of nutrients, i.e., underutilized crops. The crops, which are neither grown commercially on large scale nor traded widely, may be termed as underutilized horticultural crops. These crops are cultivated, traded, and consumed locally. These crops have many advantages like easier to grow and hardy in nature, producing a crop even under adverse soil and climatic conditions. So, exploitation of underutilized horticultural crops can become a solution to the social problem of health and nutrition insecurity, poverty, and unemployment. The consumption of underutilized fruit crops can provide nutrition to the poor and needy tribal by meeting the nutrient requirements of vulnerable groups. As underutilized fruits, nuts, and vegetables are rich of source of carbohydrates, fats, proteins, energy, vitamins—A, B1, B2, B3, B6, B9, B12, C, folic acid, and minerals—Ca, P, Fe, and dietary fibre. Thus, they have the nutritional capacity to prevent and cure various diseases like kwashiorkor, Marasmus, night blindness, anemia, diabetes, cancer, hypertension, and hidden hunger. It is also established fact that seasonal, locally available, and cheap fruits and vegetables can also keep the population healthy and nutritionally secure rather than costly off-season ones. Also, the underutilized crops have the potential to give economic security to tribals by giving employment and by fetching good returns from their sale in raw form as well as value-added products.

Keywords: nutritional security, Underutilized fruits, tribals

Received 10.01.2019

Revised 18.03.2019

Accepted 02.05.2019

CITATION OF THIS ARTICLE

E.K.Naik, Aeshna Sinha. Underutilized Fruits Role in Nutritional Importance of Indian Tribals: A Review. Int. Arch. App. Sci. Technol; Vol 10 [3] September 2019 : 01-10

INTRODUCTION

The major tribal areas of Indian states comprises -North eastern region, Rajasthan, parts of Orissa, and West Bengal areas. The *adivasis* are suffering from various deficiency diseases due to faulty eating habits, cultural myths and taboos for foods, improper dietary composition, poverty, ignorance, lack of awareness leading to malnutrition, and health insecurity. Under nutrition is found mostly in rural tribal areas and is concentrated in a relatively small number of districts and villages with 10% of villages and districts accounting for 27–28% of all underweight children (4). Under nutrition includes both protein-energy malnutrition and micronutrient deficiencies. Under nourishment not only affects physical appearance and energy levels, but also directly affects many aspects of the children's mental functions, growth, and development which have adverse effects on children's ability to learn and process information and grow into adults that are able to be productive and contributing members of society. Undernourishment also impairs immune function leaving them more susceptible to infection. Children with infections are more susceptible to malnutrition and the cycle of poverty and malnutrition continues. The prevalence of micronutrient deficiencies varies in different areas, more than 75% of

preschool children suffer from iron-deficiency anemia (IDA) and 57% of preschool children have subclinical Vitamin A deficiency (VAD). Iodine deficiency is endemic in 85% of districts, mostly due to the lack of iodized salt. Every day, more than 6000 children below the age of five die in India. More than half of these deaths are caused by malnutrition—mainly due to lack of Vitamin A, iron, iodine, zinc, and folic acid. About 57% of preschoolers and their mothers have subclinical VAD. (2). Anemia prevalence among children under five years is 69% and among women it is over 55% in a recently concluded national study (3). Women and those living in poverty, especially in tribal areas, are at high risk of malnutrition. Those who live in rural environments have less access to markets in town where there are a variety of nutrient-rich foods. They also have less access to health care facilities due to limited transportation as well as public aid, 400 million people are living below the poverty line and 75% of them live in rural areas. Women are at a lower social level than men and therefore are at a greater risk because they are not valued equally. (14). With the scientific reality of anemia being a result of iron deficiency, these data reflect an almost universal iron deficiency in Indian population. The major source of energy and protein in their diets are cereals and pulses. But due to less consumption of fruits and vegetables, these people develop various micronutrient deficiencies. Hence, underutilized fruits and vegetables can be the best solution to fight this hidden hunger. India is the centre of origin for many tropical fruit tree species, most of which are not commercially cultivated but provide a significant source of livelihood support for many rural tribal communities. Besides their importance for their nutritional value and as a source of household income, this fruit diversity also has a cultural and social value and contributes to the stability of ecosystems (7). Aravali range is the oldest range of the world, which is the treasure of underutilized horticulture crops, and if exploited properly has the potential of transforming the economy of this tribal-dominated region of India. As many as 150 tropical, 50 subtropical, and 20 temperate fruits hold considerable value and the potential of a veritable treasure of a large number of world's fruits still remains to be explored and underutilized (6). Only a few have been cultivated on large scale, many fruit species have not yet been utilized to full potential in spite of their economic value. Some of the important underutilized fruit crops are Timroo, Piloo, Jamun, Sitaphal, Mahuva, Mulberry, Kainth, Ber, Ker, Karonda, Khirni, Date sugar, Tamarind, Bael, Aonla, etc., medicinal plants are Safed musli, Mulathi, Googal, *Aloe vera*, etc. and vegetables are Clusterbean, Kachri, Khip, Khejri pod, and Kakri are the main source of livelihood for the poor tribals and play an important role in overcoming the problem of malnutrition. These horticultural crops have remained underutilized since long. The main reason of being underutilized is the lack of awareness of their potential and low erratic bearing habit of these fruit plants. Besides, some of these fruits are not acceptable in the market in fresh form due to their acidic nature and astringent taste. Hence, there is a need to concentrate on research efforts in diversification and popularization of such underutilized fruit crops. Focused attention is essential for improving and adopting the growing and utilization of these underutilized fruits and vegetables. Thus, product development and diversification of value added products have become very important for underutilized fruit production. The country is successful in evolving appropriate processing technologies for the profitable utilization and value addition in these fruits. As a result products like jam, jelly, preserve, beverages, pickle, dehydrated fruits, and vegetables have been developed and they are having good commercial potential as well as solving nutritional deficiency problems in tribal areas (11). The importance of these lesser known fruits is increasing day by day because people realized the importance of new useful terms such as caloric sweetness, insecticide compounds, and medicinal value. Most of the underutilized fruits are rich source of vitamins (ascorbic acid, thiamine, niacin, pyridoxine, and folacin), minerals, fat, protein, and dietary fiber.

USE OF UNDERUTILIZED FRUITS FOR NUTRITIONAL SECURITY

Specific nutrient deficiency, malnutrition, and under weight of children are significant challenge in tribal areas of India. The intake of nutrients in daily diet is far from satisfactory and largely less than 50% RDA is consumed by over 70% of Indian population (1). Vitamin A, iron, and zinc deficiency when combined constitute the second largest risk factor in the global burden of diseases; 330,000 child deaths are precipitated every year in India due to VAD; 22,000 people, mainly pregnant women, die every year in India from severe anemia;

6.6 million children are born mentally impaired every year in India due to iodine deficiency; intellectual capacity is reduced by 15% across India due to iodine deficiency; and 200,000 babies are born every year with neural tube defects in India due to folic acid deficiency (15). It increases the risk of premature delivery and low birth weight. Maximum children of tribals are suffering from IDA, retarded growth, impaired cognitive performance, and reduced physical activity. Nutrient deficiency also accelerates the mortality and morbidity rate in women. Fruits, nuts, and vegetables play a significant role in tribal population nutrition, especially as sources of vitamins {ascorbic acid (C), carotenoids (A), thiamine (B1), riboflavin (B2), niacin (B3), pyridoxine (B6), and folacin, minerals, fat, protein, and dietary fibre (9). Nuts are a good source of essential fatty acids, fibre, vitamin E, and minerals. Other important nutrients supplied by fruits and vegetables include riboflavin (B2), zinc, calcium, potassium, and phosphorus (13). In some of the tribal-area vegetables, fruits and *aloe* just grow wild on barren land which are available free of cost to provide food and nutrition security. *Aloe* gel is reported to be rich in amino acids, minerals, vitamins, enzymes, proteins, polysaccharides, and biological stimulants. Most of the tribal food resource is available in plenty during a particular season but all have not been utilized to desired extent due to many reasons (5). Thus, people residing in tribal areas hardly get considerable advantage from the abundantly available resources. The solution of the problem lies only in evolving the techniques of value addition, providing market, and educating the tribals about nutritional quality of underutilized commodities. Processing and value addition of tribal fruits and vegetables into more useful, digestive, tasteful, and convenient products ultimately improves the economic value of underutilized commodities and develop nutritional security of the tribals.

Sources of Protein

Proteins are the important constituent of tissues and cells of the body. They form the important components of muscle and other tissues and vital body fluids like blood. The proteins in the form of enzymes and hormones are concerned with a wide range of vital metabolic processes in the body. Proteins supply the body building material and make good the loss that occurs due to wear and tear. Proteins, as antibodies, help the body to fight against infections. Thus, proteins are one of the most important nutrients required by the body and should be supplied in adequate (60 g for male and 50 g for female) amount in diet (12). Protein deficiency is wide spread in the poor and tribal area population of India (5). Protein deficiency leads to disorders like protein energy malnutrition, kwashiorkor, etc. (Reddy, 1991). Following underutilized fruits are rich source of protein.

Table 1: Protein content in some underutilized fruits

S. no.	Common name	Botanical name	Protein content (mg/100 g pulp)
01	Walnut	<i>Juglans regia</i>	13.70–18.20
02	Jawa almond	<i>Canarium indicum lanzan 1</i>	19.60
03	Cudappach almond	<i>Buchanania sp.</i>	21.60
04	Wood apple	<i>Feronia limonia</i>	7.10
05	Bael	<i>Agle marmelos</i>	1.80
06	Ker	<i>Capparis decidua</i>	4.21
07	Khimp	<i>Leptadenia pvrotechnica</i>	3.13
08	Khejri pods	<i>Prosopis cineraria</i>	5.10
09	Phog	<i>Calligonum polygonoides</i>	6.05

Source: (12)

Sources of Fat

Fat are an important component of diet and serves a number of functions in the body. Fat is a concentrated source of energy and it supplies per unit energy more than twice the energy furnished by either protein or carbohydrate. It also imparts palatability to a diet and retards stomach-emptying time. The essential fatty acid requirement has been placed at 3–6% of total energy intake depending on the age and physiological stat. During growth, pregnancy, and lactation, essential fatty acid requirements are relatively higher. To obtain this level of essential fatty acid in the diet, the visible fat intake should be 15–25 g/day in terms of oil content of fruits and other food products. Fat is a major nutritional concern in poor societies, especially in lower income rural tribals. Fat deficiency in body causes

Pyronoderma (toad skin), weakness, and weight loss (12). Following underutilized fruits are rich sources of fat.

Table 2: Fat content in some underutilized fruits

S. no.	Common name	Botanical name	Fat content (g/100 g pulp)
01	Walnut	<i>Juglans regia</i>	64.5
02	Wood apple	<i>Feronia limonia</i>	3.70
03	Ker	<i>Capparis decidua</i>	2.00
04	Rayan	<i>Manilkara hexandra</i>	2.40
05	Phog	<i>Calligonum polygonoides L.</i>	11.81
06	Banyan tree	<i>Ficus religiosa</i>	2.0
07	Kachri	<i>Cucumis callosus</i>	1.28
08	Mahua	<i>Madhuca indica</i>	1.60

Source: (12)

Source of Carbohydrates

Carbohydrates are a class of energy yielding substances which include starch, glucose, cane sugar, sugar, etc. Starch is a complex carbohydrate made up of glucose units. Glucose derived from starch and other sugars present in the diet is the main source of energy in the body. Carbohydrates derived from different underutilized fruits form chief source of energy in Indian diets especially in tribal areas. Generally, energy requirement depends on age and nature of work. Carbohydrate deficiency in body causes weakness, weight loss, and reduced physical activity. Following underutilized fruits are rich source of carbohydrate.

Table 3: Carbohydrate content in some underutilized fruits

S. no.	Common name	Botanical name	Carbohydrate content (g/100 g pulp)
01	Date palm	<i>Phoenix sylvestris Roxb.</i>	70.0
02	Tamarind	<i>Tamarindus indica</i>	67.4
03	Phog	<i>Calligonum polygonoides</i>	57.31
04	Rayan	<i>Manilkara hexandra</i>	27.7
05	Khejri pods	<i>Prosopis cineraria</i>	44.15
06	Bael	<i>Aegle marmalos</i>	31.8
07	Mahua	<i>Madhuca indica</i>	22.7
08	Sitaphal	<i>Annona squamosa</i>	23.5
09	Timra	<i>Diasporas melonoxylon</i>	27.00
10	Snappmelon	<i>Calligonum polygonoides L.</i>	15.60
11	Ker	<i>Capparis deciduas Edgew</i>	18.2

Source: (12)

Sources of Energy

Energy is essential for rest, activity, and growth. It is well known that even when body is at rest, it expends certain amount of energy for essential functions such as respiration, blood circulation, digestion, absorption and excretion, maintenance of body temperature, etc. The amount of energy thus expended when the body is at complete rest (both mentally and physically) is termed as Basal Metabolism or Resting Metabolism. Some of the factors affecting Basal Metabolic Rate are- age, height, weight, and state of nutrition of the individual (12). The three components of foods, which provide this energy, are carbohydrates, fat, and protein. Proteins normally supply 10–12% of energy in most diets; energy that carbohydrate and fat contribute may vary from diet to diet. It is desirable that the energy from fat should not exceed 30% and rest may be derived from carbohydrate (60%). However, in diets of tribal/ poor population in Rajasthan, 9–10% of energy is provided by

protein, more than 80% of energy comes from carbohydrates. Raika community adult suffered from chronic energy deficiency (44.1%) was reported (19). The daily diet of an adult doing moderate work should provide at least 2875 Kcal for male and 2225 Kcal for female (12). In adults, Body Mass Index (BMI) is used to assess the chronic energy deficiency (51.2% in males and 37.0% in female) using cut-off values of WHO classification. Energy deficiency in body causes weakness, weight loss, marasmus, and reduced physical activity. Following underutilized fruits are rich source of energy.

Table 4: Energy content in some underutilized fruits

S. no.	Common name	Botanical name	Energy content (Cal./100 g pulp)
01	Phog	<i>Calligonum polygonoides L.</i>	. 360
02	Date palm	<i>Phoenix sylvestris Roxb.</i>	317
03	Tamarind	<i>Tamarindus indica</i>	284
04	Bael	<i>Aegle marmalos</i>	137
05	Rayan	<i>Manilkara hexandra</i>	134
06	Kaith	<i>Feronia limonia</i>	134
07	Timru	<i>Diasporas melonoxylon</i>	112
08	Banyan	<i>Ficus religiosa</i>	110
09	Sitaphal	<i>Annona squamosa</i>	104
10	Khejri	<i>Prosopis cineraria</i>	82
11	Khimp	<i>Leptadenia pyrotechnica</i>	68
12	Mahua	<i>Madhuca indica</i>	112

Source: (12)

Source of Vitamins

Vitamins are organic substances present in small amount in many foods. They are required for carrying out many vital functions of the body and many of them are involved in the utilization of the major nutrients like proteins, fat, and carbohydrates. Although they are needed in small amounts, they are essential for health and well being of the body. Vitamins can be broadly classified as water soluble and fat-soluble vitamins. B-complex vitamins and ascorbic acid belong to the former group while vitamin A, D, E, and K are the fat-soluble vitamins.

β -Carotene (Vitamin A)

A well-understood function of carotene is in the visual process. Vitamin A is necessary for clear vision in dim light. Lack of vitamin A thus leads to night blindness. Another function of vitamin A is to maintain the integrity of epithelial tissues. The requirement of vitamin A is greater during pregnancy, lactation, and during growth. For example, in the absence of adequate vitamin A intake, the outer lining of the eyeball loses its usual moist white appearance and becomes dry and wrinkled. Redness and inflammation of the eye and gradual loss of vision may follow. All these symptoms are dominant in tribal population (5). Thus, vitamin A is one of the most important nutrients required by the body and should be supplied in adequate (600 $\mu\text{g}/\text{day}$) amounts in diet. About 50 g of the common leafy vegetables like amaranth will provide adequate β -carotene to meet the vitamin A requirement of an adult. The rich source of β -carotene is green leafy vegetables, spinach, amaranths, coriander, drumstick leaves, curry leaves, mint, radish leaves, etc. Ripe yellow fruits such as mangoes, papaya, jackfruit, mahua, phalsa, rayan, and tree tomato are also rich source of vitamin A (18).

Table 5: Vitamin "A" content in some underutilized fruits

S no.	Common name	Botanical name	Vitamin "A" content (IU)
01	Surinam cherry	<i>Eugenia uniflora</i>	1200-2000
02	Kumquat	<i>Fortunella spp.</i>	2530
03	Tree Tomato	<i>Cyphomandra balance Cav.</i>	150-540
04	Jack fruit	<i>Artocarpus heteropyllus Lam</i>	175-540
05	Persimmon	<i>Dispyros kaki L.K</i>	. 2000-2710
06	Phalsa	<i>Grewia subinaequalis</i>	419 $\mu\text{g}/100$ g pulp
07	Fig	<i>Ficus carica L.</i>	162 $\mu\text{g}/100$ g pulp
08	Rayan	<i>Manilkara hexandra</i>	495 $\mu\text{g}/100$ g pulp
09	Mahua	<i>Madhuca indica</i>	307 $\mu\text{g}/100$ g pulp

Source: (12)

Source of Thiamine (Vitamin B1)

Vitamin B1 or thiamine is an important member of the B group of vitamins. Prolonged deficiency of thiamine in the diet is one of the main factors leading to the disease beri-beri, dry, and wet (8). Thiamine is concerned in the proper utilization of carbohydrates in the body and in the absence of adequate amounts of thiamine full utilization of sugars and starches for meeting the energy needs is adversely affected. Thiamine requirement of an

individual is 1.4 mg/day for adult male and 1.1 mg/day for adult female (12). Following underutilized fruits are rich sources of thiamine.

Table 6: Vitamin “B1” content in some underutilized fruits

S. no.	Common name	Botanical name	Vitamin “B1” content (mg/100 g pulp)
01	Sitaphal	1 <i>Annona squamosa</i>	0.07
02	Bael	<i>Aegle marmalos</i>	0.07
03	Rayan	<i>Manilkara hexandra</i>	0.13

Source: (12)

Source of Riboflavin (Vitamin B2)

Riboflavin as a part of coenzyme is essential for several oxidation processes inside the cell and is concerned with energy and protein metabolism. Some of the clinical symptoms attributed to inadequate intake of this vitamin in the diet are the soreness of tongue (glossitis), cracking at the angles of the mouth (angular stomatitis), redness of the eye and burning sensation in the eyes, and scaliness of the skin in the region between the nose and angles of the lips (seborrheic dermatitis) (8). Scrotal dermatitis can also be a result of riboflavin deficiency. Riboflavin is the most limiting of all B-vitamins in cereal-based diets of the tribals. It is rather difficult to ensure adequate supply of this vitamin in a predominantly vegetarian diet. The daily safe requirement of this vitamin ranges from 0.7 to 2.2 mg/day depending upon age, physiological status, and level of activity (12). There is good evidence that tribal/poor Indian diets containing following fruits are generally sufficient in riboflavin. Bael is the richest source of riboflavin (18).

Table 7 Vitamin “B2” content in some underutilized fruits

S. no.	Common name	Botanical name	Vitamin “B2” content (mg/100 g pulp)
01	Bael	<i>Aegle marmalos</i>	1.19
02	Sitaphal	<i>Annona squamosa</i>	0.17
03	Wood apple	<i>Feronia limonia</i>	0.17
04	Mulberry	<i>Morus alba</i>	0.13

Source: (12)

Source of Nicotinic Acid (Vitamin B3)

Nicotinic acid is a vitamin intimately connected with several metabolic reactions. It takes part as a component of coenzyme in oxidative reactions and is concerned with metabolism of carbohydrate, fats, and proteins (8). This vitamin can be formed in the body from the amino acid tryptophan, which is present in all dietary proteins. Part of the dietary tryptophan is converted into niacin. The safe level of this vitamin has been estimated as 6.6 mg niacin equivalents per 1000 kcal. The daily requirement of this vitamin varies from 8–26 mg niacin equivalents for various physiological activity groups (12). Severe deficiency of nicotinic acid in the diet causes disease pellagra. Pellagra in tribal areas is seen among the poor who mostly consume maize-based diet without much protective foods, because maize is a poor source of both nicotinic acid and tryptophan. Some underutilized fruits are effective in preventing pellagra because they are rich in tryptophan and nicotinic acid.

Table 8 Vitamin “B3” content in some underutilized fruits

S. no.	Common name	Botanical name	Vitamin “B3” content (mg/100 g pulp)
01	Bael	<i>Aegle marmalos</i>	1.10
02	Wood apple	<i>Feronia limonia</i>	0.80
03	Ber	<i>Ziziphus mauritiana</i>	0.70
04	Rayan	<i>Manilkara hexandra</i>	0.70
05	Fig	<i>Ficus carica L</i>	0.60
06	Mulberry	<i>Morus alba</i>	0.50

Source: (12)

Source of Ascorbic Acid (Vitamin C)

Vitamin C deficiency causes scurvy characterized by weakness, bleeding gums, and defective bone growth (8). Ascorbic acid occurs widely in plant foods particularly in underutilized fresh fruit and vegetables, especially in green varieties. The human

requirement of this vitamin is placed at about 600 $\mu\text{g}/\text{day}$. Aonla is one of the richest natural sources of the vitamin C (18).

Table 9 Vitamin “C” content in some underutilized fruits

S. no.	Common name	Botanical name of fruits	Vitamin “C” content (mg/100 g pulp)
01	Barbados cherry	<i>Malpighia glabra</i>	1500–5600
02	Aonla	<i>Emblica officinalis</i>	500–625
03	Chinese jujube	<i>Ziziphus jujuba</i>	188–544
04	Kiwi fruit	<i>Actinidia chinensis</i>	300
05	Kumquat	<i>Fortunella spp.</i>	52–151
06	Strawberry guava	<i>Psidium cattleianum</i>	25–50
07	Manila tamarind	<i>Pithecellobium dulce</i> 138	138
08	Surinam cherry	<i>Eugenia uniflora</i>	25–44
09	Ker	<i>Capparis deciduas Edgew</i>	50

Source: (12)

Source of Minerals

A large number of minerals and trace metals are present in the body. Some of these form part of body structural component and some others act as catalytic agents in many body reactions. Bones and skeleton are made up of mainly calcium, magnesium, and phosphorus, and iron is a component of blood. Minerals like zinc, molybdenum, copper, manganese, and magnesium are either structural part or activate a large number of enzyme systems. Iodine is a part of hormone, thyroxine. Sodium, potassium is important elements present in fluids within and outside the cells and along with ions like chloride, bicarbonate, and carbonate keep water and acid base balance. On an average, man excretes daily 20–30 g of mineral salts consisting of Na, K, Mg, Ca, Chloride, sulphate, and phosphates and this must be made good by an adequate intake of these mineral salts through our food. A study on underprivileged children of five years of age in tribal areas of Rajasthan exposed that maximum children are suffering from minerals deficiency (5). Mineral deficiency caused several physiological disorders in human body. The key factors responsible for mineral deficiency in tribals include improper dietary habits, elevated mineral demand, socioeconomic, and disease status of the individuals (12). It is well documented that the mineral deficiency reduces working capacity, and increases morbidity due to infections and greater risk of death associated with pregnancy and childbirth.

Calcium (Ca)

Calcium is an essential element required for several life processes. As the structural component calcium is required for the formation and maintenance of skeleton and teeth. It is also required for a number of other essential processes. It is required for normal contraction of muscles, to make limbs move, contraction of heart for its normal functioning, nervous activity, and blood clotting. The latter functions are carried out by ionized calcium present in the cells. Children need relatively more calcium than adults to meet the requirements of growing bones. Calcium requirements are also increased during pregnancy to meet the needs of growing foetus and during lactation to compensate for Ca secreted in breast milk. If the mother’s diet during this period is deficient in Ca, the Ca present in mother’s bones will be depleted and her bones become prone to fractures. Limited food availability, inadequate access to health care, poor environmental sanitation, high reproduction, and personal hygiene are socioeconomic factors contributing to Ca deficiency. Calcium deficiency is more prevalent in population groups that live in tribal area of Rajasthan. The population groups most vulnerable to developing calcium deficiency are infants, children, and women of reproductive age. Calcium deficiency causes rickets in children and Osteomalacia in adults (12). Calcium requirement for an adult male and growing child is between 400 and 600 mg/day. In case of pregnant and lactating mothers, requirement is more, i.e., (1000 mg/day) calcium.

Phosphorus (P)

Utilization of calcium is closely linked with that of phosphorus, since most of the calcium in the body is deposited as calcium phosphate in the bones and teeth. Phosphorus is also a component of nucleic acids and as phosphate esters plays an important part in the cellular

metabolism of other nutrients like carbohydrate, fat, etc. It is usually considered that about a gram of phosphorus should be supplied in the diet.

Iron (Fe)

Iron is essential for the formation of haemoglobin of red cells of blood and plays an important role in the transport of oxygen. Tissues also require iron for various oxidation-reduction processes and some of the body reactions. Most of the iron in the body is reutilized and some of the body iron is also stored in liver and spleen (12). Iron deficiency has earned distinction as the most common nutritional deficiency in the tribals that affects more than 50% of the tribal population (5). *Raika* adults suffered from chronic energy deficiency (44.1%), vitamin A and B complex deficiencies (3.4% and 2.4%) along with anemia (87.7%) (19). Iron deficiency often leads to anemia, defined as having a blood haemoglobin level below standard, which is usually the result of insufficient dietary in-take of iron, poor utilization of iron from ingested food, or a combination of the two. The incidence of IDA is high among infants, teenagers, and women of childbearing age in tribal areas. Well-documented consequences of anemia include diminished learning ability, reduced work capacity, and increased morbidity from infections and greater risk of death associated with pregnancy and childbirth (Edgerton et al., 1979). Infant born to anemic mothers are more predisposed to low birth weight and prematurity. Some underutilized fruits are rich source of iron like; dry karonda is richest source of iron (39.1%) followed by date palm (10.6%). In view of widespread prevalence of mineral deficiency, fortification of foods with some underutilized fruits and their products, which have sufficient amount of different minerals is desirable.

S. no.	Common name	Botanical name	Minerals content (mg/100 g fruit pulp)			
			Minerals (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)
01	Aonla	<i>Emblica officinalis</i>	0.50	50	20	1.2
02	Bael	<i>Aegle marmalos</i>	1.70	85	50	0.7
03	Fig	<i>Ficus carica L.</i>	0.60	80	30	1.0
04	Mulberry	<i>Morus alba</i>	0.60	70	30	2.3
05	phalsa	<i>Grewia subinaequalis D.C</i>	1.10	129	39	3.1
06	Sitaphal	<i>Annona squamosa</i>	3.10	17	47	4.31
07	Wood apple	<i>Feronia limonia</i>	5.00	130	110	0.48
08	Tamarind	<i>Tamarindus indica</i>	5.60	170	110	17
09	Dates	<i>Phoenix dactylifera</i>	2.1	120	50	7.3
10	khimp	<i>Leptadenia pyrotechnica</i>	--	156	317	3.18
11	phog	<i>Calligonum ploygonoides L.</i>	--	211	427	3.52

Source: (12)

SOURCE OF AYURVEDIC MEDICINE

It was observed that, there are serious deficiencies in the diets of our population, particularly among the tribals. As a consequence of this dietary deficiency, several nutritional deficiencies with clinical manifestation and disabilities are encountered in our country. Underutilized fruits are major source of raw material for drugs and traditional medicines. It is widely accepted that underutilized fruit produce are of explicit quality with great nutritional, medicinal, organoleptic, economic, and traditional importance. Number of underutilized fruits is source of valuable remedies of dreaded modern ailments such as cancer, diabetes, jaundice, asthma, and nutritional deficiency. In India, fruit of aonla, bahera, and hard are the most common entering in to 219 patented drugs. Bael is also used in 60 patented drugs. Aonla is the component of most famous ayurvedic medicine chyavanprash. Ber is used in joshanda, jamun seed in diabetes, and black mulberry in docking of AIDS virus on human cell. Fruits, nuts, and vegetables in the daily diet have been strongly associated with reduced risk for some forms of cancer, heart disease, stroke, and other chronic diseases (16; 20). Some components of fruits and vegetables (phytochemicals) are strong antioxidants and function to modify the metabolic activation and detoxification/ disposition of carcinogens, or even influence processes that alter the course of the tumor cell. High consumption of tomatoes and tomato products has been linked to reduced carcinogenesis, particularly prostate cancer, and has been thought to the presence of lycopene. The stem and bark of *Khejri* is used for curing boils, leprosy,

dysentery, asthma, piles, and tumors (17). Daily use of *aloe* juice shows significant improvement in glycemic control, lipid profile, and BMI of Type-2 diabetes (10). consumer preference, process ability, value addition, export, domestic consumption, foreign demand which again is based on our knowledge about the health promoting qualities and nutritional value of the crops. The global forum on Agriculture Research (GFAR) in 1999 also emphasized the role of underutilized species in raising income of the rural poor.

CONCLUSIONS

India is facing the problems of hidden hunger, nutrient and micronutrient deficiencies, poverty, and unemployment. The wise and proper utilization of underutilized horticultural crops can prove to be a promising solution after realizing their health and employment potential. The underutilized crops can be a rich and easily available source of major and minor nutrients in sufficient amounts to prevent and cure deficiency disorders. They are the source of ayurvedic medicine because of having therapeutic properties. It is also established fact that seasonal, locally available, and cheap fruits and vegetables can also keep the population healthy and nutritionally secure rather than costly off season ones.. Hence, it can be concluded that exploitation of underutilized horticultural crops can provide a way to nutrient and economic security of tribals. Also, tribals can earn their livelihood through use of underutilized fruit crops.

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