Traditional knowledge and heirloom root vegetables: Food security in trans-Himalayan Ladakh, India

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This study elaborates the role of heirloom vegetables coming down from generations to generations into the life support system of native Ladakhi highlanders (in the trans-Himalaya region of India). The study was conducted with 165 Ladakhi men and women using a combination of personal interviews and participatory methods indicated that heirloom vegetables are known for their taste, colour, shape and adaptability among Ladakhi people, and form an integral part of their food system during the period of scarcity, especially during the winter months when the region remains landlocked. Due to unfavourable conditions caused by severe cold, high altitude and a short growing season the production of many vegetable varieties are hampered. During such periods, the heirloom root vegetables available in the region with higher shelf life are of immense utility in securing the food security of the local community. However, the introduction of new varieties is posing a threat to the traditional heirloom root vegetables, and many are in verge of extinction accompanied by decreasing trend in their growing percentage. These vegetables are stored for consumption during winter, although the trend is currently declining. If the same trend continues, appropriate in situ conservations interventions are needed.

Keywords: Traditional knowledge, Heirloom vegetables, Ladakh, Food security, Conservation.

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Heirloom vegetables are vintage non-hybrid open pollinated vegetable species that have been conserved from generation to generation as seeds¹. By saving seeds of such species, the seeds sometimes called heirloom varieties to emphasize their role as an important cultural heritage became trusted as stable varieties over centuries². Overall, an heirloom vegetable needs to be a variety that has been around for many years in a garden or field, and have qualities desired by the community who preserves them. Unlike hybrids, which have been bred largely for uniformity in size, shape, and ripening, heirlooms were often selected for flavour potential and eating quality¹. Culture and ethnicity are recognized as first-class factors leading to the conservation of heirloom varieties³ and it is the gardeners’ desires to conserve varieties that are at the edge of extinction and conservation of diverse vegetable varieties. In context of high altitude regions like Ladakh, there have been significant changes in food system over the two decades and at the same time at national and international level, issue of food security in such high altitude regions are not addressed well due to lesser representation⁴. Keeping this in view, this study endeavours to study the prevalence of heirloom root vegetable in Leh district of Ladakh region, India and how the local people perceive them.

Research methodology

Study area

Ladakh, a North eastern part of Jammu and Kashmir State of India consists of two districts Leh and Kargil. Leh lies between 32 ° to 36 ° North latitude and 75 ° to 80 ° East longitude and altitude ranges from 2300 m to 5000 m above sea level. The district is bounded by Pakistan in the West and China in the North and eastern part and Himachal Pradesh in the South east. Topographically, the whole of the district is mountainous with three parallel ranges of the Himalayas, the Zanskar, the Ladakh and the Karakoram Range⁵. The district constitutes 112 inhabited and one un-inhabited villages with a population of 147104 (as per 2011 census) with Buddhist as the biggest ethnic group followed by Muslim⁶. The region is often called ‘cold desert’, where intensive sunlight, high evaporation rate, strong winds and fluctuating temperature characterize the
general climate. Because of high mountains, all round and heavy snowfall during winter, the area remains landlocked to the outside world for nearly five months in a year.

**Sampling design and method of data collection**

Exploratory research design with qualitative approach was followed to complete this study. The study was carried out during 2014-15 in two successive stages in three villages namely Nimoo, Sankar and Hunder of Leh district of Jammu and Kashmir. These villages were selected purposively due to the prevalence of heirloom root vegetables in these villages and related agriculture and food practices in vogue among the inhabitants. Nimoo is situated 35 km away to the West from the district headquarter Leh, and Sankar is situated 3 km away located in the upper Leh valley towards North. Hunder is situated across the Khardungla pass (highest motorable road, at 18380 ft amsl) towards North-west at 130 km from Leh.

Before the survey, a pilot study was undertaken to gain background experience about the local communities and the resources available, which further helped the researchers to establish rapport with the local people. Based on the information collected during the pilot study and literature reviews, radish (*Raphanus sativus* L.), turnip (*Brassica rapa* L.) and swede (*Brassica napus* subsp. *napo brassica* (L.) Hanelt) were selected for this study. Their selection was based on relevance and prevalence among the whole community in consultation with the inputs given by local people, and literature search. The study was carried out in an interactive mode involving local people. Locals were encouraged and helped to share their knowledge about the heirloom vegetables. A total of 165 informants were sampled randomly for this study and were interviewed from the three regions. Out of these, 70.90% were female with age 37 to 66 years while 29.09% male with age 45 to 67 years.

The data of this study were collected using a combination of methods comprising of distant and participatory observations, personal interview and focus group discussion (FGD). For the personal interview, whole household was taken as a unit instead of single individual. The reason being, at many occasions the key informants were aided by his/her other family members in providing information. Moreover, it acted like a semi-group discussion in itself where members of different age groups in different villages and orientations contributed to make the information more comprehensive. The FGD in each village was organized to cross check the information gathered through personal interviews. Typically the interview methodology focused on informal and open dialogues, and a semi structured set of questions were referred to, during the whole survey period. The order of ranking scale was applied through FGD to know the preference of local people on heirloom root vegetables. A series of follow up meetings were conducted to strengthen the dataset. Wherever possible the information was noted down, and in many occasions where it was not feasible to note down, the narratives were audio taped with their permission. Prior Inform Consent (PIC) was taken from every informant to use and publish their knowledge.

**Results and discussion**

The season of crop cultivation in Ladakh is only a few months long. But over the centuries, the people of Ladakh developed a farming system uniquely adapted to their harsh environment where farming is small-scale and each family owns a few acres of land. For many years traditionally, turnips, swedes and radish have been predominately grown until the last quarter of the nineteenth century when the Moravian missionaries came to Ladakh and they brought with them vegetables such as potatoes, spinach, cauliflowers, green beans, brussel sprouts and tomatoes. These were probably the first significant additions to the Ladakhi diet. It was probably also the Moravians who demonstrated that root vegetables could be stored in pits in the ground, locally named sadong, thus improving the variety of foods available in the winter. The common heirloom vegetables *gyalbuk, nyungma* and *tannyaung* (Fig. 1) are still being grown in many parts of Ladakh. They are preferred for certain traits such as taste, bright colour, adaptable to local climate, and long shelf life. Long shelf life or the storability as a parameter for crop preference was found to be the top priority followed by adaptability and taste (Table 1).

During winter, when the region remains landlocked, the locally grown vegetables available are the heirloom varieties which are stored traditionally by the local farmers, some conventional varieties of carrots, onions and potatoes and few leafy vegetables grown inside passive greenhouses. In this context it is understandable that people prefer those vegetables which have greater shelf life, to keep them as winter stocks. These heirloom root vegetables are...
traditionally stored in semi underground vegetable cellars or pits and their shelf life ranges from 5-6 months. During winter months, when no fresh vegetables are grown in open field conditions, these stored roots are their major source of vegetables.

In Ladakh, the locally grown heirloom radish (Fig. 1a) is called gya-labuk in local dialect. Literally, gya in local dialect refers to China and labuk means radish, which indicates radish with origin from China, and the physical proximity accompanied by history of silk route trade between these two regions further supports this nomenclature.

Nyungma unlike the gya-labuk, which is easily identifiable by its size and top pinkish colour, local heirloom turnip grown in Ladakh is not easily identifiable. Some of the peculiar phenotypic character which describes this plant is uneven shape, thick and hairy skin, and generally bigger size (Fig. 1c) as compared to other conventionally bred varieties like Purple Top White Globe (PTWG).

Swede (tamnyung) is thought to be the result of a cross between turnip and cabbage. In Ladakh, it can be stored for around 5-6 months in traditional cellars or pits and the local habitants cook a great variety of foods with these heirloom vegetables as one of the important ingredients, such as thukpa, skyu and chhu tagi. Even the leaves of these vegetables are sun dried for their use during winter months. In other parts of the world, for instance in Japan, people consume heirloom vegetables in several dishes such as kayu, netsuke, sunomono, oroshi, and sengiri or kiriboshi and many of these are sold as local specialities. Similarly in Ladakh also, radish, turnip and swede are used for making pickles by fermenting them and are consumed during the winter months.

Regarding the introduction of these vegetables in Ladakh the respondents believed that these heirloom vegetables were introduced from China via the famous silk route by ancient traders (where Leh was a common exchange market place for merchants coming from different regions and head back to their respective countries after the exchanges) or by the Christian missionaries visiting Ladakh.

Ethnomedicinal usage
Apart from the common usage of these heirloom varieties as root vegetables, nyungma, tamnyung and gya-labuk are also being used by the local natives to treat various ailments in human beings as well as in animals. Many diseases are treated by the local people by feeding the diseased with these vegetables either in the form of decoction or in dried form or in combination with other plants or vegetables (Tables 2a&b). Natives perceive that these methods of treatments are more common in remote locations where the modern medical health facility does not exist or use as a control first aid in situations where such facility cannot be accessed timely.

Status of heirloom root vegetables in Ladakh
After late 1970’s, when Ladakh was opened to outside tourists, there were mass advent of outsiders into the region to explore its unique landscape and socio-cultural diversity. Along with them various conventional vegetable varieties came, about which the native people of Ladakh were not aware. Till then their major source of vegetables were the heirloom vegetables and few other wild vegetables like Lactuca sp, Capparis sp, Fagopyrum sp, Convolvulus sp, Atriplex sp, Rumex sp, Artemesia sp, etc. Such practice can still be found in some remote villages of Ladakh, where the so called modern technological interventions have not reached yet and people are practicing their age old traditional way of living.

Similar to other parts of world, due to improvement in communication facilities (real and virtual both) there has been increase in interaction with other parts of the world and consequently the remote high altitude region of Ladakh is also witnessing socio-
cultural changes. With reference to changes in food consumption pattern in Ladakh region, it is reported that rice was rarely used, and instead represented a favoured meal for festive occasions and a preferred food by families of higher social status. There is a dietary transition over almost three decades with increase in rice and vegetable consumption. Nowadays, rice is the preferred staple during the summer months and different fresh vegetables add to the dietary pattern in this season.

Various introduced vegetables seeds are now available to the local farmers for their cultivation. The State Department of Agriculture, Leh (SDAL) is the main source of these seeds, which procure the seeds of vegetables in bulk and distribute them among the farming community at subsidised rates. This practice of readily availability of conventional vegetable seeds and that too at subsided rates has certainly improved the quantity and diversity of vegetables being grown by local farmers and finally available in the local market. At present, about 28 different types of vegetables are being successfully grown and marketed by the local growers with an approximate turnover of about 250 million of rupees (CAO, 2016). As per the SDAL, in the past five years (2010-2016) local heirloom varieties procured and distributed among the farmers were 15.4 kg and 770 kg only in the year 2011 and 2012, respectively. The rest of the years, procurement of heirloom root vegetables was nil as compared to other conventional varieties. The conventional varieties are being procured by the SDAL through proper official procedures and budget is allotted for the same from the district plan. Contrary to this, the heirloom varieties are procured through emergent local arrangement, thus leading to less and unpredictable availability status for an interested grower. This also seems to be one factor leading to decreased cultivation of heirloom varieties by the local farmers.

Within the three heirloom vegetables studied, gyalabuk, which was quite common among majority of the farmers growing vegetables followed by nyungma and tamnyung. The reasons behind prevalence of gyalabuk are its preference by general consumers as well as the local inhabitants, and secondly, there is no alternative radish variety available which can be stored during winter months as perceived by farmers. With regard to nyungma, other conventional turnip variety like Purple Top White Globe (PTWG) is being made available to the farmers by SDAL. For tamnyung, though there is no alternative conventional variety available, their

Fig. 1 — Locally grown heirloom (a) Radish (gyalabuk), (b) Swede (tamnyung) (c) Turnip (nyungma)- farmers felicitated for their produce during a farmers fair in Ladakh
usage is limited to some traditional cuisines only which
now days is limited to social or cultural occasions only,
because of which its cultivation is also limited.

As the desire to appear modern grows, people are
rejecting their own culture. Even the traditional foods
are no longer a source of pride\textsuperscript{7}. Majority of the
respondents had a perception that, there is spread of a
behaviour among the local people that modernisation is
correlated with adoption of introduced pattern and
rejection or dis-continuance of traditional practices,
because of which the traditional heirloom vegetables
are being neglected and not preferred. Preference for
rice as opposed to “traditional food” was associated
with various factors other than the economic\textsuperscript{4}. These

\begin{longtable}{|l|l|}
\hline
\textbf{Gya-labuk} (Radish) & \\
\hline
\textbf{Disease/Disorder/use} & \textbf{Treatments} \\
\hline
\textbf{Acidity} & Eaten raw or cooked and also helps reduce acid regurgitation. \\
\hline
\textbf{Antibacterial and antifungal} & Rub the decoction or paste on the affected part. \\
\hline
\textbf{Ant carcinogetic} & Useful in liver and gall bladder troubles. In homoeopathy, it is used to cure headache, sleeplessness and \textit{chronic diarrhoea}\textsuperscript{25}. \\
\hline
\textbf{Asthma and other chest complaints} & The leaves, seeds and old roots are used as decoction or eaten raw as well as cooked. \\
\hline
\textbf{Burns & bruises} & The poultice of root is applied on the affected parts of body. \\
\hline
\textbf{Chronic diarrhoea} & Eaten raw or cooked with salt. \\
\hline
\textbf{Frostbite} & The poultice of root is applied on the affected parts of body. \\
\hline
\textbf{Jaundice/Constipation} & Fresh leaves are cooked and eaten raw. \\
\hline
\textbf{Laxative/diuretic} & Radish juice is useful in haemorrhoids, asthma, jaundice, inflammation in urinary bladder and thus is used as diuretics and laxatives and also used as blood purifier. \\
\hline
\textbf{Stinking feet} & The juice of the root is extracted and the feet are dipped in it. \\
\hline
\textbf{Nyungma} (Turnip) & \\
\hline
\textbf{Anti scorbutic, arthritis, stomachic, laxative, gastritis, diuretic} & Roots are eaten raw or cooked with minimum of spices (recommended to use salt and turmeric only). \\
\hline
\textbf{Natural insecticide} & Root powder are spread/ dusted on infected part. \\
\hline
\textbf{Breast tumour/skin cancer} & In folk medicine turnip has been traditionally used for variety of cancers. The leaves, stems and seeds are used in the treatment of some cancers, while the root when boiled with lard is used for breast tumours and a salve derived from flowers is used for skin cancer\textsuperscript{26}. \\
\hline
\textbf{Tamnyung} (Swede/rutabaga) & \\
\hline
\textbf{Diuretic, chronic coughs and as emollient} & Roots are eaten raw or cooked, and the juice from the roots is also used. \\
\hline
\textbf{Rheumatism} & The oil from the seeds are used for stiff joints and rheumatism. \textit{When added to salt, the powder from swede seeds is folk remedy for cancer}. \\
\hline
\end{longtable}

\*Source: personal interviews and focus group discussion

\begin{longtable}{|l|l|}
\hline
\textbf{Gya-labuk} (Radish) & \\
\hline
\textbf{Disease/Disorder} & \textbf{Treatments} \\
\hline
\textbf{Coughing} & Dry radish and \textit{Saussurea lappa}, boil together and feed to the animal with cough. \\
\hline
\textbf{Nyungma} (Turnip) & \\
\hline
\textbf{Coughing} & The root extract of turnip and little salt is used for washing the affected part of the animal. Feeding the affected animal with the juice of radish. \\
\hline
\textbf{Coughing} & Put a necklace of dried turnip on the neck of coughing animals (practiced in case of horse). Seed of turnip mixed with locally brewed \textit{chhang} (made of barley) is feed to the affected animals and make it walk or ride for around 20 minutes (practiced in case of horse and donkey). \\
\hline
\end{longtable}

\*Source: personal interviews and focus group discussion
included the new food preferences of the “younger generation” and their favouring “Indian” or “Western” lifestyles. This also seems to be one reason behind why heirloom vegetables are now found in few remote villages only where the so called modernization has not yet reached.

Various causes contributing to the decline in cultivation of heirloom vegetables in Ladakh as perceived by the respondents include changes in food preference, easy availability of alternate varieties, availability of subsidised food items, lack of avenue/market for local produce and non availability of quality seeds. Except for gya-labuk, which is still popular and being grown in Ladakh, the other two heirlooms tamnyung and nyungma are grown only for some traditional food preparation, cultural necessity, and as a buffer in case there is non-availability of vegetables during winter landlocked period. These heirloom varieties which have been conserved from time immemorial have lost their importance in few years time because of the so called development and introduction of new conventional crop varieties. The governments agricultural policy prefers the global market driven parameters like, yield and ‘product uniformity’ and has out placed other characters like nutrition, adaptability and inherent diversity of heirloom varieties. Accompanied by the readily availability of subsidised food items through the government outlets, natives find it difficult to continue growing heirloom vegetables and thus sustainability of this unique system of agriculture is at stake.

Conclusion and policy implications
Cultivation of heirloom vegetables is one of the major components due to their adaptability (like the shelf life) and compatibility with local food preference. But over the years, Ladakh cold-arid region witnessed increased influx of outsiders and brought with them many socio-cultural as well as behavioural changes. One major change was the food preference, more diverted towards the mainland Indian and western food habit, where the traditional heirloom vegetables do not find their place. The heirloom vegetables are now being only used as a buffer during winter and restricted to fulfil the cultural and religious needs of the natives, whose proportion is also declining because the younger generation are more inclined towards the globalised modern culture assimilated from the west. There has been increase in the diversity of other conventional vegetables introduced from the lowland which are found abundant during summer, but during the winter months these vegetables cannot be grown due to unfavourable cold conditions. During these cold periods of winter when the region is landlocked, only few people can afford the airlifted expensive vegetables. For the poor natives, only the stored heirloom varieties are a source of their food security due to their longer shelf-life characteristics, which they grow during summer and consume the whole winter. Based on the key results, the following points emerged to be considered for the policy implications on heirloom root vegetables conservation and sustaining the native Ladakhi highlanders:

1. Documentation of heirloom varieties along with nutritional profiling and other characteristics which makes it appropriate for Ladakh like regions.
2. Provisions are required to make arrangements whereby the SDAL procure heirloom varieties also along with the other conventional varieties of vegetables, meant for further distribution among the local growers.
3. Value addition in the heirloom variety based products and traditional foods, and link them with eco-tourism.
4. Spread awareness among consumers regarding the benefits and importance of heirloom varieties.
5. Link producer and consumers via the golden triangle\textsuperscript{17}, where, an entrepreneur in Ladakh with heirloom root vegetables can invest in an enterprise at Delhi or Mumbai. Such chains at intra and inter regional levels, will help to cope-up the demand-supply mismatch around heirloom root vegetables.

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