Traditional food preparation of wild edible vegetables among the ethnic groups of Mizoram, North East India

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Abstract
Exploration of ethnic traditional food recipes has an immense contribution to the preservation and sustainability of traditional food habits and culture. The main objective of this study was to explore and document traditional food recipes prepared from wild edible vegetables among two ethnic groups of Mizoram, Northeast India. The method employed for this study was mainly based on a household survey; randomly selected 35 households in Aizawl district representing the major ethnic groups, namely Hmar and Paihte. Information was collected on different types of wild edible vegetables ethnic food, as prepared and consumed by the local people. Twenty-four types of traditional food recipes were documented according to their seasonal availability, and the affinities of choices in food consumption are comparable among the two ethnic groups. It was also reported that wild edible vegetables play a significant role in safeguarding food security and improve nutrition in diets. The present work documents the wild edible vegetables used traditionally by two ethnic groups of Mizoram for various recipes and highlights the necessity of conserving such traditional knowledge besides throwing light on their economic potential. The study suggests that future investigation be carried out to evaluate the nutritional and bioactive properties of wild edible vegetables.

Keywords: Wild edible vegetables, Traditional food recipes, Ethnic communities, Aizawl district, Mizoram

Introduction
Knowledge of traditional foods from the wild and their preparations have been transferred verbally among the indigenous people [1]. Wild edible vegetables (WEVs) define plant resources that are harvested directly from the wild for the benefit of human consumption [2, 3]. Wild edible plants provide food not only in times of food shortages but also in normal times. These wild foods add unique tastes, providing important essential biochem-icals, which help in maintaining the proper functioning of the human body [4, 5]. Globally, around one billion people use WEVs daily as a source of food [6]. Since WEVs are easily available and freely accessible from their natural habitats, many ethnic people gain knowledge on how to gather WEVs and their preparation [7]. Wild edible resources are generally collected on a seasonal basis and are often stored after processing either by cooking, drying, or fermenting. The North Eastern Region of the Indian subcontinent has an enormous reserve of traditional fermented foods owing to its rich ethnic diversity and also due to the availability of surplus bioresources in the region. There are 94.7% of the tribal people living in Mizoram state and traditional knowledge provides them food, a health care system, and shelter [8]. There are seven major tribes of Mizo living within Mizoram such as Hmar, Paihte, Pawi, Ralte, Lai, Mara, and Lusei [9]. Among these, three major tribal groups such as Paihte, Hmar, and Lusei reside within the Aizawl district.
having more or less similar methods of traditional food preparations.

Rice is the staple food of tribal groups of Mizoram and is taken along with vegetables, salads, and meats. Shifting cultivation is the main method of traditional agriculture in Mizoram which is still practised in highland till date, supporting the livelihood of the state by providing conventional food [10]. However, conventional crops do not meet the requirements of the people; traditional recipes from WEVs are still trending among local people during the available season. Vegetables are seldom imported from other districts where forest-based WEVs are the main source of vegetables, especially among Hmar and Paihte tribes. Traditional Mizo foods are mainly prepared in boiled, smoked, and fermented form, and spices are rarely used as compared to other Indian cuisines [8]. The typical Mizo popular dishes include bai (mixed vegetables combined with fermented pork fat) and tlak/mung (simply boiled form). The use of cooking oil in food preparations was never known to the general ethnic group in the past. However, with the introduction of Christianity by the British missionary in the 1890s to the people of Mizoram, the mode of food preparation has been improved tremendously [11]. A wide range of food habits found worldwide differs from different ethnic groups, and a unique traditional food processing technique practiced by the ethnic communities of Mizoram has been discussed [11]. Production of fermented food and beverages is highly popular, has been traditionally inherited, and also constitutes an essential component of the daily diet of the Mizo people [12]. The traditional food processing and preparations were previously reported by several authors globally [13–15] and also were found from northeast India such as Manipur [5, 16, 17], Tripura, [18], Sikkim [19, 20]. However, the cuisine exploration for the selected traditional WEVs has never been reported so far and is presented here in the first-ever report which will be useful for future references.

**Methodology**

**Study area and sites**

Mizoram is the fifth smallest state in India having an area of 21,087 km², the Tropic of Cancer runs through the state closely at its middle. It is a mountainous region with heavy rainfall of ~ 2500 mm annually. Mizoram is richly endowed by nature with great diversity of WEVs, timber yielding plants and medicinal plants. Moreover, Mizoram has an abundant natural bamboo resource and approximately 57% of the geographical area of the state is under bamboo cover. In terms of the percentage of forest cover of the total geographical area, Mizoram has the highest forest cover in India (85.41%). Within Mizoram, the present study was confined to Aizawl district, Northeast India (Fig. 1). It has geo-coordinates of 24°25’16.04″ to 23°18’17.78″ N latitudes and 92°37’03.27″ to 93°11’45.69″ E longitudes with an elevation of 1132 m above sea level (3714 ft) [21]. The total geographical area of the district is 3576.31 km² and accounts for 16.96% of the total geographical area of the state. Topographically, the district comprises agricultural plains, hilly terrains, and rich biotopes [22]. It received a direct influence of both the northeast and southwest monsoon with humid and moderate tropical climatic conditions. It primarily has four seasons: Winter (December-February) with temperature ranging between 10 and 22 °C, Summer (March–May) with temperature between 19 and 30 °C, Monsoon (June–August) with an average temperature of 20–30 °C, and Autumn (September–November) with temperature between 18 and 30 °C. According to India State of Forest report 2015, Aizawl district has an area of 28 km² (0.78%) very dense forest, 1135 km² (31.745) of moderately dense forest and an area of 2022 km² (56.55%) of open forest. According to the genetic system or major soil group classification, soils of Aizawl district fall under red and lateritic soils.

**Ethnic groups**

The ethnic diversity of the Aizawl district was found interesting as evidenced by three different tribal groups. Of these, two groups were selected to document their traditional recipes, based on the degree of traditionalism of the people and local dependency on forest and natural resources. Moreover, they were the dominant group and lived in a distinct village, namely Phuaibuang which is about 170 km away and N.E Tlangnuam which is 187 km away from Aizawl of the Aizawl district (Fig. 2). The major ethnic tribe of N.E Tlangnuam village is ‘Paihte.’ According to the 2011 census of Mizoram, it has a population of 658 with 318 males and 340 females resided in 97 households. In Phuaibuang village, the major ethnic tribe is ‘Hmar.’ It has a population of 2134 (1087 male and 1047 female) with 398 households, having a distinct language of their own.

**Exploration of traditional food recipe**

Field survey was conducted once a month during January to December, 2018, because the seasonal availability of WEVs used in the recipes differs as mentioned in Table 1. The method used for this study was a random household survey [23] following insight observation among the two tribal groups from the two villages of the Aizawl district. A total of 35 households (14 from Paihte and 21 from Hmar communities) were visited during the field survey. In this study, the data were obtained with the help of volunteers from the respective villages. The method of preparation of WEVs as the cuisine was documented through
Fig. 1 Geographical location of Phuaibuang and NE Tlangnuam village, Aizawl district, Mizoram, North East India [Prepared by Mizoram Remote Sensing Application Centre (MIRSAC)]
interviews. Since the two ethnic groups speak a distinct language, the names of the local dishes, and methods of preparation were recorded in their language and translated into ‘Mizo’ with the help of a language translator. The responses documented in Mizo language by the volunteers were translated in English by the authors. The entire documented recipes were photographed, and the description is given in English.

Results
During the field survey, twenty-four (24) types of traditional food recipes consumed by two ethnic groups of Aizawl district, Mizoram were documented according to their seasonal availability. A diverse group of WEVs that comprises of 19 families were documented. The life-form depicted that tree were dominating (11 species) followed by herbs (6 species), two species each of shrub, bamboo, climber, and one species of palm. The leaves and shoots were the most frequently used parts of the plant for the preparation of various traditional recipes. WEVs were readily available for consumption throughout the year and the majority of them were harvested by the local people mostly during the rainy season (April to September). Out of 24 species of WEVs documented, 16 species were of ethno medicinally importance (Table 1). The results further showed that the affinities of choices in food consumption were more or less similar among the two ethnic groups. Some of the recipes had a complex method of preparation with several traditional seasonings added to them. It is important to note that several of these cuisines have been commercialized in local restaurants and hotels. The serving size of the traditional recipes documented in this study was calculated for five individuals and prepared accordingly.

(1) Antumbu Mung

*Mung* is the simplest way of cuisine preparation among Hmar and Paihte communities (Fig. 3A). *Antumbu* (*Brassaiopsis hainla*) is the main ingredient for this recipe. It is the most prominent dish among Hmar and Paihte in the study area. The mode of preparation is simple, about 500 g of young shoots and leaves were simply boiled for 15–30 min; the water is then discarded and the dish is ready to be served. For a better taste, dried chilies and salt are normally added.

(2) Chartang

*Chartang* is a traditional dry meat-based recipe of Hmar tribe and is the most popular and delicious food. Approximately 1 kg of dry meat is first cooked for 10–15 min in a pressure cooker, after this, an appropriate amount (~100 g) of fresh leaves or dry leaves of *Sihzo* (*Eurya acuminata*) is added along with salt and two teaspoons of *chingal* (ash filtrate/lye) followed by the addition of a few drops of *saum/ sathu* (fermented pork fat). All the contents are mixed thoroughly, and it is ready to be served. *Eurya acuminata* is the main ingredient in this recipe and is also highly preferred for making another recipe (Fig. 3B).

(3) Theibal chhum

This recipe can be prepared only when fish is available. To prepare, 500 g of the dry or fresh fish is boiled with the tender leaves of *Ficus auriculata* (~500 g) and an appropriate amount of salt is added to it (Fig. 3C). For better taste, crushed onion, garlic, ginger, and wild coriander are also added as per one's wish.
**Table 1** Lists of wild edible vegetables used for the preparation of traditional recipe

| SL/No | Plant name | Family       | Local name | Common name | Habit | Edible parts          | Seasonal availability | Ethnomedicinal value                        |
|-------|------------|--------------|------------|-------------|-------|-----------------------|-----------------------|---------------------------------------------|
| 1     | *Brassaiopsis hainla* (Buch.-Ham.) Seem | Araliaceae   | Antumbu    | Chuletro     | Tree  | Leaves and shoot      | Apr–Sep               | –                                           |
| 2     | *Eurya acuminata* DC          | Pentaphylacaceae | Siho       | Tapering Leaf Eurya | Tree  | Leaves                | Whole Year            | –                                           |
| 3     | *Ficus auriculata* Lour       | Moraceae     | Theibal    | Elephant year fig tree | Tree  | Leaves                | Whole Year            | Sleep inducer                             |
| 4     | *Fagopyrum tataricum* (L.) Gaertn | Polygonaceae | Anbawng    | Buckwheat    | Herb  | Leaves                | Mar–Sep               | Gynecological problem                     |
| 5     | *Amomum dealbatum* Roxb       | Zingiberaceae | Aihritil   | Black cardamom | Herb  | Flower bud            | Jan–Apr               | Sleep inducer                             |
| 6     | *Senegalia pennata* (L.) Fabaceae | Khanghmuk   | Climbing wattle | Tree | Tender leaves | Mar–Jun               | Food poisoning            |
| 7     | *Marsdenia maculata* Hook Aposyanaceae | Ankhapui   | Masculatus | Climber     | Leaves and shoot | Whole Year            | Hypertension                       |
| 8     | *Rynchotechum ellipticum* (Wall. ex D. Dietr.) A. DC Gesneriaceae | Tiarrhep | Taiwan Rhyncho-techum | Shrub | Leaves                  | Apr–Aug               | Anti-cancer                           |
| 9     | *Ensete superbum* (Roxb.) Cheesman | Musaceae | Saisu      | Rock banana | Herb | Pseudo stem           | Whole Year            | Snake bite, Convulsion                   |
| 10    | *Solanum anguivi* Lam Solanaceae | Tawkte    | Indian night shade | Shrub | Fruits                  | Apr–Jul               | Anti-septic, boils                    |
| 11    | *Metocccana baccifera* (Roxb.) Kurz Poaceae | Mautak   | Berry bamboo | Bamboo | Shoots                  | Apr–Sep               | –                                           |
| 12    | *Aganope thyrsifolia* (Benth.) Polhill Fabaceae | Hulhu     | Flame Tree | Tree | Young leaves and shoots | Feb–Apr               | –                                           |
| 13    | *Caryota mitis* Lour Arecaceae | Meihle     | Fishtail palm | Palm | Tender shoots           | Whole Year            | –                                           |
| 14    | *Musa balbisiana* Colla Musaceae | Tumbu     | Wild banana | Bamboo | Inflorescence          | Whole Year            | Dysentery, snake bites                   |
| 15    | *Aralia dasphylla* Miq Araliaceae | Hlingthufir | Spikenard  | Tree | Tender Leaves and shoots | Mar–Aug               | Nerve problem                        |
| 16    | *Centella asiatica* L Umbelliferae | Lambak   | Indian pennywort | Herb | Whole plants        | Apr–Oct               | Anti-diabetic, hypertension           |
| 17    | *Dysoxylum excelsum* Blume Meliaceae | Thinghupui | NA        | Tree | Leaves and shoots     | Apr–Sep               | Dysentery, Stomach problem             |
| 18    | *Wendlandia budeleoides* Wall Rubiaceae | Batling  | NA        | Tree | Flower bud             | Feb–April             | –                                           |
| 19    | *Parkia timoriana* (DC.) Merr Fabaceae | Zawngtah | Tree bean | Tree | Fruits and flower head | Oct–Apr               | Indigestion, Anti-diarrheal            |
| 20    | *Trevesia palmata* (Roxb.ex Lindl.) Vis Araliaceae | Kawhtebel | Snowflake plant | Tree | Flower bud             | Feb–April             | Anti-diabetic                       |
| 21    | *Amaranthus vindis* L Amaranthaceae | Lenhling  | Wild amaranth | Herb | Tender shoots and leaves | Apr–Sep               | Snake bite, kidney problem            |
| 22    | *Gnetum gnemon* L Gnetaceae | Pelh       | Joint-fir spinach | Tree | Leaves                  | Jun–Sep               | –                                           |
| 23    | *Oroxylum indicum* (L.) Kurz Bignoniaceae | Archangkawm | Indian trumpet flower | Tree | Fruits                  | Aug–Nov               | Anti-diabetic, stomach problem         |
| 24    | *Amophophallus nepalesensis* (Wall.) Araceae | Telhawng Pa | Voodoo lily | Herb | Corm                   | Aug–Dec               | –                                           |
Fig. 3 Documented traditional recipes prepared by the ethnic communities of Aizawl district.
(4) Bai

Bai can be prepared by mixing different types of vegetables and is considered essential to complete the meal of two tribal groups. This study documented five methods of preparation of Bai from different vegetables such as:

(i) Anbawng Bai: The main ingredient of Anbawng bai is *Fagopyrum tataricum*. In this recipe, 500g of the leaves of *Anbawng* are chopped into small pieces and cooked in 2–3 cups of hot water or depending upon the number of vegetables used. Then, salt and an adequate amount of crushed chili are added along with three teaspoons of ash filtrate and a few drops of cooking oil. All the contents are stirred up well and it is ready to be served (Fig. 3D).

(ii) Aihritil Bai: It is a popular dish among Hmar tribal group. Approximately 200g of the flower buds of *Amomum dealbatum* are cut into small pieces, and these are the main ingredients. It is then mixed with dried chili, and pre-boiled water is added. To this, an equal amount of Kjango/khangmuk (*Senegalia pennata*) and *Si hizo/silneh* (*Eurya acuminata*) are added with an appropriate amount of ash water. The mixture is stirred up well and foams develop. After the addition of a subsequent amount of saum, the dish is ready to be served (Fig. 3E).

(iii) Ankhapui Bai: It is a typical dish prepared from the shoot and leaves of *Marsdenia maculate*, mostly prepared by the two ethnic groups of the study area (Fig. 3F). For preparation, 200g of the shoot and leaves are placed over a fire for about 2 minutes to soften the skin. The skin of the shoot is peeled off and cut into small pieces and are added to pre-heated water, followed by the addition of salts and an appropriate amount of chingal, bekang-un (*Fermented soybean*), and saum. It is bitter and is often served with steamed pork.

(iv) Tiarhrep Bai: It is a typical food of Hmar and is highly preferable when the staple foods are not available. *Rhynchotechum ellipticum* is the main ingredient and in the preparation, approximately 300g of the leaves of *Rhynchotechum ellipticum* are chopped into small pieces and introduced into hot water with *dawlzik* (*Colocasia esculenta*). To this, an appropriate amount of chingal is added along with salt, chili, and wild coriander. Lastly, a few amount of bekang-un is used as a seasoning (Fig. 3G).

(v) Saisu Bai: It is a prominent dish among the two ethnic groups. The main ingredient is the shoot of *Ensete superbum* (Fig. 3H). It is mostly prepared in combination with other vegetables. To prepare, approximately 500g of *Ensete superbum* shoot is cut into small pieces and added to pre-boiled water. An equal amount of leaves of cowpea (*Vigna unguiculata*) are added along with chili and salts. A few drops of cooking oil and baking soda are added. To elevate the taste, wild coriander and steamed pork can be added.

(5) Tawkte buhpawk

It is a typical porridge-type food of Hmar and Paihte where *Solanum indicum* is the main ingredient (Fig. 3I). For preparation, around 100 g of rice grains are first boiled in water for about 20 min, when the rice grains become soft, an equal amount of green fruits of *Solanum indicum* are added along with salt and a pinch of baking soda. Then, the entire mixture becomes semi-solid and has a bitter taste.

(6) Beipenek

Hmar tribal group usually prepared *beipenek* on a special occasion and during their feast. It is a highly popular dish prepared using rice flour. There are two types of *beipenek*: (1) vegetarian *beipenek* and (2) non-vegetarian *beipenek* (prepared with fresh and smoked meats). This study documented *Beipenek* prepared from *Melocca baccifera* (Fig. 3J). 1 kg of the young shoot of *Melocca baccifera* is cut into small pieces and fried with cooking oil. Turmeric powder is added along with salt, chili, crushed onion, garlic, and wild coriander to get a pleasant fragrance and hot water is added depending upon the content of the bamboo shoot and cooked for a few minutes. At the same time, the pre-soaked rice is ground in the wooden mortar to get flour. This rice flour is then suspended into cold water with turmeric powder and added to the mixture to make it *Nawng* (gravy). It is continuously stirred until it is ready to be served. For the preparations of non-vegetarian *beipenek*, fresh or smoked meats are used and the same method of preparation is followed.

(7) Hulhu Zeu

*Agonepe thyrsifolia* is the main ingredient of this recipe. To prepare *hulhu zu*, 500 g of the tender leaves and shoots of *Agonepe thyrsifolia* are boiled for 1 h. The water is discarded and added repeatedly while cooking. After the last cooking, water is removed; it is deep fried with cooking oil. Salt, onion, garlic can be added for a better taste. It is a popular dish among the two ethnic groups (Fig. 3K).
(8) **Meihle Tlak**

Different types of vegetables can be used for making Tlak. This study deals with Tlak prepared from Meihle (Caryota mitis) (Fig. 3L). The tender shoot of Meihle is sliced into 1–2 inches long (~1 kg) and boiled for about 40 min. When it becomes soft, smoked roselle leaves are added to enhance the taste. Salt and chilies can be added as per one's wish.

(9) **Tumbuvui thukthawlh**

It is a prevalent dish among the two tribal communities; the main ingredient is the inflorescence of Musa species (~1 kg). The whole inflorescence is simply put over the fire for about one hour and the skin is peeled off to get the tender inflorescence and it is ready to serve with dried chili and salt (Fig. 3M).

(10) **Hlingthufir zeu**

It is also a common dish among Hmar ethnic group. *Aralia dasypylla* is the main ingredient where approximately 500 g of the tender leaves and shoots are first boiled in water and then fried using cooking oil (Fig. 3N). Wild coriander and garlic are crushed and added at the time of serving to enhance the smell. This dish is highly preferred by Hmar community during the time of availability.

(11) **Lambak tauh**

The main ingredients are the whole plant of *Centella asiatica* and dried peanut. To prepare, a fresh plant of *Centella asiatica* (~200 g) is chopped into small pieces and then first fried with cooking oil for 2 min. Meanwhile, peanuts are fried separately and then ground nicely. The two ingredients are mixed and then crushed onion, garlic, ginger, red chili and wild coriander are added to it (Fig. 3O).

(12) **Thingthupui kan**

The young shoot and leaves of *Dysoxylum excelsum* (~500 g) are first boiled with water and this is the main ingredient of this recipe. The water is discarded and is simply fried in oil along with onion, dry chili, turmeric powder, and salt (Fig. 3P).

(13) **Batling par tauh**

This dish serves as an important food among Hmar and Paihte communities during the period of food shortage. *Wendlandia budleioides* flower bud is the main ingredient for this recipe (Fig. 3Q). After the flower bud (~250 g) is boiled for several minutes, all the water is squeezed out and the flower bud is cut into small pieces. Wild corianders, red chili, king chili, turmeric, and sesame seed are crushed, and finally, all the contents are mixed together and fried in preheated oil for 5 min.

(14) **Zawngtah bilbawlawk bawl**

This recipe is particularly common among Hmar although it is unfamiliar among Paihte people in the study area. It is often taken with plain rice as a side dish. The dense flower heads of *Parkia timoriana* (tree bean) are the main ingredients (Fig. 3R). The inflorescences (~500 g) are rubbed off, and the skins of the flower heads are peeled off. It is sliced into a thin circular shape and is boiled for 2 min to reduce the bitter taste. After that, the water is discarded and the flower head is kept aside. Green king chili is put over a fire and grounded well which is again mixed with flower head and salt. Finally, one tablespoon of fermented pork fat is added while constantly stirring it and it is ready to be served with plain rice.

(15) **Zawngtah bawl**

The main ingredient is the fruit of *Parkia timoriana*. It is a popular and delicious food among the two communities but the methods of preparation are more or less different among the tribal groups. Tree beans can be eaten raw or by mixing with fermented pork. But the taste might be different because it has a mildly bitter taste if it is not boiled. To prepare, the skin of the pods (~500 g) is peeled off by using *ziahkur* (sharp utensil made from iron). It is sliced into small pieces and introduced into pre-boiled water for 1 min. All the water is removed, and the contents are mixed with 1 tablespoon of *chingal*, salt, and two tablespoon fermented pork fat while continuously stirring it (Fig. 3S).

(16) **Kawhtebel kan**

The flower buds of *Trevesia palmata* are taken off and transferred (~500 g) into a pressure cooker for 10 min, all the water is discarded, and the remaining food is kept aside. Chopped onion, garlic, and coriander are first fried with tomato for 5 min, and finally, the flower buds are added and all the contents are mixed well and the dish is ready to be served (Fig. 3T).

(17) **Lenhling kan**

*Lenhling kan* is a typical Paihte food consumed as a main dish. The tender shoot and leaves of *Amaranthus viridis* (~500 g) are finely chopped and boiled for 10 min, the water is then discarded. The heated oil is added to the well-cooked plants, along with chopped king chili, onions, and garlic. Masala and salts are added to enhance the taste (Fig. 3U).
Pelh kan

Pelh is a local name for *Gnetum gnemon*. For preparation, chopped onions are fried with chili and then the leaves of *pelh* (~100 g) are added by constantly stirring it in. Salt is added according to taste. The mixture after frying for 5–7 min is ready to be served (Fig. 3V).

Archangkawm Tauh

The fruits of *Oroxylum indicum* (~500 g) are placed over the fire and the skin is peeled off using ziahkur. After this, it is washed thoroughly with water, chopped into thin pieces, and kept aside. To this, fried and crushed peanut is added and mixed with onion, ginger, garlic, tomato, chili, salt, and dangpuithu to enhance the taste (Fig. 3W).

Telhawng bawl

*Amorphophallus nepalensis* commonly called *telhawng-pa* is a typical Mizo food. Since the parts of the plants contain irritable substances causing itchiness on the throat, there is a long process to make it edible (Fig. 4). For preparation, the outermost covering of the corm is removed and sliced into small pieces, boiled in chingal for 4 h to reduce the irritable substance. After this, chingal is removed and the content is crushed carefully in a typical wooden mortar and pestle. The crushed corm is again boiled in an ash filtrate for 4–7 h and left to cool. After cooling, chingal is discarded, soaked in clean water by changing the water several times to remove the ash filtrate. From this preparation, ~1 kg of *telhawng* is taken out and mixed with 4–5 drops of fermented pork fat, salt and chilly as per one’s desire (Fig. 3X). Although the process of preparation takes time and effort, this food is highly preferred due to its deliciousness in taste.

Discussion

In tribal areas and society, culture, tradition, and food habits cannot be separated as they are all interconnected [24]. Since rice is considered a staple food and vegetables and meat are considered as side dishes in Mizoram [11], a huge diversity of WEVs is used and consumed especially during the scarcity of agricultural crops. It is well known that WEVs have been used globally as medicines because of their nutraceutical properties [25, 26]. This survey documented 24 traditional recipes prepared from WEVs among the two ethnic groups of Mizoram, in which, a large number of WEVs were used as food medicine. The study was confined to Hmar and Paihte tribes within Aizawl District, the Northern part of Mizoram and although
they inhabit other districts in Mizoram, the traditional recipe preparation using WEVs may slightly differ, but can be considered as representatives of the entire Mizoram for these particular tribes. Hmar and Paihte ethnic groups have more or less similar choices in affinity toward the wild edible plant consumption. This may be due to the intermixing of culture and tradition, mixed habitation, and the sharing of resources among the two ethnic communities. However, some species such as *Aganope thrysifolia*, *Fagopyrum tataricum*, and *Brassaiopsis hainla* were preferably consumed by Hmar and Paihte tribe while the use of *Rhynchotechum ellipticum* as food by the Paihte people was not recorded during the field survey. Nevertheless, species like *Oroxylum indicum* had high affinity among the Paihte communities. On the other hand, there were also many species like *Ensete superbum* and *Centella asiatica* which were commonly used among the two ethnic groups for the preparations of *Bai* and *Tauf*. For instance, Hmar and Paihte tribal groups mainly reside in Mizoram adjacent to Manipur state, many species of WEVs in the present study were also used by the local tribes of Manipur, but the complex preparation of the recipe was not found [27]. Since some of the Hmar and Paihte people migrated from Manipur and resided in Mizoram, certain seasonings used for food preparation were found to be very similar. Preparation of *Saum* of Mizo tribe, a widely used ingredient of the recipe, was found very similar to the *sathu* prepared by Manipuri tribe [5] and *chingal* preparation was also similar to the Assamese ‘Kolakhar’ which used banana ashes [28] and they were decisively used for the recipes documented in the present study. The vegetables and meat cooked with rice grain also known as *beipenek* is a common delicious food item of the communities which were studied, this recipe is also very common among the tribal people of Manipur [5] but the method of preparation differs among the ethnic groups. Several studies have been found worldwide on the documentation of certain plants as edible vegetables including the WEVS used in the current study such as *Eurya acuminata*, *Melocanna baccifera*, *Aganope thrysifolia*, *Aralia dasypylla*, *Amaranthus viridis*, *Gnetum gnemon*, [8] *Centella asiatica*, *Amomum dealbatum*, *Wendlandia budleioideae*, *Dysoxylum excelsum*, *Marsdenia maculata* [28], *Musa balbisiana*, *Ensete superbum*, *Solanum anguivii*, *Trevesia palmata* [29], *Oroxylum indicum* [30], *Amorphopahallus nepalensis* [31], *Senegalia pennata* [32], *Ficus auriculata* [33], *Rhynchotechum ellipticum* [34], *Caryota mitis* [35], *Parkia timoriana*, *Amaranthus viridis* [36]. However, to best of our knowledge, *Brassaiopsis hainla* has never been reported so far as edible vegetables. Furthermore, the present study gives the first report on the documentation of cuisine preparation on all the vegetables; nevertheless, there are other tribal groups such as Lai/Pawi, Lusei, Bru, Chakma and Mara in Mizoram that have their own unique traditional preparations of WEVs and needs to be explored. Taking all these into account, the diversities of traditional food products can be identified to explore their potentials in terms of commercialization [37].

**Conclusion**

This study presented the preparation of wild edible vegetables-based traditional foods/dishes that also have social, cultural, and economic impact on Hmar and Paihte tribes of Mizoram, Northeast India. A great diversity of WEVs was observed because of the rich natural resources in this area and the fact that the local people have knowledge about WEVs and how to prepare them. Several of them have a marketing potential and need popularization not only in other tribal groups of the states but also in other parts of the world. It is therefore important to validate the traditional food recipes to be expanded through a comprehensive socioeconomic and cultural framework. This study also presents the basic information on the necessity of conservation, sustainable utilization and preservation of local traditional knowledge on WEVs.

**Abbreviation**

WEVs: Wild Edible Vegetables.

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**Authors’ contributions**

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