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Traditional Food of Uttarakhand and Its Functional Importance: An Overview

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Abstract
Some of the most varied tribes and ethnic groups can be found in Uttarakhand. The indigenous population benefits from a diverse diet and medicinal certainty provided by the rich and varied natural flora (e.g., Garhwali, Kumaoni, Bhotiya, Jaunsari). A wide range of cuisines and locally made drinks (such soor/sur, pakhoi/paakuyi, chhang, jann/jan, jhol, lugdi/lugri, etc.) are commonly made from local millet, legumes, green vegetables, tubers, and ferns in their many forms (fresh, sundried, flour, pickled, or fermented). Meeting the dietary needs of local communities requires a combination of centuries-old indigenous expertise, traditional food preparation methods, and indigenous understanding of the local flora. Furthermore, some regional specialties have functional nutritional qualities that are still unknown and are abundant in bioactive compounds that promote health. As a result, this investigation provides the scientific rationale for preserving these rich dietary traditions while also closely analyzing the traditional cuisines prepared in Uttarakhand regions and their functional food attributes.

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INTRODUCTION

Over a billion people in underdeveloped nations suffer from acute malnutrition and undernutrition, whereas a sizable portion of the industrialized world is currently battling obesity issues brought on by overnourishment, also known as development-driven obesity (Ojha et al., 2022). The phrase "functional food" was initially used in Japan in the 1970s. Diets

beyond basic subsistence contain physiologically active components (dietary fiber, polyphenols, and other phytochemicals) that support specific biological functions. Functional foods should also improve immune function, vision, bone calcification, blood pressure regulation, blood lipid and blood glucose regulation, sleep, memory, senility prevention, oxygen deficit tolerance, anti-fatigue, body weight loss, lactation, and sexual potency (Temple, 2022). Food's therapeutic properties and methods of preparation and preservation have been used by humans for a very long time. Among the helpful ingredients that give Uttarakhand's traditional cuisines their usefulness are prebiotics, polyphenols, antioxidants, and other bioactive substances. Uttarakhand, the native cuisine of this area, has a lot of promise to reduce the risk of lifestyle diseases like diabetes, heart disease, and obesity.

TRADITIONAL UTTARAKHAND CUISINE AND ITS PRACTICAL SIGNIFICANCE

The Uttarakhand highlands' traditional farming setting yields a range of vegetables, pulses, spices, herbs, cereals, pseudo-cereals, and millets that can help combat non-communicable diseases and malnutrition (Ojha et al., 2022). According to Singh et al. (2022), millets are considered "nutritious grains" and functional foods because they contain a range of bioactive molecules, such as polyphenols (daidzein, epicatechin, catechin, epigallocatechin, gallocatechin, vitexin, taxifolin, myricetin, tricin, quercetin, luteolin, apigenin, procyanidin B1, kaempferol, and procyanidin B2), vitamins (riboflavin), minerals (iron, calcium), and amino acids (leucine, methionine, thiamine, isoleucine, and phenylalanine). Additionally, dietary fiber (18%), calcium (0.34%), phytates (0.48%), phenols (0.3–3%), protein (6–13%), and minerals (2.5–3.5%) are all present in large amounts in them (Singh et al., 2022; Shumoy and Raes, 2016).

Buckwheat millet (*Fagopyrum esculentum*), barley (*Hordeum vulgare*), rice (*Oryza sativa*), chaplain (*Amaranthus paniculatus*), wheat (*Triticum aestivum*), and tartary buckwheat or phaphar (*Fagopyrum tataricum*) are some of the cereals used in Uttarakhand's traditional meal preparation (Sreelatha et al., 2012; Senthilkumaran et al., 2008). Finger millet, also called manduwa, mandua, or ragi (*Eleusine coracana*); horse gram, also called Gahath/kulthi/kulath (*Macrotyloma uniflorum*); foxtail millet, also called kauni (*Setaria italica*); and Indian barnyard millet, also called jhanghora (*Echinochloa frumentacea*) (Singh et al., 2008). On top of that, they use urad or urd (Vigna mungo), chana or chickpea (*Cicer arietinum*), kala bhatt (Singh et al., 2008; Sati, 2009; Tomar et al., 2023), and black soybean (*Glycine max* var.). Apart from the often harvested crops like tomato, potato, spinach, pumpkin, onion, garlic, ginger, and turmeric, kandali and lingura are examples of naturally occurring wild vegetables. (*Diplazium esculentum*).

Additionally, woodlands produce sakina (*Indigofera pulchella*) and *Urtica dioica* (Kala and Nautiyal, 2022). Two other mushroom species that are harvested from the wild for human consumption are *Morchella esculenta* and *Agaricus* spp. (Kala and Nautiyal, 2022). Among the primary meals are roti (flat bread) produced from barley, finger millet, barnyard millet, badi, kauni or foxtail millet, and corn (Zea mays). Other traditional foods include gathoni, fanu, chaisu, saag, kadhi, thechwani, bodi, kafli, and aloo-gutke. Rotis made from chaulai or marsa, buckwheat millet or kuttu, and tartary buckwheat or phapar are also eaten, depending on the hill region in which they are cultivated. Because phapar and kuttu are grown at high elevations, they are the main foods consumed by the native population.

Buckwheat contains components that can act as prebiotics, reduce cardiovascular risk factors, boost antioxidant activity, raise blood glucose levels, and effectively reduce body fat, per a previous study. These consist of anthocyanin, flavonoids, rutin, vitexin, and quercetin (Ratan and Kothiyal, 2011). The mild leaves and new shoots of the plant are used to make kandali/nettle (Urtica dioica) curry at the right time of year because of its high content of balanced proteins (20%), minerals (zinc, iron, cobalt, potassium, nickel, and molybdenum), and vitamins A and C (Jan et al., 2017). Additionally, jhangora and buttermilk are used

to make the native vegetable known as snake gourd (*Trichosanthes cucumerina*), also known as chhachhindu or chhachhinde (Kala and Nautiyal, 2022).

Because barnyard millet contains crude protein (9.39%), fiber (6.3%), and fat (2.0%), it is commonly used by diabetics in place of rice. Additionally, jhangora is suitable for diabetics due to its higher levels of dietary fiber (11.4%), tannin (67.8%), resistant starch (12.81%), and total antioxidants (59.23%) compared to other cereals and staple rice (Shweta and Sarita, 2018). According to Sharma et al. (2018), breakfast usually consists of roti/parantha, a type of flatbread, served with curd, cooked vegetables, or chutney prepared from perilla, bhangjeera, or purple mint (Perilla frutescens). According to Jin et al. (2023), Ahmad (2022), Paek et al. (2013), Devi et al. (2014), fresh perilla leaves have a rich nutritional profile due to their high levels of folic acid (a B vitamin), β-carotene (a precursor to vitamin A), minerals (iron, calcium, zinc, magnesium, and phosphorus), carotenoids (antioxidant properties), and polyphenols (anthocyanins, antioxidants with potential health benefits; alpha-tocopherol, a form of vitamin E known for its antioxidant properties; phytosterols with cholesterol-lowering effects).

Perilla seed sprouts can lower body weight, blood triacylglycerides, hyperglycemia, improve glucose tolerance, lower insulin resistance, and increase AMP-activated protein kinase activation, gluconeogenic control, and glucose tolerance at doses of 100, 300, and 1000 mg/kg of body weight (Hipporagi et al., 2017). For lunch, people usually eat boiled jhangora, rice, or kauni, along with gathoni (boiled horse gram cooked with salt and spices), kadhi (made from chickpea flour slurry and spices cooked with curd for an hour), chaisu (roasted and ground urad dal cooked with salt, water, and spices), fanu (soaked horse gram ground overnight to make paste and then cooked with salt, water, and spices), and kafli, a green gravy made by stewing soaked rice paste with ground spinach or methi leaves.

Bhattya or jholi (curd, chickpea flour, and asafoetida heated together to form a gravy), bhatt ke dubke (soaking bhatt overnight, pounding it into a paste, and then boiling it with broken rice and salt in an iron utensil), bodi (sundried paste of soaked horse gram containing spices and salt; sundried batter of cucumber or ash-gourd containing spices and salt), and thechwani (fried and cooked with spices, salt, and water). For supper, finger millet and wheat roti are consumed with vegetables. Finger millet is a very nutrient-dense grain since it contains a lot of minerals (calcium, phosphorus, zinc, iron) and bioactive compounds (polyphenol, flavonoid, phytic acid, and dietary fiber) (Singh et al., 2022). Furthermore, finger millet has been associated with a number of health benefits, including improved gastrointestinal health, antidiabetic, antioxidant, anti-tumoral, antibacterial, and atherosclerogenic qualities (Singh et al., 2022; Kwon et al., 2007). The ingredients for Raithu, also called Bhangjeera Chutney, include roasted cumin seeds, coriander, curd, and cooked pumpkin.

Black soybean, sometimes referred to as bhatt, kala bhatt, or bhat maas, is a staple food in the Kumaon region and surrounding parts of Uttarakhand. Many delectable meals, like chudkani, bhatwani, chainsa, and dubke, are made with it. According to genetic tests, Uttarakhand's bhatt cultivars differ from regular soybeans (Dwivedi et al., 2024). They are known for their rich nutritional profile and profusion of medicinal substances that may have positive health effects (Dwivedi et al., 2024). The seed coat of bhatt contains anthocyanins (cyanidin 3-O glucoside), which are known to have anti-obesity characteristics, in addition to several other components like phosphate, protein, iron, calcium, carbohydrates, and vitamins A and B (Kumar et al., 2023). Additionally, this type of black soybean contains isoflavones (glycitein, genistein, and daidzein), phenolic acids (gallic, syringic, vanillin, and p-hydroxybenzoic acid), and other advantageous substances with anti-inflammatory, anti-cancer, neuroprotective, and cardioprotective qualities (Siddhuraju and Manian, 2007; Aditya et al., 2019).

Many people consider the legume horse gram (*M. uniflorum*), also known as gahath or kulath, to be a regional delicacy. A tasty garnish that makes ordinary dishes taste better. Many

people consider the legume horse gram (*M. uniflorum*), often known as gahath or kulath, to be a regional specialty. Given that gahath/kulath is believed to keep the body warm throughout the winter, a delicious variety called gathoni is eaten with cooked rice or rotis. Gahath/kulath seeds are typically used whole in simple lentil recipes due to their cooling and neutral qualities, but they can also be crushed to create phanu, a year-round, delectable dish that goes well with rice (Kala and Nautiyal, 2022).

In the winter, gathoni, another delectable dish, is consumed with cooked rice or rotis because it is thought to help retain body heat. Gahath contains antioxidant qualities and is high in calcium, iron, magnesium, potassium, zinc, and phosphorus (Patel and Acharya, 2020; Bhattacharyya et al., 2023). Additionally, studies have demonstrated that eating gahath has an anti-obesity effect and dramatically lowers the risk of kidney stones (Vadivelu et al., 2019; Reddy et al., 2013; Ojha et al., 2022). Rich in protein, antioxidants, and prebiotics (dietary fiber), the native red kidney bean (*Phaseolus vulgaris* L.), also known as rajam or rajmah, is farmed locally and is commonly eaten as a lentil (Vadivelu et al., 2019).

According to a study, traditional foods have several health benefits, including antifungal, anti-inflammatory, and a decreased risk of cancer and diabetes (Ojha et al., 2022). However, soybean, rice bean (Vigna umbellate), rice, finger millet, and horse gram are excellent sources of carbs, whereas mustard seed, also known as sarson (*Brasica juncea*), sesame seed, also known as til (*Sesamus orientale*), and cress seed (*Lepidium sativum*) are good sources of fat (Ojha et al., 2022). As a result, the local population's food supply has enough options for appropriate meals to satisfy their energy and nutritional demands while maintaining a balanced balance of vitamins and minerals (Devi et al., 2014). In order to enhance the flavor and nutritional value of chudkani, thatwan, and bhatwani, traditional Uttarakhand cooking requires that they be prepared in an iron pan (kadhai). Iron content is increased in food prepared in iron pans. Food cooked in iron pots has more iron, which raises hemoglobin levels in the blood and helps avoid anemia or iron deficiency (Sharma et al., 2021).

Fermented meals and beverages are especially popular in the Jaunsar-Bawar area of Uttarakhand, where locals still make a variety of fermented drinks and ethnic foods. Functional microorganisms such filamentous molds, lactic acid bacteria (LAB), and yeast are necessary for the fermentation process of bioprocessing raw and cooked materials obtained from plants and animals. The food or beverage's flavor, texture, and aroma are enhanced, its shelf life is extended, its nutritional content is raised, and other health benefits are added. Ghandie/ghaingti, paakyui, mava, soor/daru, dhinki, taiya, khenda, lambda, baari, mudda and chewda, siddhe, aske/kapreudi, kadiyiek, dhinki, taiya, khenda, lambda, and mudda and chewda are some of the ethnic cuisines and beverages mentioned (Rana et al., 2022). The Jaunsari people's traditional cuisine is high in fiber, proteins, calcium, minerals, and vitamins, and it offers numerous health advantages. The Kumaon region's residents are familiar with jamma, sometimes referred to as gemma or jamma. This traditional fermented sausage is made from goat flesh. It also has a big part in the Bhotiya people's traditional Pithoragarh district cuisine. *Lactobacillus sanfranciscencis, Pediococcus pentosaceus, Enterococcus faecium, Leuconostoc mesenteroides, Lactobacillus divergens, Bacillus subtilis, Micrococcus* spp., *Staphylococcus aureus, Candida albicans,* and *Debaryomyces hansenii* are the main bacteria found in jamma, according to Oki et al. (2011).

The Jaunsari and Bhotiya tribes in Uttarakhand make their own distinctive alcoholic drinks. Using a single starting culture called balam, the Bhotiya civilization typically ferments rice, barley, and rice with jaggery (condensed sugarcane juice) to produce jaan/jan, kachhi, and daru, respectively (Rawat et al., 2021). Various herbs, such as cinnamon (*Cinnamomum zeylanicum*), black cardamom (*Amomum subulatum*), long pepper (*Piper longum*), and the seeds of *Ficus religiosa* (peepal or pipala), are added to brown wheat flour and then mixed with water to form semi-dried balls. These Balam balls are then incubated for two weeks on

a bed of chir pine (*Pinus roxburghii*), bhang, and Himalayan cypress (*Cupressus torulosa*).
As a result, the balls become white, signifying the existence of the bacteria required to keep producing alcoholic beverages like cahhang or jann. Additionally, balam is used to cure cattle weakness and cholera. According to research, incorporating herbs into Balam balls promotes the development of good bacteria and yeast flora within them and provides antibacterial properties against rotting-causing microbes (Bhardwaj et al., 2016). The study found that the solid-state balam comprised yeasts (*Saccharomyces cerevisiae*, *Saccharomycopsis fibuligera*, and *Saccharomycopsis malanga*), *Bacillus strains* (*B. subtilis* and *B. aerophilus*), and *Lactobacillus pentosus* and *Pediococcus pentosaceus* (LAB) (Bhardwaj et al., 2016The Jaunsari tribes grow soor and pakhoi/paakuyi with barley and finger millet/barley/rice, respectively, using a single starting culture known as keem (Rana et al., 2022; Rana et al., 2004).

Dried-ground leaves, roots, and twigs of native plants, including *Artemisia rouxburghiana*, also known as chamur, *Sapindus mukorossi*, also known as reetha, *Cannabis sativa*, also known as bhaang, *Crassa opaca*, also known as karonda, and *Zanthoxylum armatum*, also known as timur, are combined with barley flour to create keem culture. After 30 to 40 days in a dark atmosphere, it has a variety of bacteria produced from plants (Tomar et al., 2023). According to Tomar et al. (2023), the keem culture includes a variety of fungal species, such as *Lichtheimia ramosa, Aspergillus glaucus, Aspergillus clavatus, Aspergillus oryzae, Aspergillus terreus,* and *Pichia kudriavzevii*, in addition to bacteria from the *Streptomyces, Pediococcus*, and *Bacillus genera*. Whether fermented or not, traditional foods and beverages are believed to improve digestion, cleanse the blood, and fortify the body (Rana et al., 2004).

3. CONCLUSION

The indigenous people of Uttarakhand rely on their centuries-old experience, traditional food preparation methods, and knowledge of the native flora. Furthermore, certain regional delicacies have inexplicable functional nutritional qualities and are abundant in bioactive compounds that promote health. This study provides the scientific rationale for preserving these rich dietary traditions in addition to closely analyzing the functional food attributes of the traditional cuisines prepared in the Uttarakhand regions.

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