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Traditional rice-husking technology of the Kukis of Manipur, India

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The traditional method of rice husking remains one of the indispensable household activities of the indigenous Kuki people living in the remote areas of Northeast India in general and Manipur in particular. Their husking technologies include hand-operated mortar and pestle (*sum leh suh-tum*), leg-operated husking lever (*chot-lep*) and water-operated husking lever (*tui-sum*). They have been using these technologies for pounding different kinds of foodgrains since time immemorial. However, with the introduction of modern rice mills, traditional methods of husking have been drastically reduced. Currently, traditional husking technologies remain in use only in those remote areas where there is no modern rice mill facility. Mortar-pestle is the most common traditional husking technology when compared to leg-operated and water-operated husking technologies. The present ethnographic study was conducted in four hill districts of Manipur, namely- Kangpokpi, Noney, Churachandpur, and Kamjong. This paper studies the age-old traditional rice-husking technologies of the Kukis by mainly focusing on the raw material procurement, manufacturing process, use, maintenance, and discard patterns.

Keywords: Kuki, Leg-operated husking, Mortar, Pestle, Traditional rice-husking technology, Water-operated husking

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Rice is the staple food of the indigenous people of Southeast Asia[1-3], including the Kukis[4-5] of Northeast India. Throughout the bygone centuries, human generations obtained edible rice from paddy by applying different traditional methods of husking. The indigenous rice cultivators of Northeast India and Southeast Asia have employed at least three types of traditional husking technologies of regional variants since time immemorial. In these regions, husking has been one of the main post-harvests foodgrain processing activities performed over time since prehistoric periods[6]. The process involves removing the husk and sometimes the bran layer to produce an edible rice kernel. One of the earliest known foodgrain processing methods practiced by people of the prehistoric era was that of grinding with a stone grinder. Archaeological remnants of saddle and quern excavated from various Neolithic sites are evidence of the grinding technology of prehistoric people[7-8]. The same technology has been documented ethnographically among various indigenous people of Africa and Asia[9-11].

The practice of simple rice processing came into existence with the introduction of primitive agriculture and a sedentary life during the Neolithic period. It became one of the significant women-oriented household tasks among different ethnic communities in the world[12]. Depending on raw material availability, different ethnic communities adopted diverse forms of traditional foodgrain processing technologies. For instance, the Minyanka of Mali used saddle stones for grinding millet and other grains[13]. The Nepalis, the Chinese, the Thais, and the Vietnamese living in remote areas used different types of traditional husking technology. Saddle stone, hand-driven rotary stone, leg-operated lever, water-operated lever, and mortar and pestle are the conventional traditional technologies used around the world. The indigenous Kuki people of Manipur in North-East India adopted three types of husking technologies- Mortar and pestle, leg-operated and water-operated husking lever.

The main objectives of this paper are to examine the raw material, manufacturing process, use, maintenance, and discard pattern of different types of rice-husking technologies used by the Kuki societies.

Methodology

Study area

Manipur is an important trans-border state located in the Northeastern region of India. Its geographical

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area extends from 93°03' east to 94°78' east longitudes and 23°80' north to 25°68' north latitudes[14]. The total physical area of the state is about 22,327 sq. km, which roughly constitutes 0.7% of the total land surface area of the Indian Union[15]. The state shares an international borderline of about 352 km with Myanmar on the east and about 502 km long borderline with the neighboring states of Assam on the west, Nagaland on the north, and Mizoram on the south and the southwest[14]. The state is broadly divisible into a central valley comprising six valley districts (accounting for 10% of the total area) and the surrounding mountains, which comprise ten Hill Districts[16]. The state recorded a total population of 2,855,794, of which males and females were 1,438,586 and 1,417,208, respectively, and made up 0.24 per cent of the Indian population[17]. The indigenous people of Manipur are broadly divisible into three main ethnic groups- the Meitei, the Naga, and the Kuki. The Meitei ethnic group inhabits the valley while the Kuki and Naga ethnic groups occupy the surrounding hill areas that perfectly encircle the valley. The present study is the outcome of ethnographic fieldwork conducted in Kuki inhabited villages located in the interior areas of four hill districts: Kangpokpi, Kamjong, Churachandpur, and Noney.

Methods

The primary data were collected during fieldwork conducted in three seasons from 2017-2019. Each season covered only a dry period of the year (from January to March) because most inter-village roads are accessible with vehicles only during this period. A pilot survey was carried out among the targeted villagers who have settled in and around Imphal city and Churachandpur town. This survey was conducted for gathering information about their village economy, road connectivity, social organization, material culture and traditional technology, which are the keys to planning the actual fieldwork.

Key informant interviews and personal observation are the main methods for collecting primary data. Besides these, audio recording, photography, and videography are indispensable for collecting empirical data.

Results and Discussion

The Kuki people were found to use three types of husking technologies acquired from their ancestors since time immemorial. Based on the nature of the operation, they can be classified into hand-operated, leg-operated, and water-operated. *Sum-leh-suh* is a hand-operated husking implement, *chot-lep* is a leg-operated, while *tui-sum* is the water-operated husking lever.

Hand-operated mortar and pestle (Sum-leh-Suh)

The local term *sum-* which means mortar, and *suh-* which refers to the pestle, are a pounding implement manufactured from hardwood trees like *kheng-thing* (*Schima wallichii*), *gel-thing* (*Castanopsis* spp.), and *se-thing* (*Castanea* spp). It has been one of the essential and indispensable household implements throughout the life of traditional Kuki societies. This implement is so attached to their culture that a traditional bamboo dance called '*suhta-lam*' and a traditional game called '*suhtum-kho*' derived their name from it. *Suhta-lam* is a dance performed with pestles in the olden days, while *suhtum-kho* is a pestle throwing game similar to ‘javelin throw’. The primary utility of this implement is for husking paddy to prepare rice flour. However, the Kuki people also used it for crushing dry turmeric into powder. Besides foodgrain processing, they used the same implement for pounding charcoal into a fine powder for making gunpowder.

The manufacturing process of mortar begins with selecting a large wooden log after considering wood type, desired shape, sizes, and the number of feeding holes. The mortar structure is carved out from an appropriate wooden log with the help of metal tools like *heicha* (axe), *heikhup* (adze), and *chem-lukui* (*dao* with curved head). The carving process usually takes place in the jungle where the wooden log is. After carving out the rough structure of mortar, it is transported to the village. The remaining tasks are usually done at home, including making a feeding hole with *paicha* (chisel), and smoothening the surface with a finishing touch. The selection and procurement of raw materials, manufacturing, and transporting the semi-completed heavy mortar to a village posed a significant challenge since strong and skilled laborers were required. Therefore, only a few menfolk engaged in its production activity.

The indigenously developed existing mortars of the Kukis are of two types *sum-phei* (*sum*-mortar, *phei*-horizontal) and *sum-tung* (*tung* means vertical). *Sum-phei* (Fig. 1) refers to the mortar where the feeding hole(s) is carved out from the horizontal surface. This type of mortar has a feeding-hole ranging from single to triplet or more with horizontally extended length.

The mortar length increases with the number of feeding holes, but the breadth usually remains more or less constant. For instance, the normal mortar length of single, double, and triple feeding-hole (s) ranges approximately between 100 cm-140 cm, 180 cm-190 cm and 260 cm-280 cm respectively, with an average breadth of 50 cm-60 cm. There is also a smaller version of *sum-phei* with a single hole known as *sum-te* (the word *te* means tiny). It has a rough length and breadth of about 30 cm-40 cm and 20 cm-30 cm, respectively. It is usually operated with a short wooden pestle. This type of mortar is used exclusively for pounding kitchen items instead of husking rice. *Sum-tung* refers to the mortar with a feeding-hole carved at the vertical surface of the wooden block. This type of mortar has a single feeding hole on a cylindrical body structure extended vertically. It is prominently tapering in its middle and has an average height of about 50 cm-60 cm. Of all mortars, s*um-phei* with a single feeding hole is the most common mortar found operated at the household level in every studied village. A nuclear family with one or two workers mainly employs single-hole mortar. Mortar with double feeding holes (Fig. 2) is for large family members of a nuclear or extended family with copious workers. Mortars with triple feeding holes and above are primarily for public use and mostly found within the premises of the village chief. However, multi-hole mortar rarely occurs compared to the single-hole mortar. In the traditional household, *sum-te* remains as an essential kitchen items grinder for large families, but small families rarely use it.

Pestle is made from the inner portion of a large hardwood tree by splitting the trunk horizontally into small poles with the help of a sharp axe. The poles are then made into pestles by smoothening with a metal tool- *dao* (*chempong*). There are two variants of a pestle—the pestle with an iron ring and without an iron ring. Ringless pestle is probably the earliest type, while pestle with iron is supposed to be a modified and newer type. Both types of pestles are found operational in those studied villages, but pestle with an iron ring is more common since it delivers better working efficiency. The typical pestle structure follows a uniform pattern of tapering at the middle portion for better grasping with a broader girth towards both ends and has an average length range between 160 cm-190 cm. The width of the iron ring attached at the working end ranges between 2.5 cm-6.5 cm, with a circumference of about 16 cm-17 cm. The length of the pestle roughly coordinates with the operator's height for higher user efficiency because a disproportionate ratio can cause negative user efficiency. The number of operators depends upon the availability of the workforce. Two workers typically operate a single-hole mortar facing each other (Fig. 3) while pounding. Sometimes one or three workers also

Fig. 1 — Mortar (sum-phei) and pestles of different variants (Vongmol village, Henglep, CCpur district, Manipur)

Fig. 2 — A dorsal view of unused double-hole mortar (180x55 cm) (Thinghijang village, Henglep)

Fig. 3 — A couple engaging in husking activities (T. Khonomphai village, Henglep)

operated it. The pestle is operated in such a way that the manipulator firmly stands on the ground and uses the force of arms and shoulders along with the total weight of the upper body to generate a strong force to apply on the pestle while pounding. However, for operating a shorter pestle of *sum-te*, the entire force is being generated from the arms and shoulder while pounding in a sitting position (Fig. 4). It has an average length ranging between 80 cm-100 cm, while the circumferences of the working end and the middle grasping portion ranges between 16.5 cm-17 cm and 12 cm-13 cm, respectively.

The husking process of rice grain requires at least two rounds of pounding for complete dehusk. The initial round of husking starts with filling the feeding hole with the required quantities of paddy and pounded until half of the grains get detached from the chaff. And then, the feeding hole is emptied and refilled with another round of unhusked rice for pounding. This process keeps repeated continuously until all the grains undergo an initial round of husking. After completing the initial round, the chaffs are sieved out with the help of *godal* (locally made bamboo sieves). At this stage, the husked and unhusked rice are roughly in the ratio of 50:50. The next round is for complete husking, where the semi-husked rice is pounded again until the whole grains appear completely husked. The chaff and broken kernel are then sieved out (for feeding domestic fowls and pigs) to obtain an edible kernel for consumption. Usually, after husking, the rice bran layer remains intact, which reduces the taste but retains its nutritional value. This nutritious bran is essential for hard workers. Therefore, the earlier Kuki people preferred traditional husking devices over modern rice mills. Because modern rice mill usually removes the bran layer while traditional husking methods retain it. However, contemporary Kuki people are more inclined toward modern rice mills for many reasons, but mainly because of their high efficiency with less human energy and better taste.

Fig. 4 — A woman pounding sesame seed in a small size mortar (40x24 cm) called sum-te (Vongmol village)

The traditional ways of maintenance and preservation helps to preserve mortar and pestle for at least a couple of generations. *Sam-buh* (Fig. 5), the frontal portion of a traditional Kuki house, remains the standard place for carrying out husking activities and also stores mortar and pestle safely from rain and sunray. The norms for storing mortar and pestle are almost the same among different users of the studied villages. After use, both the mortar and pestle are stored at *sam-buh* by leaning against the wall so that the working surface turns towards the wall to prevent it from pollution due to direct contact with dust particles on a floor. There is a traditional belief that strongly prohibits pounding an empty mortar hole. Because they believe that pounding an empty hole could arbitrarily slit the ear of one's (the doer) grandfather, this prohibition turns out to be an effective preservation mechanism in checking unnecessary pounding as it prompts the perforation of a mortar hole. It also helps in contributing to the longer life of the mortar for usage. However, interestingly, there is another traditional belief of calling back a lost dog while pounding an empty mortar hole. They believed that by doing so, the lost dog could return home.

Repairing rarely occurred. Only a few mortars bear the retouched marks on the upper working surface. Almost all the damaged mortars are due to the perforation of the feeding hole. However, as per their

Fig. 5 — A frontal view of a traditional house (sam-buh) where husking activities usually take place (Vongmol village, Henglep)

Fig. 6 — A ventral view of discarded double-hole mortar re-used as door step of a house (Molvailup village, Kamjong district, Manipur)

Fig. 7 — A leg-operated husking lever known as (chot-lep) (Khongmol village, Noney district, Manipur)

record, no repairing has been carried out on a perforated mortar. The damaged mortar is used as a doorstep of the pile house (Fig. 6), which is the stereotypical traditional dwelling house type of the early Kuki people, while the damaged pestle of good quality hardwood is sometimes re-used for making *kang-chong* (top), a traditional game once popular among the youths of the Kukis.

Leg-operated husking lever (*Chot-lep*)

Chot-lep (Fig. 7) is the only type of leg-operated husking lever found to be used among the Kukis of Manipur. It is also known as *Dheki* in Assam[18]. However, there is a regional variation in some of their components from place to place. The term *chot-lep* refers to the action of pushing down/pushing up the lever by foot. This type of husking implement is operated in such a way that the lever head, attached with a pestle, is raised high by pushing down the rear end against the ground by the leg and released quickly so that the pestle falls into the mortar with great force to pulverize the grains. The working mechanism of *chot-lep* is similar to a see-saw; when one end goes down due to higher weight, the other end goes up and vice-versa. The main components of *chot-lep* include a large wooden beam as a lever, a short pestle, a wooden mortar, a short vertical post as the fulcrum, and an axle for balancing the lever. The manufacturer is bound to construct the required parts and assemble them systematically by considering the overall dimensions, like the size and weight of each material, for proportionating the body components to achieve high user efficiency. The husking lever is about 180 cm, mounted on an axle usually supported by a short vertical post and a short iron cap pestle measuring about 20 cm attached near the lever head. Wooden mortar (Fig. 7) with a single feeding hole of about 18 cm in width and 15 cm in depth, positioned directly below the pestle by burying its base. Both men and women are engaged in pounding activities. However, the sieving of chaff remains a chore for women. Unlike *sum*, *chot-lep* remains fixed at one position inside a house where it is stored. There is a slight variation in its component. For instance, few individuals use stone mortar as an alternative to wooden mortar, while a horizontal wooden log is used as a fulcrum instead of a vertical post.

There is no specific traditional norm for preserving this device other than storing it in a dry place under a proper roof to protect it from rain and direct sun rays. Although drying makes it long-lasting, direct sun rays falling on it for prolonged periods could destroy the device by developing large cracks on the mortar and wooden lever. Therefore, sun rays have been a common destroying agent of mortars. Soon after use, the mortar hole is usually covered with a wooden plank. At the same time, the pestle is rested on the wooden plank to protect the mortar hole from pollution (Fig. 8). Replacing a damaged part with new material is a common repairing phenomenon. Minor repairing is undertaken multiple times before finally being discarded. There is no specific norm of discard patterns to be observed. The discarded wooden lever is sometimes re-used as a pillar for simple house construction.

The invention of leg-operated husking technology was a significant technological development in pre-literate societies where changes rarely occurred. It

Fig. 8 —A mortar hole covered with wooden plank to protect from pollution and a prominent crake of the husking lever due to direct sunray

was a breakthrough technological innovation among the early Kuki societies, which they had readily adopted and operationalized for centuries. Technologically, a leg-operated husking lever is more developed and effective, but it is less desirable when compared to a mortar and pestle because it occupies a large space and is not moveable while operating. The occurrence of *chot-lep* is minimal in those areas where mortar and pestle are used as the primary husking device. However, mortar and pestle still remain widely operationalized in those regions where local people primarily used *chot-lep*. Whatever the case, the hand-operated and leg-operated implements reside side-by-side within a village and act as supplementary to each other. For instance, the mortar and pestle user who has grasping problems due to an injured palm might want to use *chot-lep,* and in the same way, the *chot-lep* user might prefer or find it convenient to pestle his gunpowder in mortar and pestle. In such a situation, both the users are free to use any mortar through mutual understanding. This mutual sharing of husking devices benefitted both parties.

Water-operated husking lever (*Tui-sum*)

Among the traditional husking technologies of the Kukis, the water-operated locally known as *tui-sum* (*tui*-water, *sum*-mortar) is the most advanced technological innovation adopted so far, which has drastically reduced the energy and time spent on pounding activities. The device is self-propelled through the kinetic energy of flowing water that swiftly travels downstream. The basic concept of *tui-sum* (Fig. 9) is similar to that of *chot-lep* other than a few structural modifications and its working mechanism. *Tui-sum* is supposed to be the upgraded version of *chot-lep*. The main components of *tui-sum* are a pestle, a wooden husking lever with a carved-out water cavity, an axle supported by upright wooden posts, pipes for water supply, and a mortar stored inside a hut.

Fig. 9 — Water-operated husking lever (tui-sum) at its initial horizontal position where water started pouring in (Dahtum village, Henglep, Ccpur district, Manipur

Manufacturing of each part and installation requires the basic technical know-how of its working mechanism because disproportionate dimensions and weight of its parts could cause hindrance to its working efficiency. A large wooden beam of about 220 cm long, with slight tapering at the head and measuring about 13x15 cm is used as a husking lever. A wooden pestle (with iron capped) of about 54 cm long is inserted near the lever head, while a rectangular water cavity measuring about 50x21x15 cm is dug out at the rear end of the lever for receiving water. The ideal length of a pestle is to touch the bottom of the mortar hole when the lever is positioned horizontally. The husking lever is thus mounted on a wooden axle, firmly supported by two upright posts, so the pestle rises when the cavity is filled with water. The water cavity is fed through a single or multiple pipe (s) made of bamboo or wood. A mortar with a large feeding hole is fixed directly below the pestle on the floor. Mortars are of different variants made from stone or wood. Recently, a few individuals started using commercial oil containers (15 kg Oil Tin) as an alternative to wooden mortar.

The operating mode of *tui-sum* goes through different stages during the operation cycle. Initially, the water cavity is empty; therefore, the lever remains horizontal with the pestle resting on the mortar (Fig. 9). When water starts flowing into the cavity, the wooden lever maintains its original position for some time. After a few moments, the amount of water

Fig. 10 —Semi-tilted position of the husking lever. Due to its tilted position small amount of water started pouring out of the water cavity

Fig. 11 — The husking lever tilted to its maximum torque and quickly emptied the water cavity

Fig. 12 — Resting the lever with an upright wooden pole and a mortar (15 kg oil tin) covered with a lid (Dahtum village)

Fig. 13 — Side view of the double-floor thatched hut where the ground floor is used for storing tui-sumand the upper floor is mean for a resting space (Dahtum village, Henglep, Ccpur district). This type of double floor structure is not found in other places

accumulated inside the cavity is sufficient to upswing the lever steadily (Fig. 10). At this stage, due to the lever's tilted position, water rushed towards the distal side of the cavity, thereby tilting the lever more swiftly. The water started flowing out of the cavity continuously as the lever tilted progressively. However, due to the upward motion of the lever coupled with continuous flow-in of the water, the lever is tilted unceasing to its maximum torque (Fig. 11). When the water cavity is emptied due to its tilted position, the lever falls back to its initial horizontal position due to its unbalanced weight. Thus, the falling pestle pounds the rice inside the mortar with great force and continues to begin a new cycle.

The primary requirement for installing *tui-sum* is a fast-flowing stream. Therefore, unlike *sum* and *chot-lep*, *tui-sum* remains confined to villages located nearby a stream. Sometimes, the stream is diverted into a village (as seen in Haipi village of Kangpokpi district) for installing *tui-sum*. The device is designed to operate in all weather conditions throughout the year by storing inside a small thatched hut. Sometimes, the hut is walled with bamboo mats in its four corners to prevent any hindrance from animals and birds. The operation of *tui-sum* is simple and does not require much attention. They filled the mortar cavity with the required amount of paddy grains and then leave it the whole day for work. In the evening, they collect husked rice from the mortar. However, the operator sometimes leaves for more than a day for a larger mortar, like 15 kg Oil Tin (Fig. 12). After collecting the husked rice, the lever is lifted to its maximum torque and rested on a wooden pole until further operation. The mortar mouth is covered with a lid (Fig. 12) to protect it from pollution and insects. Typically, a simple hut is made to house *tui-sum*, but sometimes, they also use a double-floor hut (Fig. 13).

The use-life of *tui-sum* is generally short when compared with *sum* and *chot-lep*. It could hardly be used for three consecutive years without much repair. However, if properly maintained, high-quality hardwood can last for a decade. The bamboo pipe and water cavity of the husking lever, which are always in contact with water for a prolonged time, remain the most vulnerable parts to be damaged. The damaged parts are separately replaceable with new material of the same size except for the husking lever. There is no specific discard pattern to be followed. A new device is usually installed at the same place after removing the previous device.

Conclusion

Electric or mechanical mills or other industrial devices gradually replace the age-old traditional technologies of tribal societies[19]. This replacement becomes a general trend among the simple societies whose primary economic activities are centered around foodgrains production. Similarly, the traditional rice husking technologies of the Kukis have been gradually vanishing among the inhabitants of semi-urban centers and rural areas with accessible road connectivity for transporting modern rice mills. Without any doubt, for many users, the adoption of modern rice mills has been a positive sign toward modern-oriented development through embracing scientific technologies. However, there is also a concern for preserving the age-old traditional technologies, as the driving force towards modernization is so strong that it will ultimately bring it to their extinction shortly.

Presently, the number of users of traditional husking technology is high in those interior areas where installing modern rice mills is not feasible due to inaccessible road connectivity to transport heavy machinery. These inhabitants have no option rather than rely entirely on their own locally manufactured husking devices. On the other hand, the number of traditional users has decreased drastically in interior areas with modern rice mill facilities. However, these people do not entirely depend on modern rice mills. They use traditional methods of husking when the milling facility is unavailable due to machine breakdowns or the unavailability of fuel. Few users entirely depend on traditional methods despite having easy access to modern rice mills. The main reason for this is that, traditional husking implements retain the bran layer of rice (brown rice), which they consider nutritive[20].

Nevertheless, there is no intention of repairing or installing new mortar in the future among the present users. As per the study, their intention shows a shift of interest towards the modern rice mill. Therefore, immediate intervention is needed to improve the traditional husking technology and preserve it before it vanishes forever. Moreover, the local people should be encouraged to retain traditional technologies since those technologies are eco-friendly, cheap, and sufficient for producing household consumption.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Authors' Contributions

LK: Conceptualization, Data collection, Documentation, Compilation, Formal analysis, and Writing- original draft. MM: Supervision & Review.

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