



# New Paddy Parboiling Technique for Drudgery Reduction in Farm Women

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## ABSTRACT

Paddy parboiling is one of the tedious tasks done by female workers. Traditional method of paddy parboiling by using traditional utensil is fatigue, consumes time and output is also very low. Different manual paddy parboiling techniques have been developed by various research centres and use of paddy parboiling drum is one of them. Keeping this in view, Krishi Vigyan Kendra, Mayurbhanj-1 had conducted demonstration on paddy parboiling drum for drudgery reduction of farm women and compared its performance with traditional method of parboiling by traditional utensils. Ten female subjects each were selected from two village in the age group 25-45yr. The mean value of working heart rate was observed to be 112 and 111 beats/min under traditional method of paddy parboiling whereas 102 and 103 beats/min in NRRI paddy parboiling drum in Kadalibadia and Gundihudi villages, respectively. The output was observed to be maximum 68 and 69kg/hr in NRRI paddy parboiling drum whereas 37 and 35.5kg/hr in traditional method of paddy parboiling for both the village in Mayurbhanj district. The energy expenditure in paddy parboiling by NRRI paddy parboiling drum was same for two villages i.e 8.61kj/min and traditional method was 5.43 and 3.681 kJ/min respectively in two villages. Hence, from drudgery aspect and output point of view NRRI paddy parboiling drum was better than that of traditional method of paddy parboiling utensils.

**Key Words:** Drudgery, Energy, Expenditure, Output, Paddy parboiling.

## INTRODUCTION

Rice (*Oryza sativa*) is considered as the major staple food of the half of the world and major energy giving nutrients to the body. And about half of the total paddy in the world is parboiled (Miah *et al*, 2002). Parboiling is the hydro thermal treatment given to paddy before milling stage and it includes the pretreatment process like soaking, steaming and drying. Hydro thermal treatment is given to gelatinize the paddy starch (Das *et al*, 2004) which improves some of the properties of the paddy and makes it easier for dehusking. The prime objective of the parboiling is the removal of the husk during milling. It is a well-developed pre-milling treatment which achieves more head-to-head rice yield and lowers down the breakage of the grain. It also improves the nutritional quality and cooking quality of the rice as compared to raw rice. Parboiled rice

takes longer time to cook the desired softness than that of raw rice along with this it also takes double time and required double amount of water to attain the same level of softness during cooking (Kumar *et al*, 2018).

Farm women involved in most of the agriculture and allied activities including sowing, transplanting, weeding, fertilizer application, thinning, plant protection and post harvesting. Unsafe, unhealthy, hazardous and long hours work with their traditional tools affect their health status (Nag and Nag, 2004). Rice is the staple food of the people in tribal dominated Mayurbhanj district and there is strong consumer preference for parboiled rice. In the family, this tedious job of parboiling is done by the farm women by using traditional utensils like *dekchi*, *handa* and *Kadhei* in small batches. In traditional utensils the paddy will not be parboiled

## Bhuyan

uniformly, broken percentage of the paddy is more and the women conceived physical strain to their hand, arm, palm and the steam also affects their face and hand. Hence, looking to this problem and for reducing drudgery and health hazards, National Rice Research Institute, Bidyadharpur, Cuttack developed a Paddy parboiling drum for parboiling of paddy. Krishi Vigyan Kendra, Mayurbhanj-1 demonstrated this technology among the farm women of the village Kadalibadia and Gundihudi for the year 2018-19 and 2019-20 respectively.

### MATERIALS AND METHODS

This demonstration was conducted at the farmer's field in village Kadalibadia and Gundihudi during *kharif*, 2018 and 2019-20 in Shyamakhunta block of Mayurbhanj district during the months of December and January by selecting 20 farm women of both the villages aged between 25-45 yr with normal health and without any major illness.

### NRRI Paddy Parboiling drum

The paddy parboiling drum is made up of galvanized iron sheet of 29 gauge thickness with a lid and divided into three equal portions. The top two-third portion retains paddy for parboiling and bottom one-third portion holds water to produce steam for parboiling. A perforated slanting sheet with perforated pipes separates the steam chamber from parboiling chamber. The lateral perforated pipes attached to the main steam pipe divides the entire parboiling chamber into a number of small compartments and helps for uniform and simultaneous parboiling of paddy. Perforated sloping floors helps for natural unloading of parboiled paddy. The water in the drum can be heated by burning fire wood and agricultural waste. After completion of the parboiling process the remaining hot water can be reused for the next batch.

### Traditional method

The traditional process consists of soaking



Parboiling of Paddy by NRRI paddy parboiling drum during 2019-20



Parboiling of Paddy by NRRI paddy parboiling drum during 2018-19



## New Paddy Parboiling Technique

**Table 1. Anthropometric dimensions of farm women involved in sunflower threshing (n= 20)**

Parameter	Mean	
	Kadalibadia, 2018	Gundihudi, 2019
Age (yr)	30.5	29.5
Height(cm)	153.2	153.0
Weight(kg)	48	48.5
BMI(kg/m <sup>2</sup> )	20.5	20.7

paddy in water at room temperature for 24-48 hr. or more steaming in utensil (handa) under atmospheric pressure and drying under sun light. In a single boiling method paddy is soaked in ordinary water for 24-72hr. and then steamed. In double boiling method steam is first injected in to raw paddy in the steaming utensil before soaking. Hot paddy raises the temperature of soaking water to 45-50°C which helps to reduce the soaking time to 24hr. Then the soaking paddy is taken out and steamed again.

### Heart rate

Heart rate was recorded using a digital heart rate monitor. In the morning resting heart rate (RHR) of the respondent was recorded and after completion of the activity working heart rate (WHR) was recorded.

### Energy expenditure rate

From the average values of heart rate energy expenditure was calculated with the help of formulae given by Varghese *et al* (1994) which is as follows

$EER (kJ/min) = 0.159 \times HR (\text{beats/min}) - 8.72$  where  
 EER = Energy expenditure rate (kJ/min); HR = Heart rate (beats/min)

### Cardiac cost at work

Cardiac cost at work (beats) = Average heart rate (AHR) x duration of activity

Where, AHR = Average working HR – Average resting HR (beats/min)

The detailed demonstration programme conducted at KVK, Mayurbhanj-1 for the year 2018-19 and 2019-20 is given in Fig. 2 to Fig. 5. The significance of difference in terms of their performance parameters and ergonomic parameters were compared by using paired 't' test.

## RESULTS AND DISCUSSION

The average age was found to be as 30.5 and 29.5 yr during the year 2018 and 2019, respectively. The basic body dimensions were measured and averages were worked out as height (153.2 cm and 153.0 cm), weight (48 and 48.5 kg) and BMI (20.5

**Table 2. Performance parameters while parboiling of paddy with traditional and improved.**

Parameter	Kadalibadia, 2018			Gundihudi, 2019		
	Traditional parboiling	NRRI paddy parboiling drum	't' value	Traditional parboiling	NRRI paddy parboiling drum	't' value
Output (kg/hr)	37	68	1.68	35.5	69	1.12
Labour required (Man-hour/q)	9.5	4.5	3.19*	10	4.2	1.58

\*Significant at 5 per cent level of significance

**Table 3. Ergonomic parameters while performing Paddy parboiling with traditional and improved NRRI Paddy parboiling drum.**

Parameter	Kadalibadia			Gundihudi		
	Manual Parboiling	NRRI Paddy parboiling drum	't' value	Manual Parboiling	NRRI Paddy parboiling drum	't' value
Average Heart Rate during rest (beats/min)	72	72	0.5	75	74	0.01
Average working Heart Rate (beats/min)	112	102	4.11*	111	103	1.48
Average energy expenditure (kJ/min)	8.61	5.43	1.23	8.61	3.681	1.85
Rate of perceived exertion	Moderately high	Moderate	-	Moderately high	Moderate	-

\*Significant at 5 per cent level of significance

and 20.7) in villages Kadalibadia and Gundihudi, respectively. The BMI of the farm women indicated normal and healthy condition (Table 1).

**Performance evaluation**

The output of paddy parboiling drum was found to be 68 kg/hr while the output of parboiling by traditional practice with handa was only 37 kg/hr in Kadalibadia village. Similarly, the output of paddy parboiling drum was found to be 69 kg/hr and 35.5 kg/hr in traditional method in Gundihudi village, and were non-significant. Paddy parboiling drum also saved 5man-hour/q than traditional practice at Kadalibadia village, which was significant at 5% level of significance and saved 5.8 man-hour/q at Gundihudi village which was non-significant.

**Ergonomic evaluation**

The average heart rate during resting period was found almost similar in case of NRRI paddy parboiling and their traditional practices such as 72beats/min in Kadalibadia village but in Gundihudi village resting heart rate was of 74 beats/min by using NRRI paddy parboiling drum and 75 beats/min in traditional method of parboiling (Table 3).

The average working heart rate was observed as 102 and 112 beats/min in case of NRRI Paddy parboiling drum and traditional method of parboiling in Kadalibadia village. There was a significant difference of average working heart rate between two methods of parboiling. Whereas, in Gundihudi village it was 103 and 111 beats/min respectively in case of NRRI Paddy parboiling drum and traditional

**Table 4. Comparisons health hazards in NRRI Paddy parboiling drum and traditional.**

Health hazard	Manual Parboiling				By NRRI Paddy parboiling drum			
	Kadalibadia		Gundihudi		Kadalibadia		Gundihudi	
	Yes	No	Yes	No	Yes	No	Yes	No
Hand Pain	70	30	70	30	5	95	11	89
Shoulder Pain	80	20	82	18	12	88	10	90
Backache Pain	70	30	69	31	11	89	8	92
Palm injury	75	25	79	21	8	92	8	92
Face injury	76	24	80	20	7	93	9	91

## New Paddy Parboiling Technique

practices and found non-significant difference at both 5% level of significance. By the use of NRRI Paddy parboiling drum the farm women of both Kadalibadia and Gundihudi village found moderate rate of perceived exertion compared to moderately high in traditional method.

The average energy expenditure by using NRRI Paddy parboiling drum for parboiling paddy was found to be 5.43kJ/min while in traditional practice it was 8.61kJ/min in Kadalibadia village whereas 8.61 kJ/min and 3.681 kJ/min in case of NRRI Paddy parboiling drum and traditional method in Gundihudi village and there was non-significant difference of average energy expenditure in both the villages.

The data (Table 4) revealed that in traditional practice the percentage of respondents of both Kadalibadia and Gundihudi village reported the occurrence of hand pain (70%,70%), shoulder pain (80%, 82%), backache pain(70%, 69%) and palm injury (75%, 79% ) whereas during parboiling through NRRI paddy parboiling drum the occurrence of hand pain (5%, 11%), shoulder pain (12%,10%), backache pain (11%, 8%), palm injury (8%, 8%) and face injury (7%,9%) respectively. With the use of improved implement farm women found light rate of perceived exertion as compared to traditional method.

### CONCLUSION

Mayurbhanj is a tribal district where there is huge demand of parboiled rice throughout the district. Manual method of parboiling of rice is a time consuming and strenuous operation. Paddy parboiling by NRRI paddy parboiling drum reduces drudgery and strain, along with this the

fuel consumption is also low as compared to the traditional method of parboiling. After milling the breakage percentage was also lower as compared to traditional parboiling practice. Hence, it can be concluded that the NRRI paddy parboiling drum was found to be more effective in reducing the drudgery of farm women, more parboiling efficiency and labour requirement is lower than their traditional practice. Along with this it also reduced the health hazards like hand pain, shoulder pain, backache and waist pain of majority of the respondents. Majority of the farmwomen perceived NRRI paddy parboiling drum as most suitable and convenient women friendly equipment for parboiling of paddy.

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