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Underutilized grains of Himalayan Region: A mini review

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Abstract

Underutilized crops are those which are neither cultivated in an organized farming system nor processed by established commercial processing method. These are the minor crops and not fully exploited for commercial purpose. Food and Agriculture Organization (FAO) statistics reveal that approximate 800 million children, women and men are suffering from protein-calorie under nutrition so these underutilized grain are dire need to utilized not because of its nutritional properties but its fighting hunger and create the income generation option. In this review different grain of Himachal Pradesh viz. Amaranth, Kodo Millet, Buckwheat, Red rice and Rice bean has been discussed. All these grains are posses antioxidants, phytochemical and micro nutrients. High nutritional content of these grains shows its nutraceutical values. Cereal are the staple diet of Indian people so utilization of these underutilized crops in preparation of composite flour can also enhances the nutritional and functional properties of the cereal food products. Underutilized grains are not gain enough popularity among the people due to lack of awareness and economic interest so timely investment and research into these species can save the food for the next generation arriving on the already ailing earth.

Keywords: Underutilized grain, Nutraceutical, Awareness, Nutritional, Composite flour

Introduction

Underutilized or minor crops are traditionally grown in the centers of their origin or the centers of diversity by farmers and have lesser importance in terms of global production and consumption systems. They are locally well adapted to marginal lands and constitute an important part of the local diet. These crops provide valuable nutritional elements like proteins, vitamins and minerals as well as their role is also well known for traditional medicine (Ochatt and Jain, 2007) [31].

These crops possess promising nutritional and industrial importance for a variety of purposes for human kind. Their cultivation is restricted to specialized geographical pockets in different agro ecological regions, mainly by poor farming communities which derive their sustenance and livelihood from such crops. However the commercial importance and market value of these crops are still unknown to the public (Joshi *et al.* 2002) [20]. Bioversity International, International Centre for Underutilized crops (ICUC) and National Academy of Sciences (NAS, USA) identified 200 such underutilized crop species (29 millets, 10 oilseeds, 27 pulses, 25 root and tuber crops, 52 fruits and nuts, 24 minor fruits, 39 vegetables and 5 fibre and pulp yielding plants) for different eco-geographical region of the world (Eyzaguirre *et al.* 1999) [12]. The important underutilized crops identified for Indian regions are listed in Table 1.

Food and Agriculture Organization (FAO) statistics reveal (Swaminathan, 1999) [40] that approximate 800 million children, women and men are suffering from protein-calorie under nutrition, over 2 billion suffer from hidden hunger however, the deficiency of the micronutrients, particularly iron caused low birth-weight children. These micronutrients are in plenty in *Panicum miliaceum* (proso millet), *Paspalum scrobiculatum* (kodo millet), *Chenopodium* (chenopod), *Amaranthus* (amaranth), *Fagopyrum* (buckwheat), *Vigna Umbellata* (Rice bean) etc while, all of these are grains can help to make more balanced diet and hence can play an important role in combating silent hunger (Swaminathan, 1999) [40]. These crops could also help in poverty alleviation by providing income generating opportunities to the farmers by linking the development of these crops to market opportunities. In India, these crops are grown from Jammu and Kashmir in the west to Arunachal Pradesh in the east. Theses crop are traditionally grown in the state of Himachal Pradesh, Uttarakhand and Jammu and Kashmir due to suitable climatic conditions (Bhag and Joshi, 1991) [3]. In Himachal Pradesh most commonly grown underutilized grains are buckwheat, red rice, kodomillet, rice bean and amaranth.

Nutritional importance

Amaranth

Amaranth (*Amaranthus caudatus*) is mainly grown in Kinnaur, Kullu and Sirmour districts of Himachal Pradesh (Mohil and Jain, 2012) [29]. Amaranth is an excellent source of high quality balanced protein as it contains high amounts of lysine, methionine and cysteine apart from large amounts of dietary fibre and minerals (Marcone, 1999) [27]. Amaranth are rich in squalene and tocotrienols, which are natural materials positively involved in lowering low-density lipoprotein (LDL) and blood cholesterol (Bodroza-Solarov *et al.* 2008) [4].

Rice bean

Rice bean (*Vigna umbellata*) is mainly grown in Kangra district of Himachal Pradesh. It is mainly attributes high protein content, essential amino acid, mineral and vitamin. Low fat content and relatively high proportion of healthy unsaturated fatty acid make it a nutritional health package (Katoch, 2012) [22]. Micro nutrients are also present in plenty in Rice Bean i.e. sodium, potassium, calcium, magnesium, phosphorous, zinc, copper, iron, and manganese. Iron (9.25 mg/100 g) and potassium (1752.77 mg/100 g) contents were appreciably high (Katoch, 2012) [22] in Rice Bean.

Red rice

Red rice (*Oryza rufipogon*) is mostly grown in Shimla (Chuhara), Kullu (Nagger), Chamba and Mandi districts of Himachal Pradesh. Red rice contains polyphenols and anthocyanin, and possesses antioxidant properties (Zhang *et al.* 2005) [42]. Red rice accounts for its aroma and taste. It is traditionally used for curing blood pressure and fever. It is also used for treating leucorrhoea and abortion complications (Arumugasamy *et al.* 2001) [1]. Red rice also contains good amount of trace element such as zinc and iron (Pandit, 2012) [33].

Buckwheat

Buckwheat is mainly grown in Kinnaur, Lahul Spiti and Sirmour districts of Himachal Pradesh (Dutta, 2004) [11]. Buckwheat (*Fagopyrum esculentum Moench*) is an important pseudo cereal known as a dietary source of proteins, polysaccharides, lipids, rutin, polyphenols, dietary fibers (Skrabanja *et al.* 2004) [37], essential minerals and trace elements such as potassium (K), magnesium (Mg), calcium (Ca), and sodium (Na) (Kim *et al.* 2004; Bonafaccia *et al.* 2003; Steadman *et al.* 2000; Christa and Soral-Šmietana, 2008) [25, 53, 8, 8]. It is an excellent source of lysine which is deficient in cereals and also possesses higher antioxidant activity (Dutt, 2004) [11]. This crop also contains antioxidant compounds, primarily rutin which is responsible for beneficial health effects (Halosava *et al.* 200). Regular consumption of buckwheat containing products reduce the risk of high blood pressure, prevents oedema and hemorrhagic diseases, prevents diabetes and reduces the risk of arteriosclerosis (Kim *et al.* 2004; Préstamo *et al.* 2003) [25, 36].

Kodomillet

Kodomillet (*Paspalum scrobiculatum*) is mainly grown in Kullu, Mandi, Kangra and Sirmour districts of Himachal Pradesh (Kumar, 2013). Kodomillet is rich in calcium, dietary fiber, poly phenols, protein, vitamins and minerals (Chandel *et al.* 2014; FAO, 2009) [6, 13]. It contains significant amounts of essential amino acids particularly the sulphur containing amino acids (methionine and cysteine), and also having higher fat content than maize, rice, and sorghum (Obilana and

Manyasa, 2002) [30]. The grain is also rich in phytochemicals, including phytic acid, which is believed to lower cholesterol, and phytate, which is associated with reduced cancer risk (Coulibaly *et al.* 2011) [8]. These health benefits have been partly attributed to the wide variety of potential chemopreventive substances, called phytochemicals, including antioxidants present in high amounts in such grain (Izadi *et al.* 2012) [17].

Cereals (wheat and rice) are the staple diet of Indian and average carbohydrate in diet is about 60-70% of calories which derived mainly from these cereal crops (Jagannadham *et al.* 2014) [18]. However, these cereal crops are deficit in balance essential amino acids. Utilization of grains and legumes in preparation of composite flours for various food formulations increased their nutritional properties (Kaur and Singh, 2005) [23]. Hence forth, the utilization of these underutilized crops in preparation of composite flour can also enhances the nutritional and functional properties of the cereal food products. The underutilized crops includes amaranth, kodomillet, buckwheat, chenopod and minor millets such as rice bean and red rice (Joshi *et al.* 2002) [20].

Now a days, peoples are becoming health conscious and these grains have potential to fulfill their requirements by possess both nutraceutical and nutritional properties. So there is great scope for utilization of these underutilized grains for the development of processed products.

Composite flour

The basic composite flour technology refers to the process of mixing wheat flour with cereals and legumes to produce high quality food products in nutrition as well as economical way (Kadam *et al.* 2012) [21]. Cereals are important constitute of the Indian diet as they are good source of carbohydrate, minerals and vitamins (Khamgaonkar, 2013) [24]. But these cereal crops such as wheat and rice are deficient in quality protein and functional properties, however these minor crops are (red rice, buckwheat, rice bean, kodomillet and amaranth) rich in dietary fiber, essential amino acid, fatty acid, phenolics and vitamins (Gordon, 2013) [14]. Hence forth utilization of these underutilized grains (red rice, kodomillet, buckwheat, rice bean and amaranth) in development of composite flour can increase the nutritional quality of food.

The composite flour improves the nutritional value of the food products such as improving the balance essential amino acid and carbohydrate content (Suliaman *et al.* 2013) [39]. Pumpkin wheat composite flour improves the nutritional quality as well as the texture of the products (Pasha *et al.* 2013) [34]. Mushroom composite flour increased the nutritional content of wheat flour especially the lysine content which is deficient in cereal crops (Patiyal, 2013) [35].

Convenient food products

Now a days the consumption of convenient food such as the bakery and extruded products from wheat flour are very popular among the people but it is deficient in essential amino acids such as lysine and threonine (Bakke and Vickers, 2007; Dewettinck *et al.* 2008; Jideani and Onwubali, 2009) [2, 10, 19].

The enrichment of bakery products with legume flour increases the nutritional quality by increasing the lysine content, vitamin B and mineral content (Okoye and Okaka, 2009) [32]. The incorporation of amaranth in wheat flour for bread making, baked goods and pasta products not only increases the nutritive value but also improves the pasting and rheological properties of dough (Mlakar *et al.* 2009) [28].

The addition of buck wheat flour and durum wheat bran influenced the spaghetti quality. Redness of the spaghetti with added buck wheat and bran was higher than that made from the durum semolina. The acceptability of this colour was reported higher and was found rich in dietary fiber (Chillo *et al.* 2008) [7]. Addition of the buck wheat bran flour (up to 30%) determined a decrease of optimal cooking time of the spaghetti due to physical disruption of the gluten matrix and over all low density, which provides a path for water absorption into the enriched spaghetti, which resultant in shorter the cooking times (Chillo *et al.* 2008) [7]. Macaroni prepared with the supplementation of mushroom (white button mushroom) not only enhance the nutritional quality but also improves the rheological characteristics of the products. The nutritional quality of Indian bread was reported to be enhanced by incorporation of mushroom flour (*Pleurotus sp*) in the wheat flour (Patiyal, 2014) [35].

Conclusion

Recently Food and Agriculture Organization (FAO) statistics reveal that approximate 800 million children, women and men are suffering from protein-calorie under nutrition in developing countries. As the results there have been increasing the interest of utilization of plant sources and underutilized crop/grain as food because of their health promoting benefits. Worldwide exploration of these crops not solves the problem of mal nutrition but also providing the source for fighting hunger. This review highlights the five important underutilized grain which have all the potential required to become “a super food”.

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