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Traditional Food of Uttarakhand and Its Functional Importance: An Overview

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ABSTRACT
Some of the most varied ethnic groups and tribes can be found in Uttarakhand. For the local communities (e.g., Garhwali, Kumaoni, Bhotiya, Jaunsari), the rich and varied native flora provides nutritional diversity and guarantees medicinal certainty. Commonly used to make various cuisines and locally made drinks (such as soor/sur, pakhoi/paakuyi, chhang, jann/jan, jhol, lugdi/lugri, etc.) are the local kinds of millet, legumes, green vegetables, tubers, and ferns in various forms (fresh, sundried, flour, pickled, or fermented). Meeting the dietary needs of local communities depends on the centuries-old indigenous experience, the knowledge of the local flora, and the traditional food preparation methods. Furthermore, some regional specialities feature functional dietary qualities that have not yet been identified and are abundant in bioactive compounds that are beneficial to health. As a result, this analysis offers the scientific justification for maintaining these rich dietary traditions while also closely examining the functional food qualities of the traditional foods cooked in the Uttarakhand regions.

KEYWORDS: *Native flora, local communities, Uttarakhand, indigenous, local drinks, nutritional diversity*

1. INTRODUCTION

A significant section of the industrialised world is currently battling obesity problems caused by over-nourishment, commonly referred to as development-driven obesity, while over a billion people in poor countries are undernourished and suffer from acute malnutrition (Ojha *et al.*, 2022). In the 1970s, Japan was the first to use the term "functional food." Physiologically active components (dietary fibre, polyphenols, and other phytochemicals) that support certain biological activities are included in diets that go beyond simple sustenance. Furthermore, the following should be positively impacted by functional foods: immune regulation, memory, senility postponement, anti-fatigue, body weight reduction, lactation, blood glucose regulation, oxygen deficit tolerance, blood lipid regulation, sleep, gastrointestinal functions, vision, bone calcification, blood pressure regulation, and sexual potency (Temple, 2022). People have a long history of using food preservation and processing techniques, as well

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as its medicinal benefits. Prebiotics, polyphenols, antioxidants, and other bioactive substances found in traditional cuisines from the Uttarakhand be categorised as functional foods because of their functional constituents. This region's traditional food, which Uttarakhand, has a great deal of promise to lower the risk of lifestyle disorders like diabetes, obesity, and heart disease.

2. TRADITIONAL UTTARAKHAND CUISINE AND ITS PRACTICAL SIGNIFICANCE

The unique cuisine, culture, and traditions of the Uttarakhand highlands are thriving. The traditional farming climate of the Uttarakhand highlands produces a variety of cereals, pseudo-cereals, vegetables, spices, pulses, herbs, and millets that can combat malnutrition and non-communicable diseases (Ojha *et al.,* 2022). Since millets contain a variety of bioactive molecules, including amino acids (leucine, methionine, thiamine, isoleucine, and phenylalanine), vitamins (riboflavin), minerals (iron, calcium), and polyphenols (daidzein, epicatechin, catechin, epigallocatechin, gallocatechin, vitexin, taxifolin, myricetin, tricin, quercetin, luteolin, apigenin, procyanidin B1, kaempferol, and procyanidin B2), millets are referred to as "nutritious grains" and are regarded as functional foods (Singh *et al.,* 2022). In addition, they contain high levels of calcium (0.34%), phytates (0.48%), phenols (0.3–3%), dietary fibre (18%), protein (6–13%), and minerals (2.5–3.5%) (Singh *et al.,* 2022; Shumoy and Raes, 2016).

Buckwheat millet (*Fagopyrum esculentum*), barley (*Hordeum vulgare*), rice (*Oryza sativa*), chaulai (*Amaranthus paniculatus*), wheat (*Triticum aestivum*), and tartary buckwheat or phaphar (*Fagopyrum tataricum*) are among the cereals utilised in traditional meal preparation in Uttarakhand (Sreelatha *et al.,* 2012; Senthilkumaran *et al.,* 2008). There are several varieties of millet, including finger millet, manduwa, mandua, or ragi (*Eleusine coracana*) (Singh *et al.,* 2008), foxtail millet, or kauni (*Setaria italica*), Indian barnyard millet, or jhanghora (*Echinochloa frumentacea*), and pulses, including horsegram or Gahath/kulthi/kulath (*Macrotyloma uniflorum*) (Sati, 2009). They also utilise urad or urd (*Vigna mungo*), chana or chickpea (Cicer arietinum) (Zaheer *et al.,* 2020) and kala bhatt or black soybean (*Glycine max* var.) (Singh *et al.,* 2008; Sati, 2009; Tomar *et al.,* 2023). In addition to frequently picked vegetables like tomato, potato, spinach, pumpkin, onion, garlic, ginger, and turmeric, wild vegetables that grow naturally include kandali, lingura (*Diplazium esculentum*), include kandali, lingura (*Diplazium esculentum*).

Additionally, sakina (*Indigofera pulchella*) and *Urtica dioica* are harvested from woodlands (Kala and Nautiyal, 2022). *Agaricus* spp. and *Morchella esculenta* are two other mushroom species that are collected from the wild for human consumption (Kala and Nautiyal, 2022). Various local food preparations, including gathoni, fanu, chaisu, saag, kadhi, thechwani, bodi, kafli, and aloo-gutke, are typically consumed as part of a staple diet along with roti (flat bread) made from barley, finger millet, barnyard millet, badi, kauni or foxtail millet, and corn (*Zea mays*). Depending on the hill region where they are produced, rotis made of tartary buckwheat or phapar, chaulai or marsa, and buckwheat millet or kuttu are also consumed. The indigenous populace primarily consumes phapar and kuttu because of their high-altitude cultivation.

According to a prior study, buckwheat includes substances that can effectively lower body fat, restore blood glucose levels, function as prebiotics, lower cardiovascular risk factors, and increase antioxidant activity. These include such as flavonoids, rutin, vitexin, quercetin, and anthocyanin (Ratan and Kothiyal, 2011). Due to their high content of balanced proteins (20%), minerals (zinc, iron, cobalt, potassium, nickel, and molybdenum), and vitamins A and C, the mild leaves and new shoots of the plant are used to make the kandali/nettle (*Urtica dioica*) curry at the right time of year (Jan *et al.,* 2017). In addition, chhachhindu/chhachhinde, also called snake gourd (*Trichosanthes cucumerina*), is a local vegetable that is prepared with buttermilk and jhangora (Kala and Nautiyal, 2022). The crude protein (9.39%), fibre (6.3%), and fat (2.0%) of barnyard millet make it a popular alternative to rice for diabetics. Additionally, jhangora has higher levels of dietary fibre (11.4%), tannin (67.8%), resistant starch (12.81%), and total antioxidants (59.23%) than staple rice and ~~and~~ other cereals, which makes it appropriate for those with diabetes (Shweta and Sarita, 2018).

Typically, breakfast consists of roti/parantha, a type of flat bread, accompanied by cooked vegetables, curd, or chutney prepared from purple mint (*Perilla frutescens*), bhangjeera, or perilla (Sharma *et al.,* 2018). Because of their high content of folic acid (a source of vitamin B), 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 and known for its antioxidant properties; phytosterols with cholesterol-lowering effects), fresh perilla leaves provide a rich nutritional profile (Jin *et al.,* 2023; Ahmad, 2022; Paek *et al.,* 2013; Devi *et al.,* 2014). Perilla seed sprouts at 100, 300, and 1000 mg/kg of body weight can reduce body weight, lower blood triacylglycerides, lower hyperglycemia, improve glucose tolerance, lower insulin resistance, and increased glucose tolerance, AMP-activated protein kinase activation, and gluconeogenic control (Hipparagi *et al.,* 2017). People frequently eat boiled jhangora, rice, or kauni for lunch, along with gathoni (boiled horsegram cooked with spices and salt), kadhi (made from chickpea flour slurry, spices cooked with curd for an hour), chaisu (roasted and ground urad dal followed by cooking with spices, salt, and water), fanu (overnight soaked horsegram ground to make paste and then cooked with spices, salt, and water), kafli (green gravy made from the leaves of spinach or methi are ground and cooked along with soaked-rice paste or any lentils cooked with water and spices), bodi (sundried paste of soaked horsegram containing spices, and salt; sundried batter of cucumber or ash-gourd containing spices, and salt), thechwani (fried and cooked with spices, salt, and water), bhattiya or Jholi (curd, chickpea flour, and asafetidia heated combined to form a gravy) and bhatt ke dubke (bhatt is soaked overnight and then pounded into a paste and the mixture is boiled in an iron utensil with broken rice and salt. Wheat roti and finger millet are had with veggies for supper. Due to the presence of several minerals (calcium, phosphorus, zinc, iron) and bioactive substances (polyphenol, flavonoid, phytic acid, and dietary fibre), finger millet is an extremely nutrient-dense grain (Singh *et al.,* 2022). Furthermore, finger millet is linked to a host of health advantages, such as antidiabetic, antioxidant, antitumoural, antibacterial, and atherosclerogenic properties, and it also enhances gastrointestinal health (Singh *et al.,* 2022; Kwon *et al.,* 2007). Raithu, also known as bhangjeera chutney, is made from boiled pumpkin combined with curd, salt, coriander, and toasted cumin seeds.

In the Kumaon region and other parts of Uttarakhand, black soybean, also known as bhatt, kala bhatt, or bhat maas, is a year-round favourite that is used to make a variety of delicacies including chudkani, bhatwani, chainsa, or dubke. According to genetic research, Uttarakhand's bhatt cultivars differ from regular soybeans (Dwivedi *et al.,* 2024). They are acknowledged for having a high nutritional profile and for being a wealth of medicinal substances that may have positive health effects (Dwivedi *et al.,* 2024). In addition to various other elements including phosphate, protein, iron, calcium, carbohydrates, and vitamins A and B, the seed coat of bhatt contains anthocyanins (cyanidin 3-O glucoside), which are recognised to have anti-obesity properties (Kumar *et al.,* 2023). This black soybean type also contains other beneficial substances, like isoflavones, including phenolic acids (gallic, syringic, vanillin, and p-hydroxybenzoic acid) and isoflavones (glycitein, genistein, and daidzein), which have anti-inflammatory, anti-cancer, neuroprotective, and cardioprotective properties (Siddhuraju and Manian, 2007; Aditya *et al.,* 2019).

Horsegram (*M. uniflorum*), often known as gahath or kulath, is a legume that is highly valued as a regional food. A tasty addition that improves the flavour of simple meals. Horsegram (*M. uniflorum*), often known as gahath or kulath, is a legume that is highly valued as a regional food. In winter, a delectable version known as gathoni is consumed with cooked rice or rotis since it is said that gahath/kulath keeps the body warm. Gahath/kulath seeds are typically used whole to make simple lentil preparations, but crushed seeds can also be used to make phanu, a delicacy that is eaten with rice year-round due to its cooling and neutral qualities (Kala and Nautiyal, 2022). During the winter, gathoni, another delectable kind, is consumed with cooked rice or rotis since it is thought to help retain body heat. In addition to having antioxidant qualities, gahath 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 impact and considerably lowers kidney stone

development (Vadivelu *et al.,* 2019; Reddy *et al.,* 2013; Ojha *et al.,* 2022). Commonly eaten as a lentil, the locally grown rajam/rajmah or native red kidney bean (*Phaseolus vulgaris* L.) is high in protein, antioxidants, and prebiotics (dietary fibre) (Vadivelu *et al.,* 2019).
According to a study, traditional crops provide a wide range of medicinal benefits, including antifungal, anti-inflammatory, and cancer and diabetes risk reduction (Ojha *et al.,* 2022). While sesame seed, also known as til (*Sesamus orientale*), mustard seed, also known as sarson (*Brasica juncea*), and cress seed (*Lepidium sativum*) are good sources of fat, soybean, rice bean (*Vigna umbellate*), rice, horsegram, and finger millet are rich sources of carbs (Ojha *et al.,* 2022). As a result, local communities' food supply provides enough options for appropriate diets to satisfy energy and nutritional needs while maintaining a good balance of vitamins and micronutrients (Devi *et al.,* 2014). Curiously, in order to improve flavour and nutritional content, chudkani, thatwan, and bhatwani must be cooked in an iron pan (kadhai) in traditional Uttarakhand cooking. Iron content rises when food is cooked in iron pots. Food cooked in iron pots has a higher iron content, which raises haemoglobin levels in the blood and helps avoid anaemia or iron deficiency (Sharma et al., 2021).

In the Jaunsar-Bawar region of Uttarakhand, where the locals still prepare a variety of ethnic meals and make a variety of fermented beverages, fermented foods and beverages are also prevalent. Throughout the fermentation process, functional microorganisms—yeast, lactic acid bacteria (LAB), and filamentous molds—are essential for biotransforming raw and cooked materials derived from plants and animals. This change gives the food or drink more health advantages, improves its flavour, texture, and aroma, increases its nutritional value, and prolongs its shelf life. The following cultural foods and drinks: chilra (LAB, yeast), siddhe, aske/kapreudi, kadiyiek, dhinki, taiya, khenda, lambda, baari, mudda and chewda, ghandie/ghaingti, paakyui, mava, and soor/daru (Rana *et al.,* 2022). The ethnic diet of the Jaunsari people has many health benefits and is rich in fibre, proteins, calcium, minerals, and vitamins. Jamma, often called jamma or gemma, is a famous delicacy among the Kumaon region's residents. It is an ethnic fermented sausage made from goat flesh. It is also an important part of the Bhotiya community'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 microorganisms found in jamma (Oki *et al.,* 2011).
The Bhotiya and Jaunsari tribes in Uttarakhand make their own alcoholic drinks. Using a single starter culture known as balam, the Bhotiya society typically ferments rice, barley, and rice with jaggery (sugarcane juice that is condensed into a solid mass) to produce jaan/jan, kachhi, and daru, respectively (Rawat *et al.,* 2021). Balam is made by roasting wheat flour until it turns brown, then adding different herbs like cinnamon (*Cinnamomum zeylanicum*), black cardamom (*Amomum subulatum*), long pepper (*Piper longum*), and the seeds of *Ficus religiosa* (peepal or pipala) and kneading them with water to form semi-dried balls. After that, these balam balls are incubated for two weeks in a bed composed of *Cupressus torulosa* (Himalayan cypress), *Pinus rouxburghii* (chir pine), and bhang. The balls turn white as a result, indicating the existence of the bacteria needed to continue making alcoholic drinks like cahhang or jann. Balam is also used to treat cholera and cattle weakness. It has been found that adding herbs to balam balls encourages the growth of beneficial bacteria and yeast flora within them and offers antibacterial qualities against germs that cause spoiling (Bhardwaj *et al.,* 2016). LAB (*Lactobacillus pentosus* and *Pediococcus pentosaceus*), *Bacillus* strains (*B. subtilis* and *B. aerophilus*), and yeasts (*Saccharomyces cerevisiae, Saccharomycopsis fibuligera*, and *Saccharomycopsis malanga*) were found in solid-state balam, according to the analysis (Bhardwaj *et al.,* 2016). Using a single starter culture known as keem, Jaunsari tribes create soor and pakhoi/paakuyi using barley and finger millet/barley/rice, respectively (Rana *et al.,* 2022; Rana *et al.,* 2004). To make keem culture, combine barley flour with dried-ground leaves, roots, and twigs of local plants including *Zanthoxylum armatum* or timur, *Sapindus mukorossi* or reetha, *Cannabis sativa* or bhaang, *Crassa opaca* or karonda, and *Artemisoa rouxburghiana* or chamur. After being stored in a dark room for 30 to 40 days, it has a variety of bacteria that are derived from plants (Tomar *et al.,* 2023). According to Tomar et al.'s 2023 study, keem culture is home to a large number of *Lichtheimia ramosa*, *Aspergillus glaucus, Aspergillus clavatus, Aspergillus oryzae, Aspergillus terreus*, and *Pichia kudriavzevii* fungi,

as well as bacteria from the families *Bacillus, Streptomyces*, and *Pediococcus* (Tomar *et al.,* 2023). Traditional foods and drinks, whether fermented or not, are thought to strengthen the body, cleanse the blood, and enhance digestion (Rana *et al.,* 2004).

3. CONCLUSION

Uttarakhand communities depends on the centuries-old indigenous experience, the knowledge of the local flora, and the traditional food preparation methods. Furthermore, some regional specialities feature functional dietary qualities that have not yet been identified and are abundant in bioactive compounds that are beneficial to health. As a result, this analysis offers the scientific justification for maintaining these rich dietary traditions while also closely examining the functional food qualities of the traditional foods cooked in the Uttarakhand regions.

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