



## Evaluation of Proximate, Chemical and Functional Properties of Paddy for Suitability of Flaked Rice (*Paha*)

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### ABSTRACT

For the investigation three varieties of paddy in Chhattisgarh Zinc rice, Dokra-Dokri and Mahamaya, were experimented in order to determine the important proximate, chemical and functional properties. Moisture content, fat content, fibre content, protein content and ash content were determined as its proximate analysis of paddy. Similarly, starch, amylose and amylopectin as chemical properties and water absorbing index, water solubility index and swelling power were determined as functional properties. All varieties has different proximate composition, for moisture content of Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya 11.05 to 11.55 % (wb), for fat content 3.25 to 3.62 %, for fiber content 2.59 to 3.74 %, for protein content 3.74 to 5.48 % and for ash content 1.00 to 1.07 % was observed among all paddy varieties respectively. The starch, amylose content and amylopectin of three different rice varieties were observed 74.06 to 75.53 %, 20.11 to 24.68 % and 75.32 to 79.89 % respectively. And for functional properties of rice it was ranged between 2.46 to 2.51%, 2.94 to 3.98% and 6.15 to 6.22 taken as water absorbing index, water solubility index and swelling power of following three rice varieties.

**Key words:** Paddy, Raw rice, Characteristics of paddy, Properties of paddy.

### INTRODUCTION

The grain, called rice (*Oryza sativa* L.) for more than 8000 years, has been the companion of human kind. It is the most important food commodity in Asia, particularly in South and South-East Asia, where more than 90 per cent of rice is produced and consumed. Paddy (*Oryza sativa* L.) is one of the most important staple food crops which is a major source of

nutrients in many parts of the world. Paddy is second largest major cereal crop a member of grass family (Graminaceae), which produces starchy seeds. Rice is used as an important staple food by the people in many parts of the world after wheat. Rice is used as a source of nourishment for more than half of the world's population, thus, making it as second most important cereal grain<sup>4</sup>.

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Rice contributes about 60–70% of total calories and one-third of daily protein requirement, not only as a dietary staple but also as a convenience food in the form of expanded (puffed) rice, as breakfast cereal, snack foods, multigrain flakes, puffed, popped, flaked, and extruded products. As staple food it plays an important role in the economy of India hence occupies a central position in agricultural policy making<sup>3</sup> and used as an important source for number of industrial products like whole rice, rice starch, rice bran oil, flaked rice, puffed rice and rice husk etc.

## MATERIAL AND METHODS

### 2.1 Proximate analysis

$$\text{Nitrogen (\%)} = \frac{14.01 \times (\text{SR} - \text{BR}) \times 0.1 \times 100}{1000 \times W_s} \quad \dots 13$$

$$\text{Protein (\%)} = N \times 6.25 \quad \dots 14$$

#### 2.1.2 Fat content

Crude fat was determined by using the soxlet apparatus<sup>2</sup>. Oven dry beaker and sample at 100°C for half hours. Keep them in desiccators to avoid moisture content gain from the atmospheres. Weight the beakers and note the reading as initial weight. Carefully weight 5 gm of sample flour and keep in cellulose thimble. The thimble was then place in a

$$\text{Fat content (\%)} = \frac{W_2 - W_1}{W} \times 100 \quad \dots 15$$

#### 2.1.3 Ash content

Ash content was determined according to<sup>1</sup> procedure. 1 g of sample was taken in a silica crucible and weighted. It was made to ash in a

$$\text{Ash content (\%)} = \frac{W_2 - W_1}{W} \times 100 \quad \dots 16$$

#### 2.1.4 Fiber content

Crude fiber was determined by using the fibra plus apparatus<sup>8</sup>. Oven dry crucible and sample at 100°C for half hours. Keep them in desiccators to avoid moisture content gain from the atmospheres. Weight the crucibles

#### 2.1.1 Protein content

Nitrogen (N<sub>2</sub> %) of brown rice samples was estimated by using auto Kjeldahl equipment (Kel plus, pelican system, India). Digestion of brown rice (0.5 g sample) was carried out in the auto Kjeldahl equipment at 420°C for 2.30 hours. The digested sample obtained was distilled with 40% NaOH (sodium hydroxide) and 4% boric acid. The vapor of ammonia obtained after distillation was collected in boric acid (distillation time approximately 7 min.) and then titrated against 0.1 N HCL (hydrochloric acid). The percentage OF N<sub>2</sub> of brown rice sample was calculated by using the following equation<sup>7</sup>.

beaker and beaker is filled with petroleum ether (boiling point 40-60°C) about 80 ml of beaker. Then beaker is now place in soxlet apparatus with thimble for 2 h at 90°C. the ether was then removed by evaporation and the beaker with residue in an oven at 105°C for 30 min., cooled in desiccators and weight. The percentage of oil was calculated by using following equation.

muffle furnace at 600°C for 4 hours. The crucible was cooled in the desiccators and weighted, and the value of ash content was calculated by using the following equation

and note the reading as initial weight W. Carefully weight 2 gm of sample grind flour and keep in crucible. The crucible was then place in a fibra plus apparatus. And after that, the 1.25 % sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) is filled from top of the apparatus up to the 150 ml of

crucible. And sample is boiled in apparatus at 400°C for 40 minutes. After completion the acid wash drain the acid and wash the sample twice and thrice with distilled water. During drainage ensure that the knob is in vacume mode. After acid wash similar process is done. The 1.25 % NaOH (sodium hydroxide) is filled from top of the apparatus up to the 150 ml of crucible. And sample is boiled in apparatus at again 400°C for 40 minutes. After completion the acid wash drain the acid and wash the sample twice and thrice with distilled

water. During drainage ensure that the knob is in vacume mode. After alkali wash take out crucibles and dry them in a hot air oven until the crucible are free from moisture. cooled in desiccators. Weight the crucible and record the reading as W1. Place all the crucibles in muffle furnace at 600°C for ashing. Cool down the hot crucible after ashing to room temperature using a desiccators. Now weight the crucible and record the reading as W2. The fiber content of sample is calculated by using following equation.

$$\text{Fiber content (\%)} = \frac{W1 - W2}{W} \times 100 \quad \dots 16$$



Fig. 2.1: Varieties of paddy- 1) Chhattisgarh Zinc rice, 2) Dokra-Dokri, 3) Mahamaya

## 2.2 Chemical properties

### 2.2.1 Starch content

Starch is an important polysaccharide. Starch, which is composed of several glucose molecules, is a mixture of two types of component namely amylose and amylopectin. Starch is hydrolysed into simple sugar by dilute acid and the quantity of sample sugar is measured colorimetrically.

A 500 mg sample of grind powder of each grain variety was weighted and kept in a centrifuge tube and homogenised the sample in hot 80% ethanol to remove sugar. Centrifuged at 600 rpm for 5 minutes at 25°C and retained residue<sup>8</sup>. Washing the residue repeatedly with hot 80% ethanol till the washing did not give the color with anthrone reagent. In dried sample of residue 5.0 ml of distilled water and

6.5 ml of perchloric acid were added and centrifuged at 6000 rpm for 20 minutes at 0°C and supernatant was saved, the centrifuge of the sample was repeated with perchloric acid and distilled water and supernatant were saved and diluted sample with volume makeup with 100 ml distilled water. After that, pipette out 0.2 ml of supernatant and make up the volume to 1 ml with distilled water in each tube 4 ml of anthrone reagent was added carefully and also 4 ml anthrone reagent was added in standard solution prepared by taking 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1.0 ml of working standard of glucose with makeup 1 ml distilled water solution. Heated up 8 minute in boiling water bath and cooled down rapidly and read the intensity of green to dark color at 630 nm.

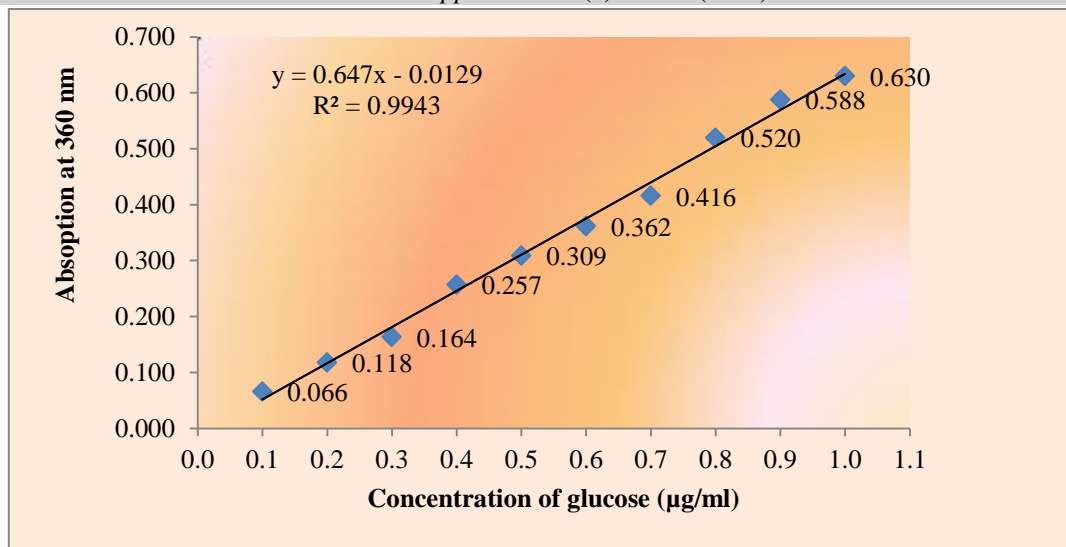


Fig. 2.2: Standard graph of glucose solution using anthrone reagent

### 2.2.2 Amylose content

Starch is composed of two compound namely amylose and amylopectin. Amylose is a linear or non branched polymer of glucose. The glucose units are joined by  $\alpha$ -1-4 glucosidic linkage.

A 100 mg of grind powdered sample of each grain variety was weighted and put into a conical flask and 1 ml of distilled ethanol and 10 ml of 1N NaOH were added<sup>8</sup>. Then the sample was heated in boiling water bath at 100°C for 10 minutes. 100 ml volume was made up by adding distilled water. 2.5 ml of the extract was taken then 20 ml distilled

water and 3 drops of 0.1 % phenolphthalein were added. 0.1 N HCL solution was added drop by drop until the pink color is disappeared. After that 1 ml of iodine reagent (KI solution) was added and 50 ml volume was made up by adding distilled water then the color of solution was read at 590 nm. The blank solution was prepared by diluting 1 ml iodine reagent into 50 ml distilled water. A standard graph of amylose content was developed by taking the color of standard amylose solution at 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9 and 1 ml concentration and read the intensity of color at 590 nm.

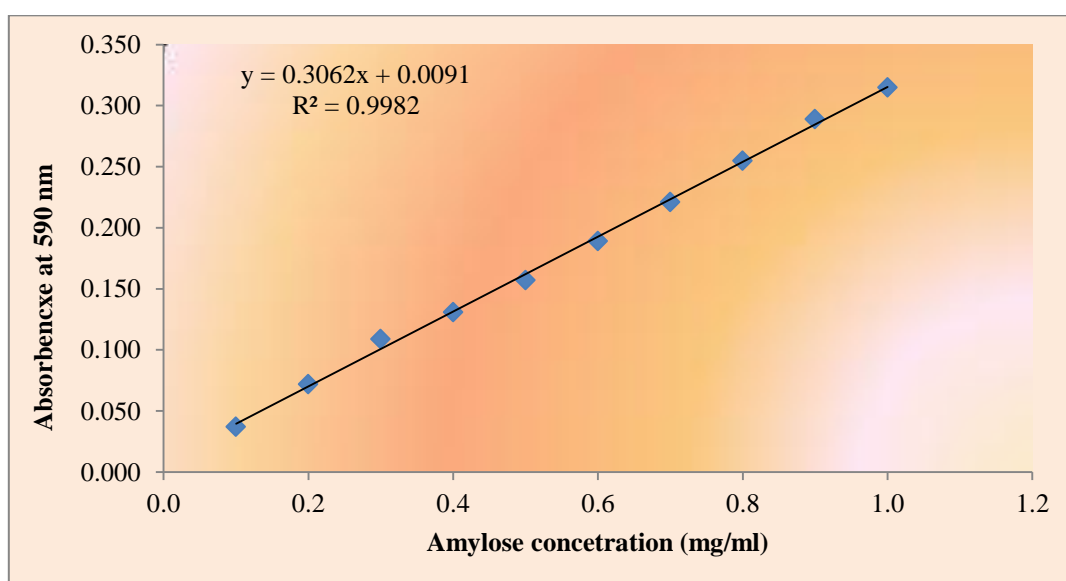


Fig. 2.3: Standard graph of amylose using iodine reagent

## 2.3 Functional properties

### 2.3.1 Water absorbing index (WAI) and water solubility index (WSI)

One gram sample taken in centrifuge tube was added with 10 ml distilled water and agitated for 30 min followed by its centrifugation at 3000 rpm for 25 min. The decanted centrifuged tube with settled gel at

$$\text{WAI (g/g)} = \frac{\text{Weight of gel}}{\text{Dry weight of sample}} \quad \dots 10$$

$$\text{WSI (\%)} = \frac{\text{Weight of dry solid in supernatant}}{\text{Dry weight of sample}} \quad \dots 11$$

### 2.3.2 Swelling power

The swelling power of rice flour sample was determined by measuring water uptake of sample<sup>5</sup>. The 500 mg of rice flour was weighted into centrifuge tube and 15 ml of distilled water was added. The suspension was heated in water bath at 80°C for 30 min. and

$$\text{Swelling Power (g/g)} = \frac{W_{ws}}{W_f - W_t} \quad \dots 12$$

## RESULT AND DISCUSSION

### 3.1 Proximate analysis

The initial moisture content of the paddy varieties namely Chhattisgarh Zinc Rice, Dokra-Dokra and Mahamaya at the time of experiment was 11.55 ± 0.38 % (wb), 11.31 ± 0.39 % (wb), and 11.05 ± 0.20 % (wb).

the value of fat content for Chhattisgarh Zinc Rice, Dokra-Dokra and Mahamaya paddy varieties was varies between 3.43 to 3.73 %, 3.20 to 3.58 % and 3.04 to 3.38 % respectively. The fat content was nearly same in all the selected varieties and not shown a big difference.

The fiber content of Chhattisgarh Zinc Rice, Dokra-Dokra and Mahamaya paddy varieties lies between 3.24 to 4.22 %, 1.26 to 4.27 % and 3.24 to 4.21 % respectively. The

the base was weighed and used in calculation of WAI (Eq. (8)). The supernatant obtained during WAI estimation was used to determine WSI by decanting it into a pre weighed evaporating dish whose final weight after oven drying at 103°C was recorded and used in the calculation of WSI by using Eq. (9)<sup>9,6</sup>.

then centrifuge at 4000 rpm for 20 min. the supernatant was carefully poured into aluminum dish (of known weight) before drying at 105°C to constant weight and weighing. The sediment was collected and weighed. The swelling power was calculated by using following equation.

fiber content was higher in Chhattisgarh Zinc Rice paddy variety and the lower value of fiber content in Dokra-Dokra paddy variety.

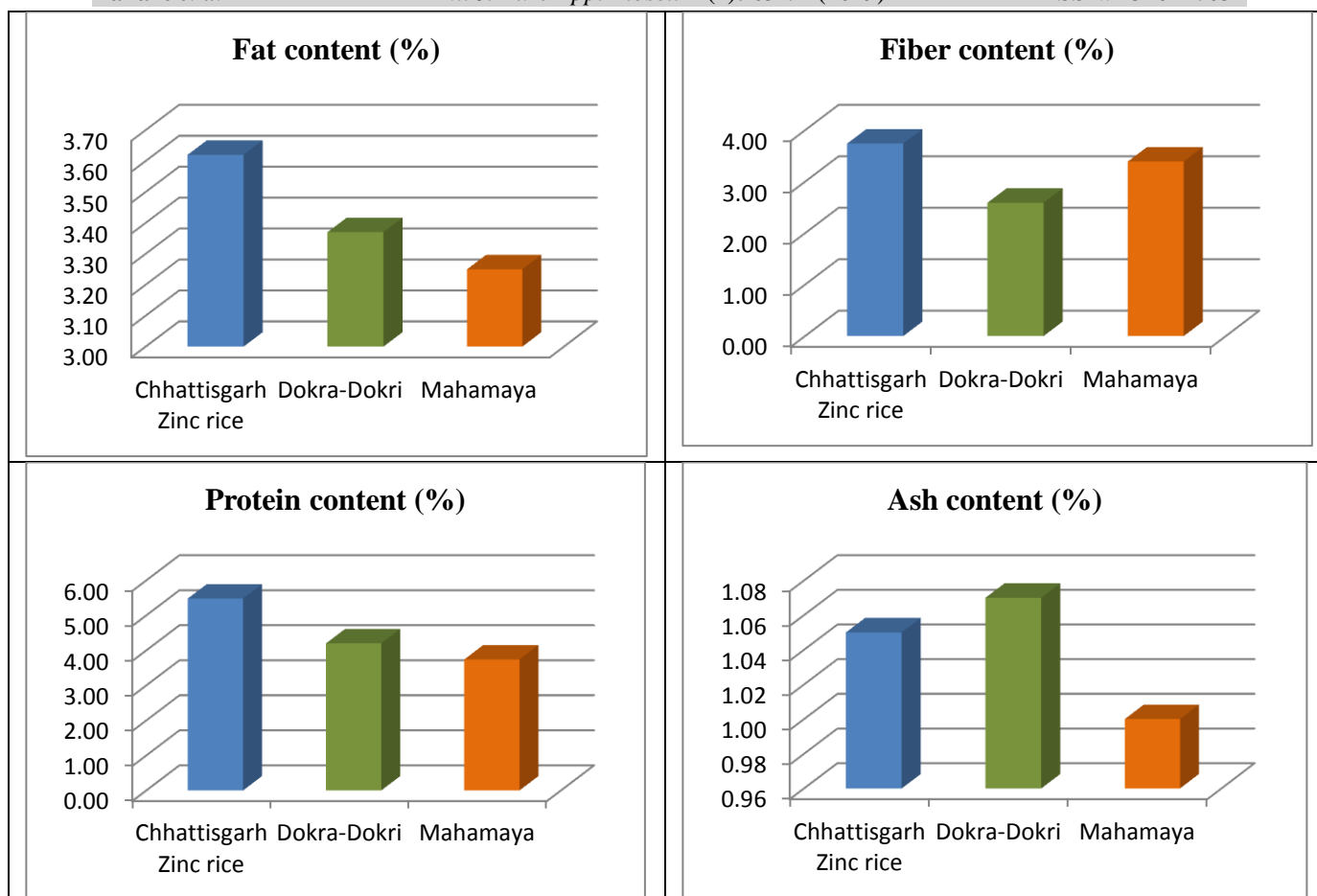
the protein content of Chhattisgarh Zinc Rice, Dokra-Dokra and Mahamaya paddy varieties lies between 5.05 to 6.06 %, 4.04 to 4.32 % and 3.49 to 3.86 % respectively. The protein content was higher in Chhattisgarh Zinc Rice paddy variety and the lower value of protein content in Mahamaya paddy variety.

The ash content of Chhattisgarh Zinc Rice, Dokra-Dokra and Mahamaya paddy varieties lies between 0.95 to 1.15 %, 1.00 to 1.15 % and 0.95 to 1.05 % respectively. The ash content was higher in Dokra-Dokra paddy variety and the lower value of ash content in Mahamaya paddy variety (Table 4.4).

**Table 4.4: Proximate composition of different varieties of rice**

Parameters	Zinc rice	Dokra-Dokra	Mahamaya
Moisture content (%)	11.55 ± 0.38	11.31 ± 0.39	11.05 ± 0.20
Fat content (%)	3.62 ± 0.17	3.37 ± 0.19	3.25 ± 0.18
Fiber content (%)	3.74 ± 0.49	2.59 ± 1.15	3.39 ± 1.03
Protein content (%)	5.48 ± 0.52	4.20 ± 0.14	3.74 ± 0.21
Ash content (%)	1.05 ± 0.10	1.07 ± 0.08	1.00 ± 0.05

Mean ± Standard deviation values



**Fig. 3.1: Graph representation of proximate analysis of three different varieties of paddy**

### 3.2 Chemical properties of rice

The starch content of Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya rice varieties lies between 75.19 to 81.49 %, 73.89 % to 88.29 % and 73.59 % to 77.69 % respectively. The value of starch content was found higher in Dokra-Dokri and the lower value was found in Mahamaya rice variety. The amylose content of Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya rice varieties lies between 23.15 to 24.79 %, 18.91 to 21.20 % and 24.13 to 25.44 % respectively. The value of amylose content was found higher in Mahamaya and the lower in Dokra-Dokri rice variety. The values of amylopectin content in Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya rice varieties lies between 75.20 to 76.85 %, 78.80 to 81.09 % and 74.56 to 75.87 % respectively. The value of amylopectin was higher in Dokra-Dokri rice variety and lower in Mahamaya rice variety (Table 4.5).

### 3.3 Functional properties of rice

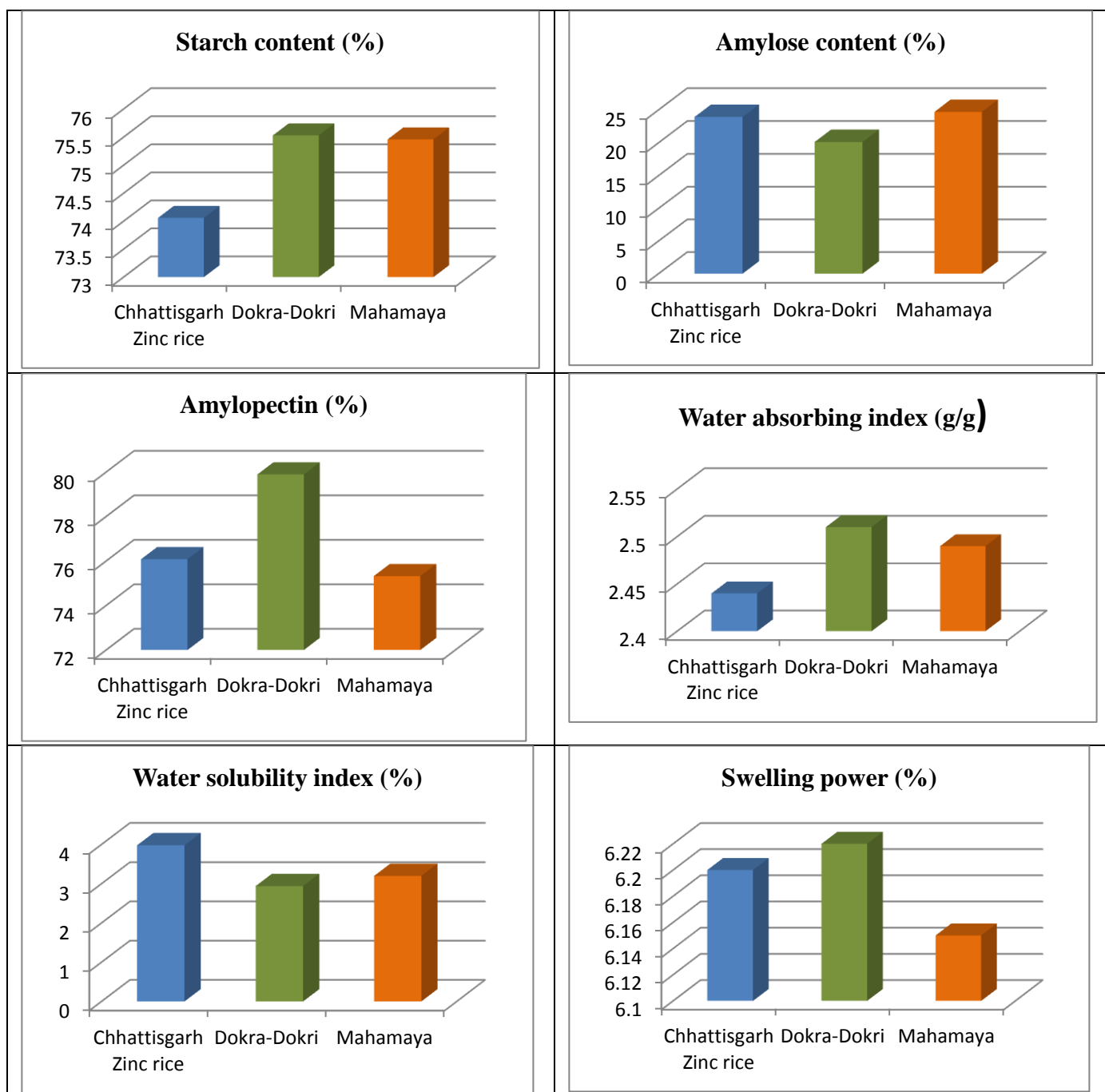
The water absorbing index (WAI) of Chhattisgarh Zinc Rice, Dokra-Dokri and

Mahamaya rice varieties lies between 2.23 to 2.70 g/g, 2.19 to 2.85 g/g and 2.35 to 2.63 g/g respectively. The water absorbing index (WAI) was higher in Dokra-Dokri variety or rice and the lower in Chhattisgarh Zinc Rice. The water solubility index (WSI) of Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya rice varieties lies between 3.00 to 5.05 %, 2.25 to 3.40 % and 2.98 to 3.37 % respectively. The water solubility index (WSI) was higher in Chhattisgarh Zinc Rice and the lower value in Dokra-Dokri rice variety. The water swelling power (SP) of Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya paddy varieties lies between 6.16 to 6.25 %, 6.11 to 6.30 % and 6.12 to 6.17% respectively. The swelling power (SP) was higher in Dokra-Dokri paddy variety and the lower value of swelling power (SP) in Mahamaya and Chhattisgarh Zinc Rice paddy variety (Table 4.5).

**Table 4.5: Chemicals and functional properties of different varieties of paddy**

Parameters	Zinc rice	Dokra-Dokri	Mahamaya
Starch content (%)	74.06 ± 3.20	75.53 ± 4.61	75.46 ± 2.07
Amylose content (%)	23.92 ± 0.82	20.11 ± 1.15	24.68 ± 0.68
Amylopectin (%)	76.08 ± 0.82	79.89 ± 1.15	75.32 ± 0.68
Water absorbing index (g/g)	2.44 ± 0.24	2.51 ± 0.33	2.49 ± 0.14
Water solubility index (%)	3.98 ± 1.03	2.94 ± 0.61	3.20 ± 0.20
Swelling power (%)	6.20 ± 0.04	6.22 ± 0.10	6.15 ± 0.03

Mean ± Standard deviation values



**Fig. 3.2: Graph representation of chemical and functional properties of three different varieties of paddy.**

**CONCLUSION**

This investigation into the properties of grains gives rise to a number of conclusions. This study concludes with information on proximate, chemical and functional properties of Chhattisgarh Zinc Rice, Dokra-Dokri and Mahamaya paddy variety which may be useful for developing much more better quality of flaked rice (*poha*). For developing of flaked rice it has been necessary that the flaked rice show higher or good result is some quality parameter like fat content, fibre content, protein content, starch content, water absorbing/solubility index and swelling power. In this investigation we found in case of proximate analysis the Chhattisgarh Zinc rice and Dokra-Dokri paddy varieties gives good or higher result in terms of fibre content and protein content at almost same moisture content but it has been also observed all three variety of paddy gives almost same result for fat content. Similarly, investigation on chemical and functional properties we found that Dokra-Dokri and Chhattisgarh Zinc rice paddy varieties gives good or higher result in terms of starch content, water absorbing index and swelling power as compare with Mahamaya paddy variety.

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