# Biological characteristics of Adaptive culinary ethnobotany: The evolution of Koryo-saram salad traditions in Uzbekistan

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## Research

## Abstract

*Background*: The Koryo-saram, descendants of Koreans relocated from the Soviet Far East to Central Asia in 1937, developed distinctive food traditions through the interaction of inherited Korean culinary knowledge with the biological resources and food practices of their new environment. This study examines Koryo-saram salads as an ethnobotanical expression of culinary adaptation in Uzbekistan, focusing on the plant resources used, their culinary functions, and the processing practices associated with their preparation.

*Methods*: Ethnobotanical data were collected from April 2023 to September 2024 through semi-structured interviews with 252 Koryo-saram respondents aged 50-85 years in Tashkent, Fergana, and Samarkand regions of Uzbekistan. Each respondent provided information on one salad recipe, resulting in a dataset of 252 recipes. Data included local dish names, plant ingredients, plant parts used, preparation and processing methods, seasonings, and preservation practices. Plant ingredients were standardized according to botanical nomenclature. Frequency of Citation ($FC_{recipe}$) and Relative Frequency of Citation ($RFC_{recipe}$) were calculated for plant ingredients.

*Results*: The documented salads demonstrate a combination of continuity and culinary adaptation. Cabbage was the most frequently cited plant ingredient, occurring in 83 recipes ($RFC_{recipe}$ = 0.33), followed by carrot in 52 recipes ($RFC_{recipe}$ = 0.21), eggplant in 23 (0.09), potato in 15 (0.06), radish in 13 (0.05), fern in 9 (0.04), and soybean in 8 (0.03). Carrot, radish, potato, and eggplant were incorporated into recognizable Koryo-saram culinary formats and became characteristic ingredients of locally developed salads. Recurrent preparation practices included fine slicing or grating, salting and removal of excess moisture, acidic marination, use of garlic and hot pepper, and addition of hot pepper-infused vegetable oil. Fish was reported in 49 recipes (19.4%) and was excluded from plant-based ethnobotanical indices.

*Conclusions*: Koryo-saram salad traditions in Uzbekistan represent a dynamic ethnobotanical system in which inherited Korean culinary knowledge has been maintained while locally available biological resources have been incorporated into new recipes and preparation practices. The findings demonstrate that cultural continuity does not require botanical continuity: culinary identity can persist through the transmission of preparation techniques, flavor combinations, terminology, and recipe knowledge even when the plant resources used in particular dishes change. Koryo-saram salads therefore provide an example of how migrant communities reorganize human-plant relationships while maintaining distinctive culinary and cultural identities.

*Keywords*: ethnobotany; culinary ethnobotany; Koryo-saram; migrant communities; food plants; culinary adaptation; Uzbekistan; traditional food knowledge

## Background

Ethnic food is an important part of the cultural identity of a people. It preserves not only food practices and preferences, but also traditional knowledge related to the selection, processing, preparation, and combination of biological resources. For migrant and displaced communities, food may become particularly important for maintaining cultural continuity while simultaneously providing a means of adaptation to new environments. In this context, ethnobotanical knowledge can contribute to the preservation of inherited plant uses and the incorporation of locally available species and culinary practices.

The resettlement of Koreans from the Soviet Far East to Central Asia in 1937 had a long-term impact on the formation of their ethnic identity. According to statistical data, approximately 172,000 people were relocated from the Far East to Central Asia (Back 2004). The main flow of migrants was directed to the Kazakh and Uzbek republics. The loss of connection with their historical homeland contributed to the formation of a distinct community -the Koryo-saram - separate from both Koreans of the Korean Peninsula and other diasporas (Tilavoldiyev, 2024). The relocation resulted in profound changes in the social, economic, and ecological conditions in which Korean communities lived. During the subsequent decades, Koryo-saram communities developed new forms of cultural adaptation while maintaining elements of their Korean heritage.

Food practices were among the cultural practices through which this continuity was maintained. Research on Koryo-saram food culture demonstrates that their cuisine developed through prolonged interaction between Korean traditions and Russian and Central Asian foodways. Rather than representing either a direct continuation of Korean cuisine or an adoption of the cuisine of the host societies, Koryo-saram food developed as a hybrid culinary system associated with the migration history and changing identity of the community (Jung, 2015; Lee & Kim, 2017). Korean-style salads are a particularly visible expression of this process. Following the dispersal of Koryo-saram communities across the former Soviet Union, several such foods became widely commercialized and consumed outside the Korean community, demonstrating that Koryo-saram culinary practices have also contributed to broader regional food cultures (Song 2016; Lee & Kim 2017).

Uzbekistan became one of the principal centers of Koryo-saram settlement. Although the initial distribution of deported Koreans between Uzbekistan and Kazakhstan was relatively comparable, the 1959 census recorded approximately 138,500 Koreans in Uzbekistan, about twice the number recorded in Kazakhstan (Kim 2020). The conditions of Central Asia required Koryo-saram households to adapt inherited food practices to new sources of food plants, locally available vegetables, spices, and cooking methods. Consequently, culinary adaptation involved not only changes in recipes but also changes in the plant resources incorporated into everyday food practices.

Recent ethnobotanical research provides evidence that this process of adaptation remains relevant to the contemporary Koryo-saram community. Kim *et al.* (2024) documented 72 plant taxa used by Koryo-saram in the Tashkent region of Uzbekistan and found that food was the most prominent category of plant use. Their findings demonstrate the coexistence of inherited Korean food practices with the incorporation of Central Asian plant species into Koryo-saram cuisine. This evidence confirms that Koryo-saram food traditions should be understood not merely as a historical or sociocultural phenomenon but also as a dynamic ethnobotanical system in which plant knowledge is retained, modified, and transmitted across generations. Despite increasing interest in Koryo-saram food culture, previous studies have predominantly examined migration history, ethnic identity, cultural hybridity, and general food practices (Jung, 2015; Lee & Kim, 2017; Kim, 2017; Khan, 2021). Comparatively less attention has been given to the ethnobotanical dimension of specific Koryo-saram dishes, particularly the selection of plant ingredients and the ways in which these plants are processed and combined in traditional salads. This dimension is important because plant-based dishes provide an opportunity to trace adaptation at a more specific

level: the replacement or incorporation of plant resources, the persistence of traditional ingredients and preparation techniques, and the transformation of culinary knowledge under new environmental and cultural conditions.

In Central Asia, culinary practices became one of the most enduring forms of ethnic self-identification, as they were passed down within families from generation to generation. Korean cuisine adapted to local conditions. This was reflected in changes in the composition of ingredients, increased use of local vegetables and spices, as well as the incorporation of elements from Central Asian cuisine. As a result, a distinct Koryo-saram cuisine emerged, differing from contemporary Korean cuisine of the Korean Peninsula. Adapted dishes and various salads based on local vegetables and seasonings became widespread and emerged as recognizable cultural markers of Koreans in Central Asia (Song, 2016). Culinary traditions performed not only a practical function but also a symbolic one, maintaining a sense of community and historical continuity (Kim, 2017; Khan, 2021).

Therefore, the present study focuses on Koryo-saram salads as a specific ethnobotanical expression of culinary adaptation. Rather than treating these dishes simply as markers of ethnic identity, we examine them as repositories of plant-use knowledge transmitted and transformed within Koryo-saram communities. Particular attention is given to the plant ingredients used in salads, their culinary functions, methods of preparation, and processing. By focusing on plant use at the level of individual dishes, this study complements previous historical and sociocultural research and contributes a more detailed ethnobotanical perspective on Koryo-saram food systems.

Thus, this study examines the adaptation of traditional Korean cuisine through Koryo-saram salads, providing an ethnobotanical analysis at the level of individual dishes. It links specific plant resources and preparation practices with broader processes of migration, environmental adaptation, and cultural continuity. In doing so, the study extends previous research on Koryo-saram history, identity, and food culture by demonstrating how ethnobotanical knowledge is embedded in everyday culinary practices and transformed through migration and cultural interaction.

## Materials and Methods

**Study area**

The study was conducted in Uzbekistan, a landlocked country in Central Asia covering approximately 448,900 km² and bordering Kazakhstan, Kyrgyzstan, Tajikistan, Afghanistan, and Turkmenistan. Most of the northern and central parts of Uzbekistan are covered by deserts: the Kyzyl-Kum Desert, the Ustyurt Plateau, and the Aralkum Desert, which formed on the dried seabed of the former Aral Sea. Among these, the largest is the Kyzyl-Kum Desert, occupying approximately 300,000 km². The southern and southeastern regions are bordered by the Pamir-Alai and Tien Shan Mountain ranges. Elevation ranges from about 200 meters above sea level in desert areas to nearly 5,000 meters at mountain peaks.

The climate of Uzbekistan is sharply continental. Summer temperatures range from +35 to +45°C, while winter temperatures range from −5 to −10°C. The country is characterized by a high number of sunny days - approximately 250 per year - and low annual precipitation (100-200 mm).

According to its administrative-territorial division, Uzbekistan consists of 12 regions, the Republic of Karakalpakstan, and the city of Tashkent, which is the capita (Fig. 1). The most densely populated area is Tashkent and the surrounding Tashkent region (6,900 people per km²).

The study was conducted in areas with established Koryo-saram communities in Tashkent, Fergana, and Samarkand regions (Fig. 1). Tashkent and the surrounding Tashkent region represent an important center of Koryo-saram settlement and contemporary community activity. These locations were selected because they contain established Korean communities and provided access to respondents with knowledge of traditional Koryo-saram food preparation and culinary practices.

**Data collection**

Data were collected from April 2023 to September 2024 using a qualitative ethnobotanical approach based on individual semi-structured interviews with Koryo-saram respondents. Participants were recruited through Korean cultural associations located in the cities of Tashkent, Fergana, and Samarkand. Participation was voluntary and anonymous. Before data collection, the purpose and scope of the study were explained to each participant, and informed consent was obtained before the interview. No personally identifying information was collected.

A total of 252 respondents participated in the study, including 229 were women and 23 were men, with ages ranging from 50 to 85 years. Respondents were categorized into three age groups: 50-59 years, 60-69 years, and ≥70 years. Their demographic characteristics, including age, sex, and place of residence, were recorded. The demographic composition of the study population is presented in Table 1. The minimum age threshold of 50 years was used to focus the analysis on respondents who were more likely to possess long-term knowledge of Koryo-saram culinary traditions and to have learned recipes from older family members.

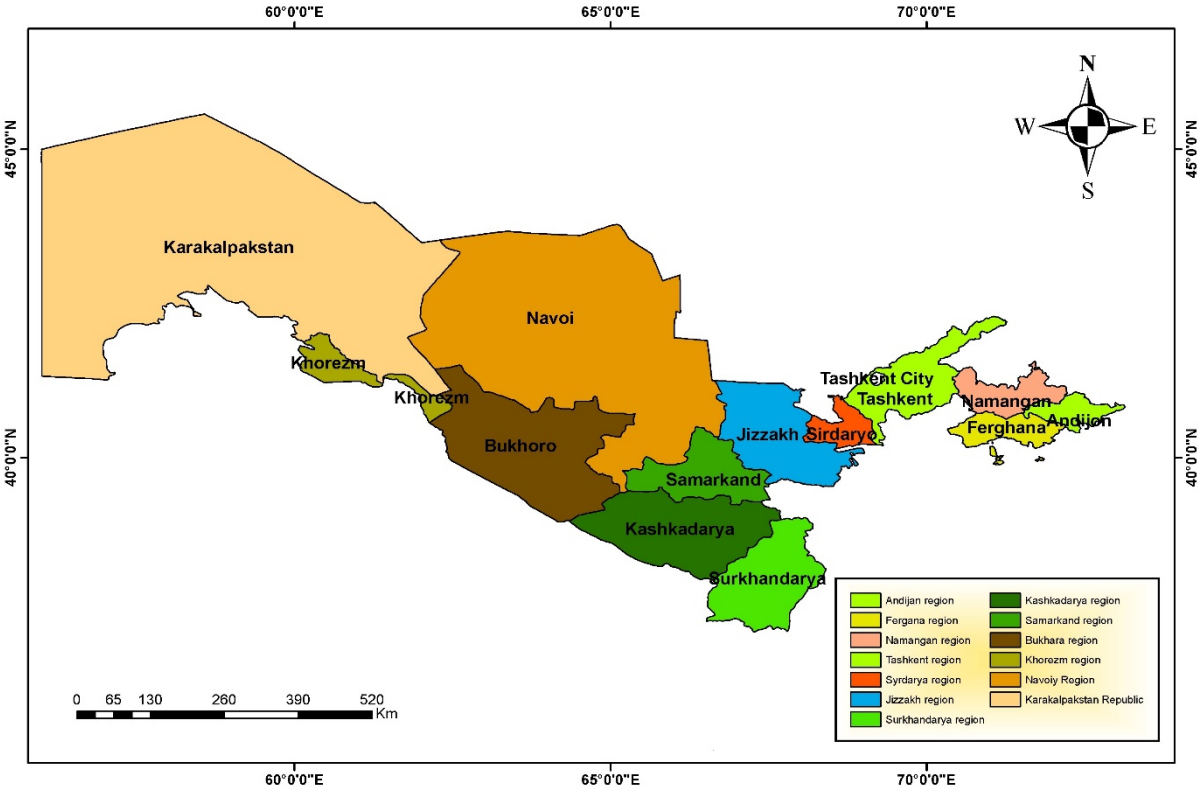



Figure 1. Uzbekistan consists of 12 regions and the Republic of Karakalpakstan. The capital of Uzbekistan is the city of Tashkent.

Table 1. Demographic composition of the respondents

| Variable | Category | Number of respondents, n | Number of respondents, % |
|---|---|---|---|
| Sex | Female | 229 | 90.9 |
| | Male | 23 | 9.1 |
| Age | 50-59 | 104 | 41.3 |
| | 60-69 | 96 | 38.1 |
| | ≥70 | 52 | 20.6 |
| Region | Tashkent | 136 | 54.0 |
| | Fergana | 51 | 20.2 |
| | Samarkand | 65 | 25.8 |

Each respondent was asked to provide information on a Koryo-saram salad that was known and prepared within their household or community. The interview covered the local name of the dish, plant ingredients, edible plant parts, preparation and processing methods, seasonings, and preservation methods. Where relevant, respondents were also asked whether the recipe had been inherited from parents or grandparents or learned from other community members.

Interviews were conducted individually and lasted approximately 30 minutes. Interviews were conducted in Korean and Russian, or combination of both languages, according to the respondent's preference. Information was documented directly by the researchers during the interview and subsequently entered into a dataset.

Plant identification was based on respondent identification. Vernacular plant names provided by respondents in Korean or Russian were recorded in their original form and subsequently standardized against botanical nomenclature (Plant of the World Online: https://powo.science.kew.org/).

The resulting dataset was analyzed descriptively to characterize the diversity of plant ingredients, their culinary functions, plant parts used, and preparation methods. Recipe variants were compared to identify recurrent patterns of plant use, as well as differences in ingredient composition and processing practices among respondents and study regions.

**Quantitative ethnobotanical analysis**

Quantitative ethnobotanical analysis was conducted to assess the frequency of plant ingredients used in traditional Koryo-saram salad recipes. A total of 252 respondents participated in the study, and each respondent provided one salad recipe; therefore, the dataset comprised 252 recipes (N = 252). The individual recipe was considered the primary unit of analysis. For each plant ingredient, the Frequency of Citation at the recipe level ($FC_{recipe}$) was calculated as the number of recorded recipes in which the ingredient was reported. The Relative Frequency of Citation at the recipe level ($RFC_{recipe}$) was calculated as the proportion of all documented recipes containing a particular plant ingredient, using the following formula:

$$RFC = FC/N \ (0 < RFC < 1)$$

where $FC_{recipe}$ is the number of recipes in which a particular plant ingredient was cited and N is the total number of recipes analyzed (N = 252). $RFC_{recipe}$ values range from 0 to 1, with higher values indicating a greater frequency of occurrence of a particular plant ingredient across the documented recipes.

The quantitative ethnobotanical analysis was restricted to plant-derived ingredients, including vegetables, legumes, and other edible plant materials. Ingredients of animal origin were excluded from the calculation of plant-related ethnobotanical indices. Fish was recorded separately as an animal-derived food ingredient and was included only in the general description of recipe composition.

The calculated $FC_{recipe}$ and $RFC_{recipe}$ values were used to identify the most frequently occurring plant ingredients and to characterize patterns of plant use in the traditional Koryo-saram salad recipe.

## Results

Traditional Korean cuisine is widely represented in many countries around the world. One of the key features of this cuisine is its health benefits for humans. The resettlement of Koreans to Central Asia primarily affected the adaptation of food preparation methods as an essential daily necessity. The wide variety of local Korean dishes in Uzbekistan can be conditionally divided into two groups. The first group includes dishes that, while following traditional Korean cuisine, have undergone only minor changes. Among them, the most popular is the Korean cabbage dish *kimchi*, recognized globally as a healthy food - locally known as *chimchi* (Patra *et al*., 2016; Cha *et al*., 2024; Song, 2016). Soy sauce, in both liquid form (locally called *tire*) and solid form (locally called *tyai*), is mainly prepared at home in Uzbekistan (Devanthi & Gkatzionis, 2019). Pressed soybean protein *tofu* (*dubu*), locally known as *tybi*, is also produced using artisanal methods (Guan *et al*., 2021; Shi & Liu, 2018). Blood sausage made from pork retains its Korean name *sundae* (Kim *et al*., 2021). Other examples include various soups with soy sauce and soybean protein, salad made from dried young fern stems (*kosari-cha*), and salad made from sprouted soybeans (*dirgumi-cha*), among others (Fig. 2).

Another group can include dishes that have been adapted in Uzbekistan. The lack of storage methods in a hot climate, as well as the absence of seafood and familiar ingredients, led to changes in traditional cooking methods and the emergence of new recipes. Notable changes are particularly evident in the preparation of salads. 252 recipes were included in the dataset. The recipes represented a range of vegetable- and fish-based preparations that are currently prepared within Koryo-saram households and community food settings in Uzbekistan.

The most frequently reported salad was the local version of kimchi (locally called *chimchi*). The next most frequently reported preparations were carrot salad (locally known as *morkov-cha*) and fish salad (locally known as *ryba-khe*), respectively. These were followed, in descending order of popularity, by eggplant salad (*kadi-cha*), potato salad (*kamdi-cha*), radish salad (*redka-cha*), *kosari-cha*, *dirgumi-cha*, and others (Fig. 3). The frequency distribution indicates that Koryo-saram salad traditions include both preparations that retain recognizable Korean culinary characteristics and dishes that incorporate plant resources commonly available in Uzbekistan.



a. b.

Figure 2. Salad made from dried young fern stems (local name: *kosari-cha*) (a), and salad made from sprouted soybeans (local name: *dirgumi-cha*) (b).

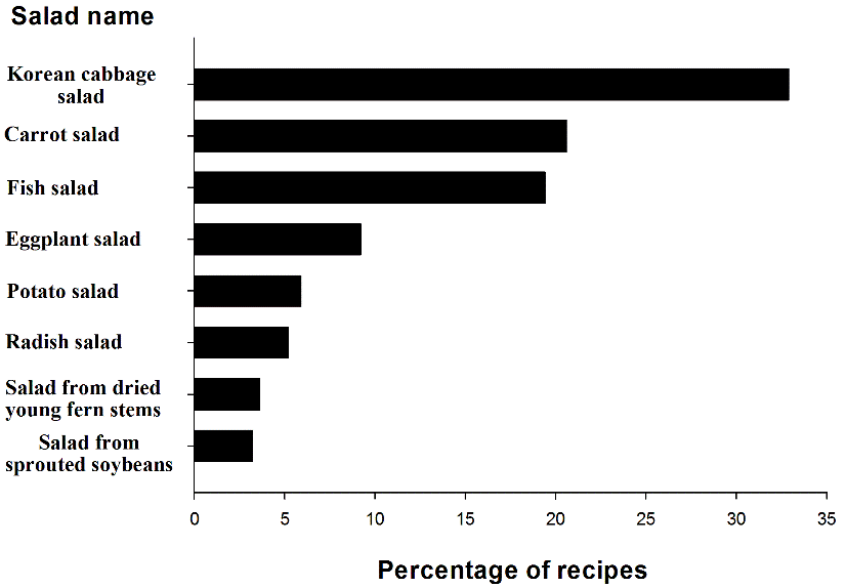



Figure 3. Percentage distribution of salad recipes. Korean cabbage salad is the local version of *kimchi*. Carrot salad is locally known as *morkov-cha*. Fish salad is locally known as *ryba-khe*. Eggplant salad is locally called *kadi-cha*. Potato salad is locally known as *kamdi-cha*. Radish salad is locally known as *redka-cha*. Salad made from dried young fern stems is locally known as *kosari-cha*. Salad made from sprouted soybeans is locally known as *dirgumi-cha.*

The analysis of preferences by respondents' age showed that the three most frequently reported salads were present across all age groups aged 50 and above. Eggplant salad (*kadi-cha*) is also represented across all age groups, but it is most popular among respondents aged 50-59. This recipe requires a relatively expensive and diverse set of ingredients, which may reflect improved living conditions and, consequently, greater access to the necessary products. Potato salad (kamdi-cha) and radish salad (redka-cha) were mentioned primarily by respondents over the age of 60. The three age groups were used as descriptive categories to examine whether the reported recipe of salad preparations differed between older and relatively younger members of the study population (Fig. 4).

**Plant and other biological resources used in salads**

Local Korean dishes are mostly prepared at home, in Korean cafés, or in small batches using artisanal methods. They can be tasted and purchased at Korean cafes or in the open market (Fig. 5). The documented recipes incorporated several plant species that are widely cultivated and commercially available in Uzbekistan. The principal vegetable ingredients included cabbage (*Brassica rapa* var. *pekinensis* (Lour.) Kitam.), carrot (*Daucus carota* L.), radish (*Raphanus sativus* L.), potato (*Solanum tuberosum* L.), and eggplant (*Solanum melongena* L.). Other preparations incorporated soybean sprouts, young fern stems, mushrooms, onions, garlic, coriander, hot pepper, and other herbs and seasonings.

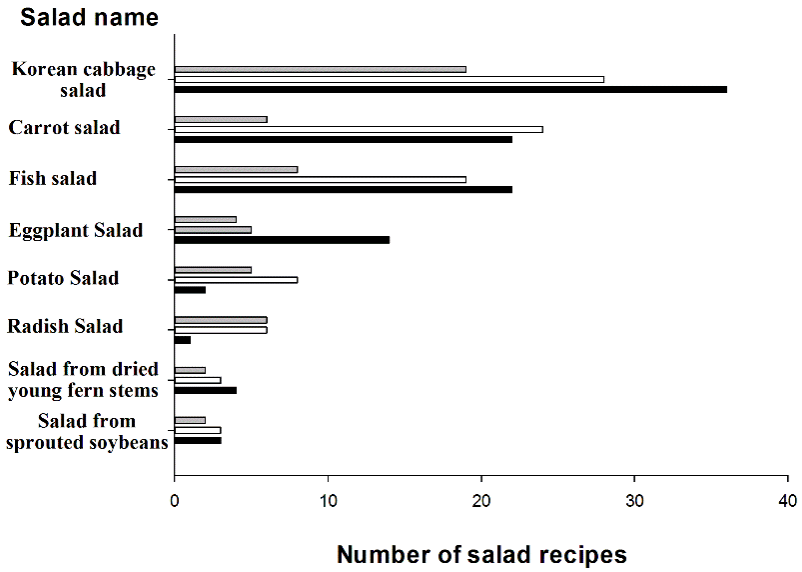



Figure 4. *Number of salad recipes reported by respondents in each age group.* Black represents the 50-59 age group, white represents the 60-69 age group, and gray represents 70 and above.



**a.**



**b.**

Figure 5. Local Korean salads at the market: a. Parkent open market, Tashkent city; b. Gospitalniy open market, Tashkent city.

Among the wide variety of local Korean salads, several (Tab. 2) can be highlighted as the most characteristic in reflecting their adaptation to local conditions, in terms of original ingredients, spices, and preparation methods. Comparing salad recipes allows us to generalize the ways they are prepared, which may vary slightly depending on the place of residence (urban or rural) and the region.

Table 2. Biological resources and characteristics of selected Koryo-saram salads in Uzbekistan

| Name of the dish | Main ingredient | Scientific name of the main ingredient | Local Koryo-saram salad name |
|---|---|---|---|
| Cabbage salad | Cabbage | *Brassica rapa* var. *pekinensis* (Lour.) Kitam. | Chimchi |
| Carrot Salad | Carrot | *Daucus carota* L. | Morkov-cha |
| Carrot Salad with Meat | Carrot | *Daucus carota* L. | Morkov-cha s myasom |
| Radish Salad | Radish | *Raphanus sativus* L. var. *lobo* | Redka-cha |
| Potato Salad | Potato | *Solanum tuberosum* L. | Kamdi-cha |
| Potato Salad with Meat | Potato | *Solanum tuberosum* L. | Kamdi-cha s myasom |
| Eggplant Salad | Eggplant | *Solanum melongena* L. | Kadi-cha |
| Eggplant Salad with Meat | Eggplant | *Solanum melongena* L. | Kadi-cha s myasom |
| Fish Salad | Carp | *Cyprinus carpio* | Ryba-khe |
| Fish Salad | Pike-perch | *Sander lucioperca* | Ryba-khe |
| Beef Fillet Salad | Beef | *Bos taurus* | Khe iz myasa |
| Chicken Breast Salad | Chicken | *Gallus gallus domesticus* | Kurica-khe |
| Chicken Thigh Salad | Chicken | *Gallus gallus domesticus* | Kurica-khe |
| Chicken Stomach Salad | Chicken | *Gallus gallus domesticus* | Khe iz kurinih jeludkov |
| Tripe Salad | Pork | Sus scrofa domesticus | Khe iz trebukhi |
| Mushroom Salad | Honey Fungus | *Armillaria mellea* (Vahl) P. Kumm. | Khe iz gribov |
| Mushroom Salad | Oyster Mushrooms | *Pleurotus ostreatus* (Jacq.) P. Kumm. | Khe iz gribov |
| Eggplant Salad | Eggplant | *Solanum melongena* L. | Kadi-khe |

**Characteristic salad preparations**

***Carrot Salad (local name "Morkov-cha")***

The name of one of the most popular salads comes from a combination of the Russian word *"morkov"* (carrot) and the Korean word *"cha",* which denotes a salad. It is pronounced *"morkov-cha".* This dish is prepared from red carrots, which are widely cultivated in Uzbekistan and are one of the key ingredients of Uzbek cuisine. However, carrots are not typically used as a main ingredient in traditional Korean salads. In Uzbekistan, red carrots represent a traditional variety, often referred to as "*Mirzoi Krasnaya"* or "*Laal Gajar"* (an Indian/Asian variety), belonging to the species *Daucus carota* L. They are distinguished by their rich coral-red color, sweetness, high lycopene content, and the presence of various organic acids, minerals, and biologically active compounds (Yusuf *et al*., 2021; Ergun & Susluoglu, 2018). This carrot variety is especially popular for preparing traditional Uzbek dishes such as *plov*, *dimlama*, *shurpa*, and others (Khojimatov *et al*., 2015).

**Preparation method:** The carrots are finely grated, salted, and left for some time to release their juice, after which they are squeezed. Then they are seasoned with spices, garlic, sugar, herbs, and fried onions cooked in oil with hot pepper, and vinegar is added. A variation of this salad includes adding thinly sliced pieces of meat marinated in vinegar. In this version, the dish is called *"morkov-cha with meat"* (Fig. 6).



**a.** **b.**

Figure 6. Salad made from red carrots (local name: morkov-cha) (a) and carrot salad with meat (local name: morkov-cha s myasom) (b).

***Radish Salad (local name "Redka-cha")***

The name of this salad derives from a combination of the Russian word "*redka*" (radish) and the Korean word "*cha"*, which means "salad" (Fig. 7). It is pronounced "*redka-cha*". In Uzbekistan, the green Margilan radish is widely cultivated and popular, and has become the main ingredient of this salad. Margilan radish (*Raphanus sativus* L.) belongs to the variety *Raphanus sativus* var. *lobo* and is not grown in Korea. It has juicy, crisp roots with a mildly pungent or slightly sweet taste. This vegetable consists of about 80% water and is low in calories. It contains various nutrients such as potassium, calcium, iron, carotene, phosphorus, sulfur, and vitamins $B_1$ and $B_2$. It also has beneficial effects on the endocrine and nervous systems, helps improve stress resistance, and may reduce inflammation (Gamba *et al*., 2021). In traditional Uzbek salads, Margilan radish is an essential ingredient.

**Preparation method:** The radish is grated into thin strips and salted. It is then left for some time to release its juice, which is subsequently drained. The prepared mixture is seasoned with minced garlic, spices, sugar, and vinegar. Finally, onions with hot pepper are fried in vegetable oil and poured hot over the seasoned mixture.



Figure 7. Salad made from Margilan radish (local name: redka-cha).

***Potato Salad (local name "Kamdi-cha")***

The name of this salad comes from two Korean words: *"kamdi,"* meaning potato, and *"cha,"* meaning salad. It is pronounced *"kamdi-cha" (Fig. 8).* The main ingredient of this salad is potatoes, which are commonly used in many Uzbek dishes but are less typical in traditional Korean cuisine. In Uzbekistan, primarily early and mid-early varieties of potato (*Solanum tuberosum*) are grown, adapted to the hot climate and with high starch content (up to 18-20% in dry matter). Key characteristics of these varieties include high yields (up to 200 centners per hectare), large planting areas, light yellow flesh, and rapid growth (Ahatkulov, 2025; Gafforov *et al*., 2024).

**Preparation method:** The potatoes are finely grated and rinsed in several portions of water to remove excess starch. They are then briefly boiled in water for 1-1.5 minutes so that they become soft but remain slightly crisp. After boiling, the potatoes are rapidly cooled under running water. The mixture is then seasoned with spices, garlic, and herbs, and topped with hot oil infused with red hot pepper; vinegar is also added. This salad can also be made with fried meat. In this version, it is called "Kamdi-cha s myasom".



Figure 8. Potato salad (local name: kamdi-cha).

***Eggplant Salad (local name "Kadi-cha")***

The name of this salad consists of two Korean words: *"kadi",* which refers to the main vegetable in the salad - eggplant, and *"cha",* meaning salad (Fig. 9). It is pronounced *"kadi-cha".* Eggplant (*Solanum melongena L.*), known in Uzbekistan as *"baqlajon",* is a valuable vegetable crop rich in fiber, potassium, and vitamins C and $B_6$. It grows well in the local climate, has a high content of anthocyanins (nasunin), benefits heart health, helps regulate cholesterol levels, and is used in traditional medicine for general wellness. Local varieties are characterized by high yields (25-40 t/ha) and a preference for hot climates. They have dark purple skin and firm, non-bitter flesh, making them ideal for traditional Uzbek dishes (Gürbüz *et al*., 2018; Meyer *et al*., 2012). In Korea, this vegetable is not commonly used in traditional Korean cuisine.

**Preparation method:** The eggplants are cut into wide strips, salted, and left for some time to release their juice. The mixture is then rinsed in portions of cold water and squeezed to remove excess liquid and bitterness. The prepared eggplant is then fried and stewed in a mixture of vegetable oil, onions, tomatoes, bell peppers, and hot peppers. In another variation, if meat is added during frying, the dish is called "Kadi-cha s myasom".



Figure 9. Eggplant salad (local name: kadi-cha).

***Fish Salad (local name "Ryba-khe")***

The name of this salad is pronounced *"Ryba-khe"* and is one of the most popular dishes of Koryo-saram cuisine, which has also gained wide recognition beyond Uzbekistan. The term *"khe"* comes from the Korean Peninsula and translates as "raw". Traditionally, this name refers to a dish made from raw sea fish, which was adapted in Uzbekistan. In the conditions of Central Asia, this dish began to be prepared using river or lake fish.

The dish is primarily made from carp (*Cyprinus carpio*), a large freshwater fish with golden scales found in rivers and lakes. Pike-perch (*Sander lucioperca*), a predatory fish from the perch family, is also popular; it inhabits reservoirs and river plains and feeds on smaller fish. Both species are widely distributed in Uzbekistan's water bodies (Umurzokov, 2025; Izzatullaev *et al*., 2024).

**Preparation method:** The fillet of the fish is cut into slices and marinated in vinegar essence. Once the fish is marinated, large-ringed onions, garlic, herbs, hot pepper oil, soybean paste, and spices are added.

It should be noted that in Uzbekistan, similar techniques have been used to prepare dishes from beef fillet, chicken, chicken and pork offal, mushrooms, and certain vegetables. When using mushrooms or vegetables, they undergo initial heat treatment. The name of the dish depends on the main ingredient: for example, *khe* from beef, *khe* from chicken, or *khe* from mushrooms (Fig. 10).

The diversification of *khe* preparations demonstrates that an inherited culinary concept can be maintained while the biological resource used as its principal ingredient changes according to local availability.

**Preparation patterns**

Comparison of the documented recipes identified several recurrent preparation techniques. These included:

- fine slicing, grating, or shredding of the principal ingredient;
- salting and removal of excess moisture;
- acidic marination;

- addition of garlic, hot pepper, and aromatic herbs;
- preparation of hot pepper-infused vegetable oil;
- brief heat treatment followed by rapid cooling;
- combination of vegetable ingredients with meat or fish.

The repeated use of these techniques across different recipes suggests that adaptation occurred not only through changes in ingredients but also through the development of a recognizable Koryo-saram culinary processing system.



**a.** **b.** **c.**

Figure 10**.** Salads collectively known as "khe": a. Fish salad (local name: *ryba-khe*); b. Beef fillet salad (local name: *khe iz myasa*); c. Mushroom salad (local name: *khe iz gribov*).

**Frequency of citation of plant ingredients**

A total of 252 local Koryo-saram salad recipes were documented and analyzed. The frequency of plant ingredients varied substantially among the recorded recipes (Table 3). Cabbage was the most frequently reported plant ingredient, occurring in 83 recipes ($RFC_{recipe}$ = 0.33). Carrot was the second most frequently cited ingredient, occurring in 52 recipes ($RFC_{recipe}$ = 0.21), followed by eggplant, which was reported in 23 recipes ($RFC_{recipe}$ = 0.09).

Potato and radish were reported in 15 ($RFC_{recipe}$ = 0.06) and 13 recipes ($RFC_{recipe}$ = 0.05), respectively. Fern was recorded in 9 recipes ($RFC_{recipe}$ = 0.04), whereas soybean was cited in 8 recipes ($RFC_{recipe}$ = 0.03). The relatively high $RFC_{recipe}$ values for cabbage and carrot indicate that these ingredients were particularly prominent in the documented Koryo-saram salad recipe.

Overall, the results demonstrate that a limited number of plant ingredients accounted for a substantial proportion of the recorded plant use. Cabbage and carrot together occurred in 135 recipes, corresponding to 53.6% of all documented recipes. However, these frequencies should not be interpreted as mutually exclusive categories because individual recipes could contain more than one plant ingredient (Table 3).

Table 3. Frequency of citation of plant ingredients in local Koryo-saram salad recipes

| Plant ingredient | Scientific name | Plant part used | Local Koryo-saram salad name | $FC_{recipe}$ | $RFC_{recipe}$ |
|---|---|---|---|---|---|
| Cabbage | *Brassica rapa* var. *pekinensis* (Lour.) Kitam. | Leaves | Chimchi | 83 | 0.33 |
| Carrot | *Daucus carota* L. | Root | Morkov-cha | 52 | 0.21 |
| Eggplant | *Solanum melongena* L. | Fruit | Kadi-cha | 23 | 0.09 |
| Potato | *Solanum tuberosum* L. | Tuber | Kamdi-cha | 15 | 0.06 |
| Radish | *Raphanus raphanistrum* subsp. *sativus* (L.) Schmalh. | Root | Redka-cha | 13 | 0.05 |
| Fern | *Pteridium aquilinum* (L.) Kuhn | Stem | Kosari | 9 | 0.04 |
| Soybean | *Glycine max* (L.) Merr. | Seed | Dirgumi | 8 | 0.03 |

**Animal-derived ingredients**

Fish was reported in 49 recipes (19.4% of all recipes). As an animal-derived ingredient, fish was excluded from the calculation of plant-based ethnobotanical indices but is relevant to the overall characterization of Koryo-saram salad composition (Table 4).

Table 4. Animal-derived food ingredients reported in local Koryo-saram salad recipes

| Animal-derived ingredient | Local Koryo-saram salad name | Number of recipes | *Frequency (%) |
|---|---|---|---|
| Fish | Ryba-khe | 49 | 19.4 |

**Frequency (%) was calculated as the number of recipes containing the ingredient divided by the total number of recorded recipes (N = 252) × 100.*

## Discussion

**Koryo-saram cuisine as an ethnobotanical system**

The results demonstrate that Koryo-saram salad traditions are neither a simple preservation of pre-migration Korean cuisine nor an unmodified adoption of Uzbek food practices. Rather, they represent a dynamic ethnobotanical system produced through the interaction of inherited Korean culinary knowledge with the biological resources, agricultural systems, markets, and food practices of Central Asia.

This interpretation is consistent with the recent ethnobotanical study of Koryoin communities in Uzbekistan by Kim *et al.* (2024), which documented 72 plant taxa, 51 of which were used as food. That study similarly identified the coexistence of Korean practices with the incorporation of Central Asian plants and food resources.

The present study complements this broader ethnobotanical inventory by examining plant use at the level of individual salad preparations. The results show not only which plants are used but also how their incorporation is associated with particular processing techniques, flavor combinations, and recipe variants.

**Retention, substitution, and culinary adaptation**

The observed culinary changes can be organized into three interconnected processes: retention, substitution and incorporation, and adaptation.

First, some culinary practices have remained recognizable after migration. Examples include kimchi-type preparations, soybean-based foods, salads based on young fern stems and soybean sprouts, and the use of garlic, hot pepper, acidic seasonings, and fermentation- or preservation-related techniques. These elements represent continuity with Korean food traditions.

Second, locally available plant resources became incorporated into established culinary formats. Carrot, radish, potato, and eggplant are particularly illustrative examples. Their importance does not necessarily mean that they simply “replaced” Korean plants. In many cases, the evidence supports a more cautious interpretation: locally accessible crops were incorporated into an existing Koryo-saram culinary framework and became associated with new dishes and recipe variants.

Third, new combinations emerged through interaction among Korean, Uzbek, Russian, and broader Central Asian food practices. Linguistic evidence is particularly visible in names such as *morkov-cha* and *redka-cha*, in which a Russian vegetable name is combined with the Koryo-saram culinary element *cha*. Such names demonstrate that culinary adaptation occurred simultaneously at the levels of ingredients, preparation, and language.

**Carrot, radish, potato, and eggplant in Koryo-saram salad recipes**

The incorporation of carrot, radish, potato, and eggplant should be understood in relation to the agricultural and food environment of Uzbekistan rather than solely as a matter of culinary preference. These crops were readily cultivated, traded, stored, and obtained through local markets, making them practical resources for migrant households adapting their food practices to a new environment.

The importance of these crops therefore reflects an interaction among ecological availability, agricultural production, market access, and cultural knowledge. Migrant communities do not adapt their food systems only by changing recipes; they also adapt to plants that can be cultivated, purchased, preserved, and incorporated into everyday meals.

The Koryo-saram case is consistent with broader ethnobotanical observations that migration may result in the preservation of culturally salient food practices while simultaneously encouraging the incorporation of locally available resources and new processing strategies. Research on migrant ethnobotanies has similarly demonstrated that cultural continuity can coexist with creative combinations of inherited knowledge and resources available in a new environment.

For this reason, the documented vegetables should be interpreted as indicators of plant translocation and culinary adaptation rather than merely as replacements for traditional Korean ingredients.

**Preservation of food knowledge and adaptation to local conditions**

A comparison of salad recipes based on local ingredients revealed characteristic features in their preparation methods. First, the main ingredients undergo preliminary processing, including the removal of excess moisture. Second, the hot climate, the large number of sunny days, and limited access to cold storage for prepared dishes may have contributed to the widespread use of acidic ingredients as food-preservation agents. One of the most readily available products used for this purpose is vinegar essence, which contains approximately 70-80% acetic acid. According to the dataset of collected recipes, the use of table vinegar with an acetic acid concentration of 4-9% does not produce the desired effect on the taste and texture of the salads.

Vinegar essence acts as a highly concentrated source of acetic acid and may inhibit the growth of certain microorganisms under appropriate conditions (Lacorn & Hektor, 2025). When added to vegetables, an acidic environment can inhibit the growth of microorganisms and molds. It may also influence vegetable texture and contribute to extending shelf life. When applied to fish, acidic marinades can reduce microbial growth and alter the structure of fish proteins through denaturation, resulting in changes in texture and appearance (Goli *et al*., 2012; Park *et al*., 2021).

Our data indicate a non-conventional use of concentrated acetic acid in food preparation. However, the salads described in this study have reportedly been consumed for more than 80 years and show a trend toward broader dissemination (Song, 2016). In recent decades, numerous variations of local Korean-style salads have emerged in Uzbekistan, incorporating both commonly used ingredients and ingredients atypical of the region, which were not examined in the present study. Nevertheless, the underlying principle of processing ingredients with vinegar essence has remained essentially unchanged.

Another commonly used ingredient is hot red pepper. In Uzbekistan, it is represented by both locally bred varieties of *Capsicum annuum* (e.g., Eastern Pearl) and traditional varieties such as Fergana. These peppers are adapted to the local climate and are used throughout the year (Liu et al., 2025). They may be used fresh, pickled, or dried. In Uzbek cuisine, hot peppers are used fresh, for pickling and preservation, and as a spice in vinegar-based preparations.

Hot red peppers grown in Uzbekistan may contain approximately 0.2-0.3% capsaicin, a natural alkaloid responsible for pungency (Gudeva *et al*., 2013). Capsaicin has demonstrated antimicrobial activity under certain experimental conditions (Periferakis *et al*., 2023; Fuchtbauer *et al*., 2021), suggesting that its presence may contribute to the preservation properties of pepper-containing preparations. However, its antimicrobial effect in actual food systems depends on concentration, food composition, processing conditions, and other factors.

Traditionally, hot pepper is also used as a pepper extract in vegetable oil. The ratio of pepper to oil in Uzbek cuisine is higher than that used in the local Korean-style salad recipes documented in this study. Because capsaicin is highly soluble in fats, it can be extracted into oil. The resulting pepper-infused oil is used both cold and hot, depending on the salad recipe. When added to vegetables or raw fish, it enhances flavor and pungency and may contribute to the preservation of the product.

Another common ingredient category in the recipes is collectively referred to as “herbs.” This category includes varying proportions of green onions, green garlic, and fresh coriander leaves, which are used much more frequently than parsley (*Petroselinum crispum* L.) or celery (*Apium graveolens* L.). Coriander (*Coriandrum sativum* L.) is an annual herb in the *Apiaceae* family. Two main plant parts are used: *kinza*, referring to the fresh leaves, and the dried seeds, commonly known as coriander seeds. *Kinza* has a strong, distinctive aroma, often described as citrus-like, while the seeds are widely used whole or ground as a spice in both Korean and Uzbek cuisines (Mahleyuddin *et al*., 2022).

In traditional Uzbek cuisine, the use of *kinza* is more extensive than in traditional Korean cuisine. In the present study, coriander was widely used as a culinary herb and was valued by respondents primarily for its characteristic aroma and contribution to flavor.

One of the most consistent characteristics of the documented salads is the repeated sequence of moisture removal, acidic seasoning, addition of garlic and hot pepper, and treatment with oil. These practices may have practical implications for food preservation.

The persistence of these techniques is nevertheless ethnobotanically significant because it demonstrates how food-processing knowledge can be retained and transformed following migration. The importance of a technique may lie not only in its technological function but also in its sensory characteristics and its incorporation into community culinary identity.

**Food, cultural resilience, and diaspora identity**

The findings support the interpretation of Koryo-saram cuisine as a mechanism of cultural resilience. Food provides a relatively accessible means through which displaced communities can maintain collective identity while adapting to new surroundings. Unlike historical narratives or formal cultural institutions, everyday recipes can be reproduced within households and transmitted through repeated practice.

Recent ethnobotanical evidence from Uzbekistan similarly indicates that Koryo-saram knowledge combines retained Korean practices with the incorporation of Central Asian plant resources. Kim *et al.* (2024) described this combination as a characteristic feature of Koryo-saram ethnobotanical knowledge. The present results extend this interpretation by showing how such cultural resilience operates through specific dishes.

Cultural continuity in this context does not depend on maintaining an unchanged culinary repertoire. Rather, cultural identity is maintained through the continued use of particular preparation principles, flavor combinations, terminology, and modes of recipe transmission, even when the biological resources used in the recipes change.

This distinction is important for understanding migrant ethnobotany. Cultural continuity should not be equated with botanical stability. A culinary tradition may remain culturally recognizable while its plant components change in response to local availability. In this sense, Koryo-saram cuisine demonstrates how human-plant relationships can be reorganized without losing their cultural significance.

## Conclusion

The study demonstrates that Koryo-saram salad traditions in Uzbekistan represent a dynamic form of ethnobotanical adaptation in which inherited Korean culinary knowledge has been maintained while new plant resources, ingredients, and processing practices have been incorporated.

The most important pattern is not the simple replacement of Korean plants by Central Asian plants, but the reorganization of culinary knowledge around locally available biological resources. Carrot, radish, potato, and eggplant illustrate how agricultural availability and market access can become integrated into established culinary practices, producing new dishes while preserving recognizable Koryo-saram preparation principles.

One distinctive feature is the use of vinegar essence, an ingredient that is not typical of traditional Korean cuisine. Its incorporation appears to reflect adaptation to local food-processing practices and environmental conditions. Uzbek culinary traditions have also contributed cooking methods and flavor combinations that have been incorporated into Koryo-saram cuisine. This interaction has resulted in mutual enrichment of Uzbek and Koryo-saram culinary traditions.

The culinary traditions of Koryo-saram and the corresponding diversity of local Korean-style salads have spread far beyond Uzbekistan and have become part of the multinational culinary culture of Central Asia. They have also spread to other countries where Koryo-saram communities reside. In the CIS countries, alongside traditional Korean cuisine, Korean-style salads are often specifically associated with those that originated in Uzbekistan. This phenomenon demonstrates how culinary traditions can travel across cultural boundaries and become integrated into new food environments while retaining recognizable characteristics.

The results also demonstrate that cultural continuity does not require botanical continuity. Koryo-saram food identity has been maintained through the transmission of preparation techniques, flavor combinations, terminology, and recipe knowledge, even as the ingredients themselves have changed. This provides an example of how migrant communities negotiate continuity and adaptation through everyday interactions with local biological resources.

The study contributes to the ethnobotany of migrant communities by linking plant use with culinary practice, environmental adaptation, and cultural resilience. The documented recipes provide a basis for future comparative research involving younger generations, different Koryo-saram communities, and quantitative analyses of plant-use frequency and intergenerational transmission of knowledge.

## Declarations

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