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Therapeutic uses of edible plants in Bangalore city, India: combining health with cooking practices through home herbal gardens

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Abstract This article examines the therapeutic uses and perceptions of edible plants cultivated in home herbal gardens in the city of Bangalore, Southern India. We suggest that an examination of edible plants within a therapeutic context facilitates a more comprehensive understanding of the role that plants play both in the diet and in the health of urban populations such as in Bangalore. We conclude by reinforcing the importance of promoting awareness of the combined value of medicinal and edible plants through their cultivation in home gardens and the role of local health knowledge in health promotion.

Keywords Home herbal gardens · Edible plants · Traditional medicine · Women · India

1 Introduction

Studies documenting the local effects of edible plants on health have been recently carried out, with a focus on South-Asian countries including India (Govindarajan et al. 2005; Katan and De Roos 2004; Gardner et al. 2003). There exists a wide literature in ethnomedicine and ethnopharmacology that examines various spices and other plants used in the context of nutrition. These studies analyse the active ingredients of different edible plants and explain how they are useful in curing certain diseases (Tanabe et al. 2002; Dragland et al. 2003). The therapeutic properties of herbs and spices in preventive health, especially the antioxidant and nutritious properties of medicinal plants, have also been documented (Liu 2003).

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It is well known in the ethnosciences that many plants and foods have been and continue to be ingested because of their perceived medicinal and health-promoting characteristics (Jacobs and Steffen 2003; Kris-Etherton et al. 2002). The importance of edible plants and foods have also been studied in the social sciences. Anthropologists and sociologists have conducted studies on various aspects of food beliefs and practices of people living in urban areas, with a special focus on cultural aspects and local perceptions (Aikman et al. 2006; Anderson 2005; Variyan and Golan 2002; Wray 1992). Nevertheless, the majority of these studies are limited by narrow disciplinary perspectives and have not discussed in any depth the possible effects of dietary behaviour and knowledge of edible plants on both health and nutrition.

In addition, very little research has been carried out in urban societies with the purpose of analysing the grey area between food and medicine. Instead, most studies have focused on the use of traditional medicines among migrants (Balick et al. 2000; Reiff et al. 2003; Waldstein 2006) or on food plants used by people living in urban areas (Jonsson et al. 2002; Burnes 2004; Ray 2004; Mellin-Olsen and Wandel 2005), or on more general ethnobotanical issues (Nesheim et al. 2006). The interlinkages between edible and medicinal plants have hardly been studied among urban populations. Thus far, there have been no studies that have directly addressed the issue of the perceived overlap between food and medicine among urban people from both a sociological and ethnobotanical point of view, despite the vital importance of medicinal plants and food to prevent illness and malnutrition.

In this article, we focus on edible plants, fruits and spices cultivated in herbal gardens in the urban areas of Bangalore, India. Although the home garden has many important roles in village life, it has not attracted much attention of agriculturists and sociologists (Wojtkowski 1993; Mendez et al. 2001; Depommier 2003; Salam et al. 2000). As a result, an understanding of its structure and functioning and its role both in urban and rural areas is still fragmentary.

Thus, the aims of this study were to:

(a) determine the culinary uses and perceptions of possible medicinal value that urban women ascribe to the plants they grow in their home gardens;
(b) determine the awareness of the interrelated uses of edible plants with the ascribed therapeutic values of women (nutrition and therapeutic level) within the household, with a special focus on gender and age components; and
(c) understand the mechanism of transfer of knowledge of edible plants with multiple therapeutic values within different generations.

2 Methods

Ethnographic field work was carried out between July and August 2010 in the city of Bangalore, Karnataka, Southern India. Women between the ages of 21 and 58 were interviewed using a semi-structured interview. Particular attention was focused on women's local health knowledge, since it is well known that in numerous countries, India included, women are the primary health-care providers within the household, and are also in charge of cooking and family nutrition (Pennartz and Niehof 1999).

Women were further selected as the primary research group as women are those who normally cultivate home gardens and are in charge of them. As the space most closely situated to the house, home gardens can be geographically viewed as the 'feminised' part

of agriculture as they are predominately maintained by women (Etkin and Ross 1982; Nesheim et al. 2006). Further, women as the dominant 'managers' of the gardens, make decisions about garden management and layout. They delegate tasks such as watering (during the dry season) and weeding to husbands and children, but control the major decisions regarding what to plant, where and when, and which plants to cull or be left to grow (Ceuterick et al. 2007; Balick et al. 2000) (see Fig. 1).

In total, a sample of 35 women were interviewed, mainly belonging to upper castes. The interviewees were selected on the basis of their age and socio-economic status. There was an observed uniformity in terms of socio-economic background of the interviewees as two-thirds of them were considered to belong to the middle or upper class. Owning or renting a house with a spacious garden, where it is possible to grow different types of plants is considered a status symbol in Bangalore, as 'poorer' people usually live in apartments or small houses without land, or with only a small slot of land.

Questions about the use of various food plants were asked using classical means of ethnobotanical analysis (Alexiades and Sheldon 1996; Berlin and Berlin 2005). At the beginning of the semi-structured interviews, interviewees were asked to free-list edible plants (vegetables, spices and fruits) they normally used in their cuisine. For each named item, details of how the food was prepared, its frequency of use, taste, perceived healthiness and medicinal properties were asked. Questions were also explored in order to understand the transfer of knowledge on therapeutic uses of edible plants and their consumption within households.

A surprising number of agricultural studies are limited to 'doorway' interviews, where informants respond to a battery of questions about what they plant, how much land is devoted to each species, etc. We thought this approach to be unsuited to the study of home gardens and argue that interviews alone without observation leaves out important information that can deepen socio-cultural analysis. Interviews here revealed that gardeners may be unable to reliably list the full range of species that might be growing in their home gardens; many rare plants, and perhaps some plants too ubiquitous to be considered 'interesting,' could not be recalled. Consequently, we followed up free lists with a third research strategy: in-garden interviews, in the form of a videotaped 'walk-through'. This technique afforded a general sense of the relative abundance of different species and

Fig. 1 Residents tending herbal gardens in Bangalore, South India (*photo* M. Torri)

varieties, planting patterns and overall garden organisation. Taxonomy was later established by comparing videotape and still photographs of plants with published sources.

3 Results

3.1 Edible plants consumed for therapeutic uses

Interviewees reported the growing of between 15 and 20 edible plants in their gardens. These plants include vegetables, spices and fruit trees. Vegetables represented the edible plants that were most present in the gardens of the interviewees (60%), followed by tree plants (30%) and spices (10%). Vegetables are used on a daily basis, being one of the principal ingredients of curries and *chatnies* (a sauce from Southern India that is normally consumed with rice). Among the most common vegetables used by interviewees were doddhapathre (*Coleus aromatica*), aubergine (*Solanum melongena*), bitter melon (*Momordica charantia*), cassava (*Manihot esculenta*), cluster bean (*Cyamopsis tetragonoloba*), drumstick (*Moringa oleifera*), angular loofah (*Luffa acutangula*), Indian asparagus (*Asparagus officinalis*), okra (*Abelmoschus esculentus*), spinach (*Spinacia oleracea*), taro (*Colocasia esculenta*) and carrot (*Daucus carota*) (see Table 1). The most common spices were coriander (*Coriandrum sativum*), cumin (*Cuminum cyminum*), ginger (*Zingiber officinale*), fenel (*Foeniculum vulgare)* and curry leaves (*Murraya koenigii)* (see Table 2). Fruits most commonly grown in the home gardens were papaya (*Carica papaya*), mango (*Mangifera indica*), kokum (*Garcinia indica*) and goose tree (*Phyllanthus emblica*). (see Table 3).

Tables 1, 2 and 3 show different medicinal properties attributed to the principal edible plants named by the interviewees. Most of the plants listed were thought to have anti-diabetic properties, improved digestion and fought infections. A selection of vegetables was considered to be good for enhancing the immune system and increasing energy. Other vegetables and plants were thought to be good for purifying the blood and the liver.

The fact that the women interviewed often cited the anti-diabetic properties of edible plants suggests that they were fully aware of the health problems present in their households, and that they adopted preventive and therapeutic measures to reduce the incidence of these diseases. Interviews also documented that the majority of women (i.e. 23 out of 35) used plants mainly for preventive health. The majority of the cited edible plants were perceived to have specific medicinal properties (see Tables 1, 2, 3). It is interesting to note here that the majority of the edible plants with perceived medicinal properties were associated with specific diseases or pathologies. Thus, they represent real *food-medicines* or *medicinal foods*. The majority of the most-eaten plants grown in the home herbal gardens were further perceived as *folk functional foods* (Pieroni and Quave 2006), being considered by the interviewees as generally good for health.

Ethnoscientific studies carried out during the last decade have highlighted the strong link between food and ethnomedical practices (Johns 1990). This finding has been confirmed in the present study, which shows that the perceived medicinal value of vegetables is also crucial to their use. Two-thirds of the interviewees affirmed that they attributed a higher value to edible plants that had positive effects on health. This concept is clearly expressed by a middle-aged woman who affirmed: *Every time you eat, it is not just a gesture to appease your hunger, but also a gesture through which the body is kept healthy… we Indian people say: 'there is no difference between food and medicine.'*

Table 1 Perceived medicinal properties of vegetables and properties documented in the literature

English name	Botanic names	Perceived medicinal properties	Properties documented in the literature
Angular loofah	*Luffa acutangula*	Treats diabetes and good for general health. Provides vitamins	No documented medicinal values of the plant
Aubergine	*Solanum melongena*	Good for rheumatism; combats constipation; digestive; diuretic; stimulant for the liver and intestines	Helps to block the formation of free radicals and is also a source of folic acid and potassium (Marchiori et al. 2004)
Bitter melon	*Momordica charantia*	Fruits and leaves of are a good source of minerals and vitamins	Bitter melon extracts have shown activity in vitro against the nematode worm *Caenorhabditis elegans* (Beloin et al. 2005)
		Juice from the leaves is also good to prevent and lessen cough, fever and roundworms	Laboratory tests suggest that compounds in bitter melon might be effective for treating malaria (Waako et al. 2005)
		Good to prevent diabetes	Bitter melon also contains a lectin that has insulin-like activity due to its non-protein-specific link to insulin receptors. This lectin lowers blood glucose concentrations by acting on peripheral tissues
Carrot	*Daucus carota*	Prevents diabetes; blood purifier; improves eyesight; helps constipation	No documented medicinal values of the plant
Cassava	*Manihot esculenta*	For relief of headache or fever Relieves the ill-effects of rashes and prickly heat Cures rheumatism; can be applied in ulcerated wounds and as antiseptic Increases energy and stamina	Effective to treat irritable bowel syndrome and hypertension (White et al. 1998)
Cluster bean	*Cyamopsis tetragonoloba*	Keeps digestive tract regulated and prevents constipation	No documented medicinal values of the plant
Drumstick	*Moringa oleifera*	Used in the treatment of rheumatism A decoction or infusion of the root with the addition of bruised mustard seeds is used in ascites caused by diseases of the liver Applied as a plaster or poultice to inflammatory swellings	Drumstick leaves contain high concentrate of Vitamin A, calcium, iron, Vitamin C and potassium (Fahey 2008)
Bitter gourd	*Cucurbitaceae*	Contains calcium, iron and vitamins. Good to treat disorders such as itches, rashes, and eruptions, hives and acne, pimples and blood boils Can be used to prevent diabetes	Effective to reduce insulin levels in the blood (Chang et al. 2008; Sridhar et al. 2008)

Table 1 continued

English name	Botanic names	Perceived medicinal properties	Properties documented in the literature
Indian asparagus	*Asparagus officinalis*	The roots of the plants are prescribed for diarrhoea and dysentery. Useful in nervous disorders, scalding of urine, throat infections, cough, and bronchitis Used also in the treatment of rheumatism The fresh juice taken in small doses acts as a diuretic and laxative. Good for prevention of liver diseases. Helps in preventing cramping	Asparagus is a good source of vitamin C. Vitamin C helps the body produce and maintain collagen, the major structural protein component of the body's connective tissues (Vaughan et al. 1997)
Okra	*Abelmoschus esculentus*	Good for summer heat treatment, constipation, asthma, preventing diabetes. Maintains smooth and beautiful skin	No documented medicinal values of the plant
Radish	*Raphanus sativus*	Diuretic and stimulates the appetite and digestion. The juice of raw radishes is helpful in catarrhal conditions	Radish is rich in ascorbic acid, folic acid and potassium. It is a good source of vitamin B6, riboflavin, magnesium and calcium (Zohary and Hopf 2000)
Spinach	*Spinacia oleracea*	Good for general health; helps against constipation; rich in vitamins; blood purifier	Spinach is considered to be a rich source of iron and calcium (Ball 2006)
Taro	*Colocasia esculenta*	Good for constipation, stomach-aches, joint-pain and arthritis	No documented medicinal values of the plant

The data revealed that there was less awareness among the women regarding the categories of plants used as spices and fruits, and their interconnection with health. For example, concerning fruits, the interviewees were aware of the important values of fruits to enhance health: two-thirds of them emphasised the fact that fruits are rich in vitamins and minerals. Despite this, there were only six women who clearly indicated the specific therapeutic values of particular fruit plants they cultivated in their home garden.

In contrast, the majority of vegetables were thought to be good for maintaining health. These plants were believed to purify the blood, reinforce the immune system and provide important vitamins and minerals to the human body. Among the category of these vegetables were bitter melon (*Momordica charantia),* carrot (*Daucus carota),* bitter gourd (*Cucurbitaceae)* and spinach (*Spinacia oleracea).*

It is interesting to note how the beliefs and health practices of local communities are also at times supported by scientific evidence. For instance, it has been shown that bitter melon contains lectin that has insulin-like activity due to its non-protein-specific link to insulin receptors. Lectin lowers blood glucose concentrations by acting on peripheral tissues, thus reducing the possible emergence of diabetes. It has also been shown that bitter gourd is effective to reduce insulin levels in the blood (Chang et al. 2008; Sridhar et al. 2008). Although the interviews documented that spinach may purify the blood, this property has yet to be documented in the medical literature. Spinach, however, is considered to be a rich source of iron and calcium (Ball 2006).

Table 2 Perceived medicinal properties of spices and properties documented in the literature

English name	Botanic names	Perceived medicinal properties	Properties documented in the literature
Coriander	*Coriandrum sativum*	Good for indigestion, nausea	Chemicals derived from coriander leaves were found to have antibacterial activity against *Salmonella choleraesuis* (Isao et al. 2004) Coriander has been documented as a traditional treatment for diabetes. A study on mice found that coriander extract had both insulin-releasing and insulin-like activity (Gray and Flat 1999)
Cumin	*Cuminum cyminum*	Roasted cumin seeds can be eaten freshen the breath. Chewing roasted cumin seeds can also heal soars in the mouth and reduce excess saliva Boiling a teaspoon of cumin in a glass of water to make a tea cures problems in the urinary tract, cleans the bladder and kidneys	Cumin is considered to have antibacterial properties (Iacobellis et al. 2005)
Ginger	*Zingiber officinale*	Good remedy for cough and cold. Also a painkiller	Ginger has been documented to decrease diabetes (Al-Amin et al. 2006; Afshari et al. 2007) Ginger has been found effective in multiple studies for treating nausea caused by seasickness, morning sickness and chemotherapy (Ernst and Pittler 2000)
Fennel	*Foeniculum vulgare*	Good diuretic. Improves the milk supply of a breastfeeding mother	Extracts of fennel seed have been shown in animal studies to have potential use in the treatment of glaucoma (Agarwal et al. 2008) Fennel as a diuretic effect (Wright et al. 2007) and it may be an effective diuretic and a potential drug for treatment of hypertension (El Bardai et al. 2001)
Curry leaves	*Murraya koenigii*	The leaves contain calcium, iron and vitamins. It is a potent blood purifier. It strengthens the liver. It is a good digestive, especially after fatty and fried food. It cures indigestion, nausea, sour belching, morning sickness and other digestive disorders such as diarrhoea, dysentery, and haemorrhoids	The leaves of *Murraya koenigii* are also used as a herb in Ayurvedic medicine. They are much valued as an anti-diabetic and antioxidant (Arulselvan et al. 2006; Arulselvan and Subramanian 2007)
Mint	*Mentha sativa*	Rich in minerals and vitamins. It stimulates the appetite, promotes digestion, relieves flatulency and biliousness. Good tonic for the stomach and liver. Eliminates thread worms in children, relieves colic due to worms, and due to indigestion	It is considered to be good for digestion and effective in the treatment of irritable bowl syndrome (Cappello et al. 2007; Merat et al. 2010)

Table 2 continued

English name	Botanic names	Perceived medicinal properties	Properties documented in the literature
Turmeric	*Curcuma longa*	Good for wounds and infections	In Ayurvedic practices, turmeric has been used as an anti-inflammatory agent and remedy for gastrointestinal discomfort associated with irritable bowel syndrome and other digestive disorders (Seo et al. 2011). Raw turmeric strengthens cartilage and bone structure (Henrotin et al. 2010)

More than two-thirds of the interviewees (i.e. 27 out of 35) affirmed their use of between five and eight plants for their basic health needs. These interviewees, especially the elderly, possess knowledge regarding the preparation methods for using these plants. The 'decoction' method was the most common form of preparing medicinal plants and spices of the herbal garden, cited as a principal preparation method by 78% of the interviewees. The second method, cited by 56% of the interviewees, was 'extraction' of fresh juice from the plant. Depending on complaint, the juice of the plant is normally drunk by the person affected by the disease, or it is applied to the affected area of the body.

Regarding the uses of medicinal plants used for preventive health, our data showed that the interviewees possessed less precise knowledge in terms of doses of plants, and they were not able to indicate the quantity of plants necessary to prevent certain diseases or to enhance well-being. This is exemplified by a woman in her late forties who affirmed using the plant Okra (*Abelmoschus esculentus*) in the form of decoction to prevent diabetes. Although this was a common belief among the interviewees, no scientific correlation has been shown between the consumption of this plant and the reduction of diabetes. When asked how often she used to drink the decoction for preventing this disease, she affirmed: *Well, I cannot really tell… I drink this decoction whenever I feel like it…there are not precise moments or doses….*

Interviews documented certain edible plants used for therapeutic purposes by different members of the family and different age groups. One of the edible plants in this category is represented by the Jujube or Ber plant (*Zizyphus jujube*), a small to medium-sized evergreen tree that produces egg-shaped red berries (fruits). As the interviewees emphasised, the fruit of this plant has several therapeutic uses and is used by family members for different purposes, such as preventing colds, joint pains and gynaecological problems. Some pregnant women affirmed that they used to take the seeds of this fruit with milk to halt nausea, vomiting and abdominal pains in pregnancy. Mixed with oil and rubbed on the joints, the same fruit was also used by the elderly to cure rheumatism. The Ber fruit is also often given to children, as it is believed to be beneficial in preventing frequent attacks of cold and influenza. An interviewee affirmed that she gave her children a teaspoon of the fresh juice of the fruit with a pinch of pepper once daily in the rainy season for preventing colds. Although no studies to date document the effectiveness of *Zizyphus jujube* for the treatment of the above complaints, scientific literature does show that the Jujube plant may help to prevent impairment of hippocampal memory (Jiang et al. 2007). A controlled clinical trial also found the fruits helpful for chronic constipation (Koo et al. 2011).

Table 3 Perceived medicinal properties of fruits and properties documented in the literature

English name	Botanic name	Perceived medicinal properties	Medicinal properties documented in the literature
Fig	*Ficus carica*	Analgesic effect against insect stings and bites. The leaves can be used in decoction form to condition hair. The fruit is also given as a cure for piles and diarrhoea	Figs have a laxative effect and contain many antioxidants. They are good source of polyphenols (Veberic et al. 2008). In one study, a 40-gram portion of dried figs (two medium size figs) produced a significant increase in plasma antioxidant capacity (Vinson 2005)
Papaya	*Carica papaya*	Good for blood clots, indigestion, infertility, ringworm, worms, abscesses, arthritis, bronchitis, burns, circulatory problems	The juice has an in vitro anti-proliferative effect on liver cancer cells, probably due to its component of lycopene or immune system stimulation (Rahmat 2002)
Mango	*Mangifera indica*	Dried mango flowers are used in the treatment of diarrhoea, chronic dysentery and some problems of the bladder	Mango has antioxidant properties (Ribeiro et al. 2007)
		Reinforces the immune system of human body	The mango triterpene, lupeol is an effective inhibitor in laboratory models of prostate and skin cancer (Prasad et al. 2008)
Kokum	*Garcinia indica*	Good as digestive tonic and to cope with paralysis	No documented medicinal values of the plant
Jujube	*Zizyphus jujuba*	Helps preventing cold, joint pains and gynaecological problems	The plant may help prevent impairment of hippocampal memory (Jiang et al. 2007). A controlled clinical trial found the fruits helpful for chronic constipation (Koo et al. 2011)
Goose tree	*Phyllanthus emblica*	Rich in vitamins, diuretic and laxative. It cures insomnia and is good to improve memory. Useful in haemorrhages and discharge of blood from uterus	These fruits are reputed to contain high amounts of vitamin C and to have a high antioxidant effect (Tarwadi and Agte 2007)
		It improves immune system and gives physical strength	
		It is also used to treat constipation and is used as a cooling agent to reduce the effects of sun strokes and sun burns	

3.2 The concepts of 'hot' and 'cold' and their relevance for therapeutic uses of edible plants

The concepts of 'hot' and 'cold' foods are quite widespread in India and many other countries, but the underlying criteria for classifying foods as 'hot' and 'cold' are often not clear. Despite this, there seems to be some consensus regarding the classification of specific foods as 'hot' and 'cold' and the perceived consequences of taking them in a localised population (Burnes 2004; Williamson 2002). It is interesting to observe how the concepts of 'hot' and 'cold', which are relevant for Indian traditional medicine, are also applicable

for the therapeutic uses of edible plants grown in home gardens. Indeed, there are some edible plants and fruits which are considered to be 'hot' for the body and others that are considered to be 'cold'. These plants and fruits are considered to be 'inappropriate' in certain stages of life and health conditions of the person.

Perceptions regarding 'hotness' and 'coldness' of vegetables vary more than those regarding fruits. The interviewees defined certain vegetables as 'hot' (aubergine, bittergourd, pumpkin and drumstick) but none as 'cold'. From the data, perceptions of the hot–cold qualities of food seem to be derived from associations with diseases that are thought to result from eating too much of the food in question. For example, aubergines are perceived as 'hot' because of the belief, perhaps based on some experience, that if a person eats too much of it, he/she will get a skin disease (which is 'hot'); bananas are 'cold' because too many bananas cause coughs and colds (which are 'cold' diseases). Thus, all skin diseases are thought to be caused by excessive heat in the body. Respiratory diseases are perceived as 'cold' diseases caused by excessive cold food or cold weather.

Spices and herbs are perceived more commonly as 'hot'. Some spices, however, are perceived as 'cold' (cumin and coriander). Spices in general are believed to be harmful during pregnancy: amaranth, chillies, fenugreek, garlic, ginger, onion, salt, sour spices and tamarind. The reason most commonly cited for avoidance is their 'hotness', which is thought to induce abortion. Most fruits are believed to be harmful for pregnant women in the third semester of pregnancy because fruits are believed to be 'cold', causing a sticky layer of 'fat' formed around the foetus, making it 'stuck' to the womb. No scientific evidence has yet shown the existence of a possible correlation between the consumption of these fruits and gynaecological problems during pregnancy.

It is believed that pregnant women should only use 'cold' plants for their treatment during their first three months of pregnancy. During the early stages of gestation, the 'cooling' quality of the plants is considered to be decisive, which is also evident from the fact that up to the sixth month, pregnant women are strongly dissuaded from eating 'hot' and spicy foods. According to the data, restrictions during pregnancy seem to be more prevalent for fruits than for any other food category. The fruits that were most widely believed to be harmful by the interviewees were papaya (*Carica papaya*) and mango (*Mangifera indica*). Next in order of their reported harmfulness were jackfruit (*Artocarpus heterophyllus*) and pineapple (*Ananas comosus*). Other fruits that were mentioned as undesirable during pregnancy were coconut (*Cocos nucifera*), guava (*Psidium guajava*), melon (*Momordica charantia*) and palmyra fruits (*Casuarina Equisetifolia*).

3.3 The role of 'taste' in the medical perception of edible plants

Ethnobotanical studies have shown how the perception of 'taste' is culturally determined, and can influence the medical perception and uses of plants (Jonsson et al. 2002; Pieroni et al. 2002). In accordance with the study carried out by Pieroni et al. (2007) among South-Asian families in London, our study shows that the vegetables considered to be 'bitter' are those that are also perceived to be healthier and particularly effective in preventing diseases and in purifying the blood. This perception could be explained by the fact that all bitter vegetables are considered to be important for preventing diabetes, hence they are seen as having this specific therapeutic function. The vegetables identified by the interviewees as having an 'aromatic' taste, such as radish, were also those which were considered to be the most effective for maintaining health. The interviews highlighted how radish is considered to be diuretic and capable of stimulating the appetite and digestion. It is also believed that the juice of raw radishes is helpful in catarrhal conditions. Although

these therapeutic properties of radish have not been demonstrated by scientific studies, it has been shown that radish is particularly good for its nutritional values, being rich in ascorbic acid, folic acid and potassium. It is also a good source of vitamin B6, riboflavin, magnesium and calcium (Zohary and Hopf 2000). Thus, there is a specific role played by taste in the adaptive behaviour of human beings, especially in their cognitive categorisation of 'medicinal plants' (Leonti et al. 2002; Brett and Heinrich 1998).

3.4 Knowledge transmission, age and interrelationships between plants and health

Since food habits are very dynamic (Baumann 1999; Waldstein 2006), it is useful to analyse changes in the appreciation of edible vegetables among the interviewees, especially within younger generations. The women interviewed for this study, especially older women and those who were married with several children, were more aware of the interlinkages between plants used in the kitchen and their therapeutic uses. Two-thirds of the women that declared using more than eight to 10 plants both for cooking and for curing themselves and their families, were elderly women in their 60s or women who had more than two children. Our data confirms previous studies (Reiff et al. 2003; Sandhu and Heinrich 2005) that show that women are normally in charge of the health of the family, in particular children.

The data from this study also emphasises that there has been a progressive loss of knowledge between the 'new' and 'older' generations. A few young people were able to name certain plants (between five and eight) and were able to associate their uses with some health complaints, in comparison with the number of plants named and used by the elderly (10–15 plants). The majority of the younger generation were also incapable of explaining how to actively use plants and to produce natural remedies. The data also showed that elderly women had a higher knowledge of the different therapeutic uses of edible plants, being capable of indicating on average up to five to six medicinal uses of single edible plants. On the contrary, younger women were often unaware of the several uses of each single edible plant, being able to name on average only one or two of their therapeutic properties.

The above phenomenon might be explained by the fact that many people of the older generations migrated from rural areas, and who used to grow plants with medicinal uses and/or to collected them from the wild. This is not the case for the newer generations that were born in Bangalore and that were less capable of recognising medicinal plants and using them. It was also observed that the interviewees, whose origin was from the state of Kerala, were more knowledgeable in terms of medicinal plants in general and had a better understanding of the therapeutic uses of edible plants. This could possibly be explained by the popularity of Ayurvedic medicine and natural medicine in Kerala.

Despite lower plant knowledge among younger women, the interviews undertaken with younger women highlighted how there had been a transfer of knowledge from older to younger generations regarding the therapeutic uses of edible plants. Women in their 20s and early 30s, for example, were able to identify plants used to prepare traditional dishes such as curry leaves, turmeric and cumin, although they were not aware that these plants are also of therapeutic value. This selective process in terms of transfer of knowledge (e.g. some forms or knowledge were transferred but not others) could be explained with the modernisation process and the fact that knowledge related to medicinal plants has been more easily and rapidly eroded due to the competition of biomedicine and allopathic drugs. (See Hollenberg and Muzzin 2010; Hollenberg et al. 2008). Nevertheless, the data did also show that there has been a mechanism of knowledge transfer between older and younger

generations in the case of married couples who are living with their in-laws. This has been the case especially for families who migrated to Bangalore city proper from the close-by state of Kerala. Two-thirds of the women living with their in-laws, one of whom came from Kerala, affirmed that they learned how to use edible plants, spices and fruits not only for cooking but also for therapeutic use.

Women who had more children also declared that they were more interested in learning about the therapeutic uses of edible plants and species. One woman in her early thirties affirms:

> I would like to learn the therapeutic uses of edible plants as it is a good thing for the family and in particular for my children…I want them to grow healthy and strong…eating is something that we do every single day so it is important to eat well and to know what plants are more useful to keep us healthy…my mother-in-law that comes from Madhatara, in Kerala, knows how to use many edible plants that we cultivate in the home garden to cure people…I have learned from her how to do the same but I still need to learn more…

This point of view from younger women has been confirmed by several (i.e. nine) mothers-in-law. One of them affirms:

> At the beginning, my daughter-in-law was not very interested in learning how to use the plants we cultivate in the garden to cure the family…we said she did not have enough time…After she had her first child, my daughter-in-law started to be more receptive regarding the uses of medicinal plants and she often uses them to cure my grandchild...

Despite the general trend where the older generations showed a higher knowledge and use of edible plants for therapeutic uses, there were also some exceptions. In some cases, there were conflicts between mothers-in-law and daughters-in-law regarding the plants to be cultivated in the home gardens and their relative uses. For example, a young woman declared that she wanted to grow more edible plants in the home garden, especially those that can also be used for gynaecological problems (white discharges and menstrual problems). The mother-in-law and the elderly of the house, however, did not agree and preferred cultivating decorative plants and plants such as the garike hullu (*Cynodum dactylon*) and the tulsi (*Ocimum sanctum*) that are mainly used for religious and ritual purposes.

3.5 Differences in the consumption of edible plants with therapeutic value inside the household and by gender

Data from this study also illustrated differences between the consumption of edible vegetables at the household level. These differences are especially generational differences associated with different ages. Although edible plants were consumed throughout the different stages of life of the women interviewed, it was observed that women consume more plants in certain phases: elderly women and pregnant women both consume a higher quantity of edible plants.

The above could be explained by the particular phase of women's lives: older women are more prone to chronic diseases (especially diabetes, rheumatism and arthritis); pregnant women have the tendency to improve their diet with plants rich in vitamins and iron during and after their pregnancy and while they are breastfeeding babies. It was also observed that the consumption of edible plants was not always high and frequent among children and

adolescents. Younger members of households had the tendency to use edible plants in specific cases, especially when they had a cold or influenza, but they did not consume edible plants on daily or regular basis. This could possibly be explained with dietary habits or by the fact that priority in the consumption of edible plants with therapeutic use is given to the elderly, to pregnant women or to those who are perceived to be more vulnerable or in need of special care due to their health conditions.

The findings in this study indicating that a lower quantity of edible plants is used by young children and teens in the household should also be taken into consideration. In a national Family Health Survey conducted by the Government of India in 2005–2006, 88% of adolescent girls were reported to suffer from anaemia and from a lack of vitamins due to a poor diet (Ministry of Health and Family Welfare, Government of India 2007). The discrimination against women and female children in household food distribution and health care is well documented in the literature (Subramanian et al. 2007; Kumar et al. 2005). Regarding the consumption of edible vegetables between gender, interviews clearly documented that in one-third of households, there was a significant difference in terms of consumption of edible plants between men and women. The latter, unless they are old, with chronic diseases or pregnant, normally ate a lower quantity of edible plants and with less frequency than men. As a young woman in her late twenties explained: *When we prepare food, we serve first of all the elderly and the men in the house…we eat afterwards what remains….* This situation reflects the lower status of women in India inside the family, especially when young. There is a precise hierarchy inside the household, and young married women who have come to live with their in-laws generally occupy a lower status when compared to the male and elderly members of the family. This aspect of gender inequality, which is also reflected in terms of consumption of edible plants, needs to be carefully examined in further studies and deserves to be further addressed. Several studies have shown that the food consumed by a large section of women in India is deficient in caloric content, protein and other nutrients: a leading cause, among others, of maternal and child mortality (Basu 1995; Griffiths and Bentley 2001; Kumar 2000; Bloom et al. 2001).

4 Discussion and conclusion

Our study clearly shows an evident link between food and health. Edible plants are perceived as having certain medicinal properties, particularly in counteracting different diseases such as diabetes and in preventing other complaints. The pattern of traditional use of edible plants for medicinal value has in some cases been in decline, but this use is clearly still alive; there has been a direct process of knowledge sharing between older and younger generations within the same household. The findings from our study also show that the perceived medicinal value of vegetables is crucial for those who consume them.

This study further shows that although the therapeutic and dietary values of plants have not always been documented in studies nor proven through scientific evidence, numerous plants are widely used by urban populations to meet health needs and have maintained their popularity. To date, scientific evidence from randomised clinical trials is only strong for a limited number of herbal remedies (Anderson 2005). Although further research is needed to ascertain the efficacy and safety of medicinal plants, the continued valuing and validation of local health knowledge is an ongoing necessity in international development campaigns (Hollenberg et al. 2008).

It is important to promote interlinkages between different uses of plants through their cultivation in home gardens and to support this local knowledge through education, and increased awareness of the importance of the combined value of medicinal and edible plants. Certain challenges do still persist, however, in the consumption of edible plants by gender and also in terms of the generational uses of these plants. Another important aspect emphasised by this study is that at present, the cultivation of edible plants within home gardens is more diffused among upper castes rather than lower castes. The former, having a higher economic background that allows them to have larger houses with gardens and land, are more likely to have the means to grow plants than lower castes and the 'urban poor.' Allowing both the urban and rural poor to grow plants that can be used both to enhance their health and diet is crucial to the well-being of poorer rural/urban populations worldwide.

An increased understanding of perceptions and beliefs related to the therapeutic uses of edible plants could be very important for improving the implementation of public-health programmes aimed at reducing malnutrition and preventing diseases, especially among urban populations. Appropriate educational programs and local public-health projects could possibly be developed with the active involvement of these communities. Studies that shed light on health and dietary practices and beliefs among urban communities can be a valuable starting point for providing inputs for improving such policies.

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