Traditional water mills (Gharats) - A source of rural livelihood in mountainous region of Jammu and Kashmir

PS Slathia1*, Rakesh Kumar1, Narinder Paul2, BC Sharma3, Rajinder Peshin1 & SK Gupta4
1Division of Agriculture Extension Education, 2KVK-Doda, 3Division of Agronomy, 4Division of Agro forestry Sher-e-Kashmir
University of Agricultural Sciences and Technology of Jammu, Chatha, Jammu 180009, Jammu & Kashmir, India
E-mails: slathia2007@gmail.com, rkthakyal76@gmail.com

Received 19 January 2018, Revised 9 April 2018

The present exploratory study was conducted in Shivalik hills of Jammu region of J&K at an altitude of 4500-5000 ft height to document the traditional knowledge of the local people regarding traditional water mills locally called as “Gharats” used for grinding of different cereals and grains especially maize for their household consumption by using energy of flowing water. Among different cereal crops maize is predominately grown and is the staple food for the peasants of the area. Along with farming, these traditional water mills act as source of livelihood for the people of hilly areas. Water flowing in different perennial springs of these hills is utilized by the local people for operating their traditional water mills for grinding of maize & wheat. Elderly people of the village construct it by using locally available material. Wood of Quercus leucotrichophora locally known as “Banj” and Pinus roxburghii locally known as “Chir”, clay and stones are predominately used for construction of gharats. Locally available stone called “kupar” is used for making grinders locally known as “pan” and “talli”. Operators of gharat locally called as “Gharati” reported that they earn to the tune of ₹48000 to 52000/- annually from these gharats as charges for grinding maize and wheat grains and act as source of livelihood for farm households in addition to farming. Local inhabitants reported that these traditional water mills are cost effective source of grinding/milling of different grains, requires less maintenance and moreover are eco-friendly. Respondents also reported that flour obtained after grinding from these traditional water mills possesses longer keeping quality and more nutritious as compared to electric Attachaki. Erratic rainfall and snowfall due to climate change results in decreasing the water flow in perennial nallas which affects the continuous functioning of these traditional watermills.

Keywords: Traditional water mills, Gharat, Wooden channel, Livelihood, Sustainable, Energy, Grinding, Pan, Talli, Dull
IPC Int. Cl.8: A47, A47I, B23C, B23F 1/06

People living in far-off remote hilly regions are still using different natural & sustainable source of energy such as energy of moving water, wind energy, etc., for carrying out different day to day agricultural and household related activities by applying their traditional knowledge gained over a period of time. India is having rich traditional knowledge base and need is there to extensively understand the scope of traditional knowledge about different natural sources of energy for harnessing it for development and trade to benefit the traditional knowledge possessing communities1. Since time immemorial rural people have developed their own ways and means to fulfill their basic agriculture and household needs from different natural resources such as free flowing water of rivers, streams and forest resources available in their surroundings. They possess peculiar indigenous knowledge and technologies unique to their culture which have been generated by ancestors and transmitted from generation to generation. Indigenous Knowledge is the knowledge that exists in local form, different from scientific and modern knowledge, used by the people who are living very near to nature for their subsistence2. This indigenous knowledge is learnt from nature from time immemorial3. People make use of their own wisdom and accumulated knowledge from their predecessors4. The diverse indigenous knowledge existing in our country is on the verge of extinction due to different reasons such as globalization, poverty, illiteracy, recent environmental threats like climate change, etc. Hence, there is real urgency to preserve this unique indigenous knowledge because all the scientific discoveries are rooted in this knowledge and if we lose it, then it may adversely affect the livelihood of the people2. The idea of using energy in water and

*Corresponding author
converting it into mechanical energy was known to the mankind since long. Sustainable source of energy in food production and processing plays a crucial role in economic and social development of mountainous region worldwide. Sustainable natural resource management is driven by the beliefs and behavior of the human communities and local cultures. In the hilly and mountainous regions where there is availability of perennial flow of water, traditional water mills convert the energy of moving water and perform various mechanical operations such as grinding, milling, rolling, hammering, etc. These traditional mills are usually located at the banks of perennial streams and rivers in hilly and mid hilly areas. Watermills have been the part of villages for centuries, however, due to its low efficiency; it has not been able to meet the increasing processing needs and other energy requirements of the communities. Traditional water mills for grinding are being widely used in the Himalayan regions and about 2.5 lacs traditional wooden water mills are still in use in Himalayan and Sub-Himalayan regions. Climate change and development and invention of power mills left these power mills obsolete. The state of Jammu and Kashmir mainly being hilly and mountainous is bestowed with number of streams, rivers, lakes having running water throughout the year and rural people in the hilly area have installed these gharats. Installation and operation of gharat is a traditional practice for grinding maize in rural hilly areas. These gharats are known as “watermill” in the western countries. In the area of present study, i.e., Chenani block of Udhampur district streams having perennial flow of water and local inhabitants harness the power of flowing water for running traditional water mills. Inhabitants of the area approach these traditional water mills for grinding maize because it is the staple food of people of this hilly area. These traditional water mills still act as one of the source of family livelihood. Adequate efforts have not been made to harness the water resources that originate in the Himalayan region in order to address the increased need for small-scale energy for local use and sustainable livelihoods among the population living in remote and inaccessible mountain areas. This traditional way of grinding the grains is fighting for its existence. This mainly happened due to the openings of electric grinding machines called as “Attachaki” even in remote hilly area and mainly unwilling attitude of rural youth towards adopting these traditional watermills as an extra source of livelihood in addition to farming and live-stock rearing. In order to keep this traditional technology alive, modification is needed in existing structure of traditional watermills to make these sustainable source of energy as multipurpose machines. The improved gharats are recognized as a small-scale industry with great potential for improving livelihoods and reducing pressure on forests. The up-gradation and improvement of these water mills is an effective and sustainable way of meeting the energy needs of a major section of the hilly people. Reviving these gharats and encouraging power generation through traditional watermills can act as a driving factor to achieve the objective of promoting the all-round development of the hilly regions of Jammu & Kashmir. The sole aim of documenting and presenting this research paper is to ensure the preservation and sustainability of traditional water mills in Jammu and Kashmir and transform these water mills to become heritage for future generations.

Methodology

The present study was conducted in purposively selected Chenani block of Udhampur district which falls in Shivalik hills of Jammu province. Present research pursuit was conducted in villages namely Choki Naal, Sarat Khud, Marothi and Latti because of maximum concentration of gharats in these villages. In-depth interview of owners/operators of these traditional water mills was conducted after obtaining their consent and explaining them the purpose of study. Pre-designed questionnaire including both closed and open ended questions was used to document varied traditional information related with local material and technology used for the construction of these traditional water mills. The entire discussion was carried out in local dogri pahari language with the owners/operators of these traditional water mills in order to extract detailed information about these water mills locally called as “gharat” (Figs 1A, B & C). Local owners/operators also gave the demonstration by running these gharats and by grinding the maize grains. Information was collected from all the gharat owners/operators of different study villages in order to document and validate diverse information gathered about the history, old structure, material used and working of these gharats and their contribution in the livelihood
of farm households of hilly region. Documentation of indigenous knowledge systems is important to preserve indigenous knowledge so that it may continue to provide local solutions or alternatives to western knowhow and instill pride in rural communities about their indigenous knowledge systems.

Results and discussion

It has been observed that these gharats are peculiar to the study area which is constructed by local elder persons of area by using indigenous generated technology. This eco-friendly and safe structure in use since times immemorial has withstood the test of time. Information was documented on various aspects of traditional water mills such as different local material used for its construction and its working. The detailed description about gharat and its functioning is presented as:

Materials used for construction of traditional water mill (Gharat)

1. Open wooden channel

This open wooden channel made up of locally available wood of chir (Pinus roxburghii) tree and is used for the diversion of water flowing in perennial nalla up to the location of gharat. Gharat is generally constructed at a site below from this open water channel in order to obtain water fall of approximately 15 to 20 ft height. Then again a narrow wooden channel made up of locally available chir tree (Pinus roxburghii) is used for allowing the water to fall from the height of 15 to 20ft on the shaft (Fig. 2). This falling water rotates the shaft and due to which gharat starts functioning.

2. Iron water sieve

This sieve is fixed at the start of the wooden channel in order to prevent the entry of unwanted materials.
material such as, grasses, small wooden pieces if any flowing along with running water, etc., into main rotator shaft. Respondents reported that if any one of this material got entered into wooden channel then it may break the rotatory shaft, thereby damaging the traditional water mill. Iron rods are used by gharaat owners/operators for this purpose in place of wooden sieve (Fig. 3).

3. Vertical rotatory shaft.
   This shaft rotates when waterfalls over it. This vertical shaft connects the wheel to upper rotating stone, which moves against a stationary grinding. This rotatory shaft locally known as “Makkri” converts the flowing energy of water into mechanical energy for grinding purpose.

4. Grinding stones
   Two types of stones are fixed on this rotating shaft for grinding purpose. Lower stone locally called as “tali” is of stationary type (Fig. 4). Second stone is of revolving type and fixed over the stationary stone locally called as “Pan” (Fig. 5). Both these parts are made up of stone and a local rural artisan namely Sher Singh of village ‘Madha’ possesses the skill to prepare it after giving proper shape. Pan and tali costs ₹ 5000/-. These two stones when in operation create friction and maize grains get grinded between these two parts for conversion into flour (Fig. 6). Speed of rotation of these two stones depends upon the water flow. Respondents reported that speed of rotation (rpm) remains high during rainy season.
5. Grain pouring compartment

It is locally called as “dull” and made up of Quercus leucotrichophora tree locally called as “banj”. It is fitted above the rotating stone of traditional water mill and grains are poured into it for grinding and its capacity ranges from 30 to 40 kg. A small opening is made up at the bottom of this part and grains falls in a hole made at the center of rotating stone. Operator locally called as gharati adjust the quantity of grains to be poured into rotating stone with the help of wooden piece depending upon the speed of rotation of grinding stone (Fig. 7).

6. Water outlet channel

This channel is mainly made up of stones. After rotating the shaft, incoming water moves out to next gharat or in the perennial nalla. This channel is mainly built beneath the main rotatory shaft. In the center of this channel, a small opening is made with the provision of opening and closing with wooden plate whenever needed. Local respondents reported that when they do not have to operate their gharat, they divert the entire flow of water through this opening in the perennial nalla (Figs 8A&B).

7. Shed to cover traditional water mill/gharat

All the owners of these traditional water mills raise shed to cover each and every part of their traditional unit to protect it from rain and snowfall. A small shed is also raised along with main shed to keep the food grains for grindings, fire place for cooking their meal and other belongings including bedding. This shed is mainly made up of locally available stone, clay and wood. Walls are made up of stone and clay. Roof is made up of wooden planks of chir (Pinus roxburghii) tree. Wooden supports are also made up of chir tree. These gharats are mainly located at the slopes to utilize the gravity of falling water.

Economics of traditional water mills

On daily basis these traditional water mills grind on an average two to two and half quintal of grains by
obtained from electric and more nutritious and tasty as compared to flour that maize flour of maintenance. Moreover, local inhabitants reported negligible running cost, eco-friendly, requires less modification and preservation in order to increase livelihood in the remote hilly areas.

Advantages of these traditional water mills
Local inhabitants reported that during severe winter months and abnormal weather situation regular electric power supply gets interrupted for longer duration at a stretch, then under such conditions these gharsats are the only source of grinding grain especially maize in hilly areas. Besides farming, these gharsats also act as source of additional income to farm families. These gharsats are cost effective having negligible running cost, eco-friendly, requires less maintenance. Moreover, local inhabitants reported that maize flour of gharsats possesses more shelf life and more nutritious and tasty as compared to flour obtained from electric attachaki.

Constraints
Respondents reported number of constraints associated with these traditional water mills. Erratic rainfall and snowfall due to climate change results in decreasing the water flow in perennial nallas which affects the continuous functioning of these traditional watermills. Moreover this traditional profession is confined to elderly people in the areas because they possess the skill of preparing these traditional water mills but next generation of rural youth is less interested in carrying out this sustainable & remunerative traditional profession.

Conclusion and Suggestions
On the basis of different observations and detailed discussion held with ghara owners/operators, it is concluded that these traditional water mills are acting as source of livelihood for the resource poor farmers of hilly region besides farming. These conventional water mills are the sustainable and eco-friendly source of energy in the form of flowing water in hilly areas. This traditional profession of gharsats requires modification and preservation in order to increase their utility. This hydro-power through traditional water mills should also be exploited for other purpose in hilly areas besides grinding of maize and wheat grains such as running of cloth sewing machines, running of hair clipping machines for goats and sheeps in hilly areas, maize grain extractor, extraction of oil from rapeseed mustard also with little modification in its existing structure. Improved structure can generate employment opportunities in the rural hilly area of the region. Incentives should be provided by the concerned stakeholders for the construction and improvement of existing traditional water mills so that this sustainable source of energy may become ever flourishing. Participation of local people should be ensured for reviving these traditional water mills.

Acknowledgement
Authors highly acknowledge all the owners/operators (Gharsatas) of these gharsats namely Hari Chand, Krishan Chand, Jaffu, Ramesh Lal, Bishan Dass, Bhag Mal for providing the valuable information concerned with different local material used in the construction of these traditional water mills, about their functioning and utility. Apart from these authors are also grateful to the local inhabitants namely Bimla Devi, Tarsem Lal, Chunni, Mukesh for their interaction regarding the importance and utility of these gharsats in their day to day life.

References
8. Improved water mill, Search Results, NET browsed on 05, Jan, 2018.


