



## RESEARCH PAPER

# Development and evaluation of barnyard millet instant *dosa* mix

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**Abstract :** Instant mixes offer great convenience to the homemakers to prepare traditional delicacies. It reduces the time and drudgery associated with the preparation. The present study aimed to at standardization of barnyard millet instant *dosa* mix. The impact of barnyard millet flour incorporation on sensory characteristics and shelf life of instant *dosa* mix was studied. Instant barnyard *dosa* mix with 50 per cent of barnyard millet flour was finalised and assessed for shelf life. The particle size distribution of barnyard millet *dosa* mix and cooking characteristics of best accepted variation was carried out using standard procedures. The results revealed that, as millet flour increased, the thickness of *dosa* decreased and diameter was increased, resulting in increased spread ratio. The nutrition composition of 100 g barnyard millet instant *dosa* mix contains 9.50 % moisture, 12.67 % protein, 2.64 % fat, 1.81 % crude fibre, 2.57 % ash, 72.62 % carbohydrates, 4.93 mg of iron, 2.21 mg of zinc and 23.94 mg of calcium. From storage study it is evident that the barnyard millet instant *dosa* mix stored in food grade aluminum foil pouches at ambient temperature can be stored for four and half months.

**Key Words :** Barnyard millet, instant *dosa* mix, shelf life, Organoleptic evaluation

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## INTRODUCTION

In the processed food segment, the instant food products have occupied a significant shelf space in the retail outlets in India. Food manufacturers through instant food products have offered high quality food choices which have been unimaginable to ancestors. Instant food mixes made a wide range of suitable food for households, being convenient to use without any further processing and women find it easy to use. It assisted them to save

time and effort and also reduce the tiresome job of gathering various ingredients, cleaning and preparing food.

Barnyard millet is a fastest growing crop as compared to other millets. It is a multipurpose crop, thrives well even under adverse agro climatic conditions. Barnyard millet is main crop (among millet) of North Western Himalayan Region (NWHR) of India, and is popularly known as Jhingura. It is also known as 'sawa' millet. It is important minor millet in Japan, China, India

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and other South East Asian countries. In India, its cultivation is restricted to hilly and semi-arid regions of Southern peninsula of Tamil Nadu, Andhra Pradesh, Karnataka and Northern states of Jharkhand and Uttar Pradesh (Veena *et al.*, 2005).

From the nutritional aspect, Barnyard millet is a fair source of highly digestible protein, lipid, vitamins B1 and B2, and nicotinic acid compared with other cereals, such as rice and wheat grains (RCSTA, Japan, 1982). However, barnyard millet shows the highest concentration of iron (40.2 ppm) followed by finger millet (34.15 ppm). The barnyard millet contains carbohydrates which are slowly digestible and a nature's gift for the modern mankind (Ugare, 2008).

Value addition through processing of millets can be explored and commercialised to make them popular among consumers. Instant *dosa* mix is a ready to cook product to overcome the problems faced in the processing of *dosa* batter. It reduces the time, drudgery associated with the preparation. Hence, the present study was done to expand the utility of barnyard millet (*Echinochloa frumentacea*) and to study the impact of millet flour incorporation on sensory characteristics and storage study of instant *dosa* mix.

## MATERIAL AND METHODS

### Raw materials:

Barnyard millet, bold rice, black gram dhal, and other minor ingredients were procured from local market in Dharwad for preparation of instant *dosa* mix.

### Development of barnyard millet instant *dosa* mix:

Barnyard millet and rice were cleaned thoroughly with water and dried in cabinet drier for three hours at  $60 \pm 5^\circ\text{C}$ . Dried barnyard millet, bold rice and other

ingredients were roasted for 2-5 minutes and milled separately into flour.

The standardized recipe for instant rice *dosa* mix from the MSc thesis (2019-20) "Nutrient composition and development of proso millet based *dosa* mix" was employed for standardization of barnyard millet instant *dosa* mix. The variations of instant *dosa* mixes were formulated by incorporating barnyard millet at varying proportions of 40, 50, 60 and 70 per cent.

### Preparation of *dosa* from barnyard millet instant *dosa* mix:

Four compositions were made along with control. To prepare *dosa* batter from 100 g of barnyard millet instant *dosa* mix, 150 – 200 ml of water was added to make a thick flowing batter. Then 25 ml finely churned curd was added. It was mixed well to make a smooth lump free batter and kept for fermentation for 25 minutes. After fermentation, *dosa* was prepared by pouring batter on non stick *tawa*. After it is baked turned upside down and further baked. Based on sensory evaluation best accepted *dosa* mix was selected for further process.

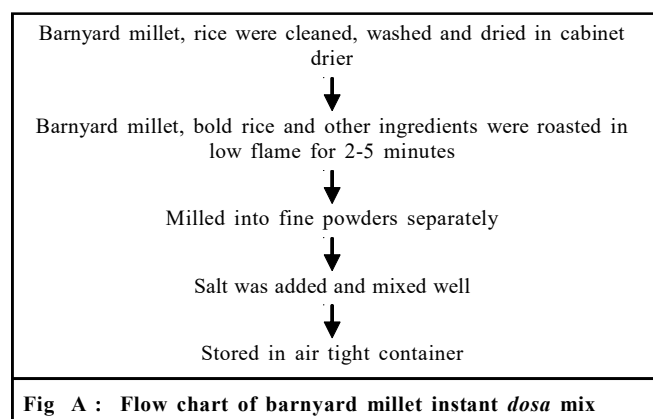
### Evaluation of organoleptic characteristics of *dosa* prepared by barnyard millet instant *dosa* mix:

Barnyard millet *dosa* variations were evaluated by a semi trained panel of ten judges for organoleptic characteristics *viz.*, appearance, texture, flavor, taste and overall acceptability, using 9 point hedonic scale, where 1- dislike extremely, 2- dislike very much, 3- dislike moderately, 4- dislike slightly, 5- neither like nor dislike, 6- like slightly, 7- like moderately, 8- like very much and 9- like extremely. Acceptability index was calculated by totaling up of all the sensory scores of appearance, texture, flavor, taste and overall acceptability and it was divided by maximum score (54) and multiplied by 100.

$$\text{Acceptability index (AI)} = \frac{\text{Total scores}}{\text{Maximum score}} \times 100$$

### Particle size distribution of barnyard millet instant *dosa* mix:

The Particle size distribution of Barnyard millet instant *dosa* mix was carried out using standard procedures. To check the particle size of instant barnyard millet *dosa* mix, 100 g of instant barnyard *dosa* mix was taken and passed through different meshes of BSS standards from 300, 240, 200, 150, 100, 85, 60, 36, 30 and 35 with sieve opening of 53, 63, 75, 105, 150, 180,



250, 420, 500 and 600 microns respectively. The sample was passed from smaller to bigger mesh size. The sieved sample was weighed and recorded.

### Cooking characteristics characteristics of *dosa* prepared by barnyard millet instant *dosa* mix:

Physical characteristics of *dosa* prepared with barnyard millet instant *dosa* mix *viz.*, diameter, thickness, spread ratio cooking time and weight of the cooked product were analysed by taking 50 ml volume of *dosa* batter constant. By using 50 ml of batter *dosa* was prepared, while preparing cooking time of *dosa* was noted. After *dosa* was cooked the weight was measured through weighing balance. Diameter of the *dosa* was checked by measuring scale (or using thread) and thickness measured by vernier caliper. Spread ratio was calculated using following formula:

$$\text{Spread ratio} = \frac{\text{Diameter of the dosa (cm)}}{\text{Thickness of the dosa (cm)}}$$

### Evaluation of nutritional quality of barnyard millet instant *dosa* mix:

Nutrient composition of the barnyard millet instant *dosa* mix was analyzed in the NABL accredited lab at PJTSAU, Hyderabad as it is required for nutrition labeling of commercialized products.

### Storage quality of barnyard millet instant *dosa* mix:

The mix was stored in food grade aluminium foil pouches, drawn every 15<sup>th</sup> day and evaluated for moisture content, free fatty acid content and subjected to sensory evaluation. The procedures are as below.

#### Moisture content:

Moisture was determined by taking about 10g of powdered sample in petri dish and dried in an oven at 105°C till the weight of the petri dish with its content was constant. Each time before weighing, the petri dish was cooled in desiccators. Moisture content of the sample was expressed in g/100g of sample (Anonymous, 2000).

$$\text{Moisture content (\%)} = \frac{\text{Initial weight (g)} - \text{Final weight (g)}}{\text{Weight of the sample}} \times 100$$

#### Free fatty acid content:

Free fatty acids were estimated by using standard procedure given by Sadashivam and Manikam (2008).

#### Sensory evaluation:

The organoleptic evaluation of barnyard millet

instant *dosa* was carried out by using nine point hedonic scale by a panel of 10 semi-trained judges in the Department of Food Science and Nutrition. Further, acceptability index was calculated.

### Statistical analysis:

SPSS statistical software (version 16, SPSS Inc) was used to perform the statistical analysis of the data. Analysis Of Variance (ANOVA) followed by Duncan's multiple range test was performed to determine significant differences. For comparison of two treatment means, t-test was used.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Development of barnyard millet instant *dosa* mix:

The barnyard millet instant rice *dosa* mix was formulated by incorporating barnyard millet at varying proportions of 40, 50, 60 and 70 per cent along with control (Table 1). As the millet proportion increased, addition of water also increased. The sensory scores of barnyard *dosa* mix revealed that *dosa* prepared by 50:20:30 barnyard millet: rice flour: other ingredients variation had the highest acceptability index (85.74) followed by 40:30:30 (83.14), 60:10:30 (80.19) and 70:00:30 (72.41) which is on par with control (82.22) (Fig. 2). The sensory scores of Barnyard millet instant *dosa* mix is presented in Table 2. The most acceptable barnyard *dosa* mix (50:20:30) had the highest scores for appearance (7.90), colour (7.60), flavour (7.40), taste (7.80), texture (7.70) and overall acceptability (8.00). The variation with 70:00:30 of barnyard millet flour : rice flour : other ingredients was significantly lower with respect to flavor, taste, texture and overall acceptability compared to control, 40:30:30, 50:20:30, 60:10:30 and 70:00:30. So instant barnyard *dosa* mix of 50 per cent variation was finalised and kept for shelf life study.

The results of Priyanka and Sudesh (2015) were

**Table 1: Formulations of barnyard millet instant *dosa* mix (per 100 g)**

Composition	Control	V1	V2	V3	V4
Rice flour(g)	70	30	20	10	-
Bamyard millet flour (g)	-	40	50	60	70
Other ingredients (g)	30	30	30	30	30

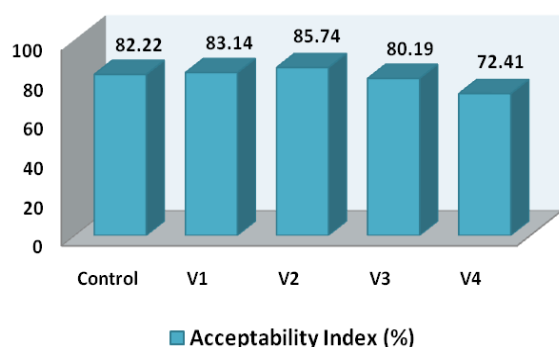
**Table 2: Sensory scores of barnyard millet instant *dosa* mix**

Variation BMF: RF:OI	Appearance	Colour	Flavor	Taste	Texture	Overall acceptability
Control						
0:70:30	7.50±0.71	7.40 ±0.70	7.30 <sup>a</sup> ±0.67	7.40 <sup>a</sup> ±0.70	7.30 <sup>a</sup> ±0.67	7.50 <sup>a</sup> ±0.71
V1						
40:30:30	7.60 ±0.70	7.50 ±0.71	7.30 <sup>a</sup> ±0.82	7.50 <sup>a</sup> ±0.71	7.30 <sup>a</sup> ±0.67	7.50 <sup>a</sup> ±0.71
V2						
50:20:30	7.90±0.32	7.60±0.52	7.40 <sup>a</sup> ±0.70	7.80 <sup>a</sup> ±0.79	7.70 <sup>a</sup> ±0.48	8.00 <sup>a</sup> ±0.82
V3						
60:10:30	7.40 ±0.70	7.30 ±0.67	6.40 <sup>b</sup> ±0.52	6.40 <sup>b</sup> ±0.52	7.30 <sup>b</sup> ±0.48	6.30 <sup>b</sup> ±0.48
V4						
70:0:30	6.43 ±0.52	5.46 ±0.62	5.20 <sup>c</sup> ±0.54	5.80 <sup>c</sup> ±0.77	6.58 <sup>c</sup> ±0.43	5.10 <sup>c</sup> ±0.52
F value	1.18	0.39	4.66	7.86	10.36	11.00
S.Em. ±	0.2	0.21	0.22	0.22	0.18	0.22
CD	NS	NS	0.62*	0.62*	0.53*	0.63*

\*Significant at 5% level (p&lt;0.05), NS: Non-significant

No. of replications: 10

Values in a column followed by different Superscripts are significantly different according to DMRT at the 0.05 level

**Fig. 1: Acceptability index of barnyard millet instant *dosa* mix with different proportions of millet flour**

also on par with the present study where in they reported *dosa* was prepared with 85 g rice, 15 g black gram dhal and 5 g bengal gram brokens gave better *dosa*.

The results reported by Sushmitha *et al.*(2017) are also on par where they reported that instant *dosa* mix was prepared by using Italian millet flour, rice flour and black gram flour in 60: 30: 10 proportions and Italian millet proportion was 60 per cent.

### Particle size distribution of barnyard millet instant *dosa* mix:

Particle size distribution of Barnyard millet instant *dosa* mix is depicted in Table 3. The finalized variation (50:20:30) was subjected to particle size analysis. Highest per cent of the flour (34.046%) passed through the sieve opening of 75 microns followed by 150, 105 and 420 microns. The lowest per cent of the flour (0.048%) passed through the sieve opening of 63 microns.

### Cooking characteristics of *dosa* prepared by Barnyard millet instant *dosa* mix:

Cooking characteristics of *dosa* prepared by

**Table 3: Particle size distribution of barnyard millet instant *dosa* mix**

BSS No.	Microns	Sample weight (%)
300	53	00
240	63	0.048
200	75	34.046
150	105	20.475
100	150	21.804
85	180	7.512
60	250	3.380
36	420	10.730
30	500	2.014
25	600	00

Barnyard millet instant *dosa* mix is presented in Table 4. The results showed that, the spread ratio of control *dosa* was 25.53, which was significantly lower than the variations R1(30.04) , R2 (34.42) and R3 (36.91). As millet flour increased, the thickness of *dosa* decreased and diameter was increased, resulting in increased spread ratio. There was significant difference in weight of the cooked product at p<0.01. The weight of the cooked *dosa* was significantly higher in control variation (48.47) than R1 (47.55), R2 (47.07) and R3 (46.85). As there was increased millet content, the diameter of *dosa* was increased but weight of the *dosa* was gradually decreased. This may be due to less hydration rate of millet flour. Cooking time gets increased gradually as increased millet content.

Similar results were reported by Roopa (2017) who stated that high level of little millet (70%) and lentil flour increased the diameter of the *dosa* and decreased the weight of the *dosa*. Thickness of *dosa* reduced with increment in spread ratio. Cooking time gets decreased gradually with increase in spread ratio.

**Table 4 : Cooking characteristics of *dosa* prepared by barnyard millet instant *dosa* mix**

Variation BMF: RF	Volume of batter (ml)	Diameter (cm)	Thickness (cm)	Spread ratio	Cooking time (min.)	Weight of cooked product
Control 0:70	50	12.34±0.01	0.48±0.01	25.53±0.30	1.23±0.06	48.47±0.05
R1 40:30	50	12.61±0.02	0.42±0.01	30.04±0.68	1.87±0.06	47.55±0.11
R2 50:20	50	12.73±0.02	0.37±0.01	34.42±0.89	2.20±0.10	47.07±0.07
R3 60:10	50	12.78±0.01	0.35±0.02	36.91±1.68	2.27±0.06	46.85±0.08
F value		781.09	94.19	72.29	133.94	249.81
S.Em. ±		0.01	0.01	0.59	0.04	0.05
CD		0.02**	0.02**	1.92**	0.13**	0.15**

### Nutrient composition of the barnyard millet instant *dosa* mix:

Nutrient composition of the Barnyard millet instant *dosa* mix (Table 5) was analysed from the PJTSAU accredited laboratory for nutrition labelling, as it is required for nutrition labeling of commercialized products. It was found that in 100 g sample there is 9.50 % moisture, 12.67 % protein, 2.64 % fat, 1.81 % crude fiber, 2.57 % ash, 72.62 % carbohydrates, 4.93 mg of iron, 2.21 mg of zinc and 23.94 mg of calcium. Protein content was high in barnyard millet instant *dosa* mix due to incorporation of millets.

**Table 5: Nutrient composition of the barnyard millet instant *dosa* mix**

Composition	Percentage
Ash (%)	2.57
Moisture (%)	9.50
Protein (%)	12.67
Fat (%)	2.64
Crude fiber (%)	1.81
Carbohydrates (%)	72.62
Iron (mg)	4.93
Zinc (mg)	2.21
Calcium (mg)	23.94

### Storage quality of instant barnyard millet *dosa* mix: Moisture and free fatty acid content during storage of Barnyard millet instant *dosa* mix :

The moisture and free fatty acid content of the barnyard millet instant *dosa* mix during storage is presented in Table 6. Initially the moisture content was 6.44 per cent. The moisture content was significantly increased from 6.44 to 9.92 per cent on 150<sup>th</sup> day. There was significant increase in the moisture content from initial day to all other storage days. ( $p < 0.01$ ). Storage days increased moisture content in the barnyard millet

instant *dosa* mix and it was within the acceptable limit. The increase in moisture content of all the stored *dosa* mixes may be due to environmental conditions and diffusion of gases and vapour through microscopic pores (Palling 1980). Similar findings were seen in the study of Rathod *et al.* (2019) who reported that increase in moisture content of composite millet mix stored in high density polyethylene was observed from 7.07 to 9.53 per cent and 7.07 to 7.40 per cent in metalized polypropylene package.

**Table 6: Moisture and free fatty acid content during storage of barnyard millet instant *dosa* mix**

Days	Moisture (%)	Free fatty acid content (mg KOH/g)
Initial day	6.44±0.05	0.11
15	6.69±0.17	0.11
30	7.41±0.05	0.12
45	8.62±0.02	0.12
60	8.69 ±0.02	0.12
75	8.88±0.12	0.13
90	8.90±0.07	0.13
105	9.04±0.12	0.13
120	9.45±0.13	0.15
135	9.58±0.04	0.16
150	9.92±0.05	0.17
165	Study discontinued	
F value	501.73	412.00
S.Em±	0.05	0.02
C.D	0.15**	0.05**

Free fatty acid content was 0.11 mg KOH/g on initial day. It was increased significantly to 0.17 mg KOH/g on 150<sup>th</sup> day during storage. However, it was within the permissible limits. Deterioration during storage is mainly related to lipid peroxidation and enzymatic

**Table 7: Sensory scores of *dosa* prepared with barnyard millet instant *dosa* mix during storage**

Trials	Appearance	Colour	Flavor	Taste	Texture	Overall acceptability	Acceptability Index (%)
Initial day	8.30±0.67	8.30±0.82	8.10±0.99	8.10±0.74	8.20±0.63	8.10±0.57	90.93
15	8.10±0.57	8.20±0.42	8.10±0.57	8.30±0.67	7.90±0.57	8.20±0.42	90.37
30	8.10±0.74	8.20±0.92	8.05±0.69	8.05±0.69	8.10±0.88	8.15±0.58	90.09
45	8.20±0.57	8.10±0.42	8.10±0.57	8.00±0.67	8.10±0.57	8.00±0.42	89.81
60	8.30±0.48	8.30±0.48	7.80±0.63	8.00±0.67	8.00±0.67	8.00±0.67	89.63
75	8.40±0.52	8.10±0.32	7.90±0.32	7.90±0.32	8.00±0.47	8.00±0.47	89.44
90	8.20±0.42	8.10±0.32	7.90±0.32	7.90±0.32	7.80±0.42	7.90±0.32	88.52
105	7.2±0.92	7.8±0.63	8.0±0.67	8.0±0.67	6.9±0.88	7.4±0.70	83.89
120	7.5±0.53	7.3±0.82	7.3±0.67	7.2±0.63	7.4±0.70	7.2±0.63	81.30
135	6.8±0.79	6.4±0.52	6.1±0.57	6.2±0.63	6.1±0.74	6.5±0.71	70.56
Fvalue	7.62	10.05	10.47	10.71	11.59	10.76	
SEm±	0.20	0.19	0.19	0.19	0.20	0.17	
C.D	0.56**	0.53**	0.54**	0.53**	0.56**	0.47**	

hydrolysis. Auto oxidation of fats and oils is the most limiting factor in determining the storage quality of the dehydrated convenience mixes as it causes off flavors (Semwal *et al.*, 1999). Increase in free fatty acid content as oleic acid may be due to the breaking of long chain fatty acid chains into individual fatty acid moieties (Yadav *et al.*, 2008).

Rathod *et al.* (2019) reported that increase free fatty acid content of composite millet mix stored in high density poly ethylene was 0.12 to 0.65 mg KOH/g and metalized poly propylene package was 0.12 to 0.34 mg KOH/g).

### Organoleptic evaluation of *dosa* from barnyard millet instant *dosa* mix:

The sensory scores of *dosa* from barnyard millet instant *dosa* mix during storage are presented in Table 7. The sensory scores for overall acceptability initially was 8.10. There was significant decrease ( $p < 0.01$ ) in the scores of appearance, colour, texture and overall acceptability after 105 days of storage. However, they were more than 7. Hence the storage study of barnyard millet instant *dosa* mix was continued further till 135<sup>th</sup> day where the overall acceptability score was 6.5, which indicate “slightly to moderately liked”. On 150<sup>th</sup> day the springiness was observed. So the sensory evaluation was not done and the storage was discontinued. The acceptability index of the barnyard millet instant *dosa* mix initially was 90.93 per cent which decreased to 70.56 per cent after 135 days of storage and was acceptable up to 135 days.

Similarly Rani *et al.* (2019) reported decreased

values for sensory parameters during storage of instant *puttu* mix prepared with 50: 50 foxtail and finger millet.

### Conclusion:

On the basis of findings it can be concluded that, the quality of barnyard millet *dosa*, in terms of nutrient density as well as sensory point of view can be considered good. This instant *dosa* mix nutritional benefits for health conscious people and also can be used as entrepreneurial activity to improve financial condition. The technology is approved for commercialisation.

### Acknowledgement:

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### REFERENCES

- Anonymous (2000). *Association of Analytical Chemists, Official Methods of Analysis*. 17<sup>th</sup> edition, Washington, DC, USA.
- Palling, S.J. (1980). *Development in packaging – 1*, Ed, Applied Science Publishers. Ltd. London, pp. 56 – 63.
- Priyanka, B. and Sudesh, J. (2015). Development, chemical composition and antioxidant activity of *dosa* prepared using Bengal gram seed coat. *Int. J. Advan Nutr Health Sci.*, **3** (1): 109-115.
- Rani, M., Chavan, U. D., Kotecha, P. M and Lande, S. B. (2019). Instant *puttu* mix preparation from finger millet and foxtail

millet. *Int. J. Food Sci Nutri.*, **4** (4): 37 – 42.

**Rathod, J.M., Sarojani, J.K. and Hemalatha, S. (2019).** Formulation of high fiber multigrain composite flour and its storage quality. *Int. J. Chem Stu.*, **7** (3): 1513 – 1516.

RCSTA (1982). *Standard tables of food composition in Japan*. (4th revised). Resources Council, Science and Technology Agency, Tokyo, Japan.

**Roopa, S. S., Dwivedi, H. and Rana, G. K. (2017).** Development and physical, nutritional and Sensory evaluation of instant mix (*DOSA*). *J. Multi Dis Advance Res.*, **6** (1): 109-113.

**Sadashivam, S. and Manickam, A. (2008).** *Biochemical methods*. 3<sup>rd</sup> edn. New Age International Publishers, New Delhi, India.

**Semwal, A.D., Sharma, G. K and Arya, S. S. (1999).** Pro or anti – oxygenic activity of tezpat (*Cinnamomum tamala*) and red chilli (*Capsicum annum*) in sunflower oil. *J. Sci Food Agric.*,

**79**: 1733 – 1736.

**Sushmitha, G., Bhasker, V., Swathi, M., Prashanth, V. and Reddy, M. S. (2017).** Formulation and evaluation of *dosa* instant mix using Italian millet/ foxtail millet (*Setaria italic*). *Int. J. Advance Engg. Res. Develop.*, **4** (6): 869-874.

**Ugare, R. (2008).** Health benefits, storage quality and value addition of Barnyard millet (*Echinochloafrumentacaea*). (Thesis sciences) 18, University of Agricultural Science, Dharwad, pp. 101-105

**Veena, S., Bharati, V., Chimmad, Rama, Naik, K. and Shanthakumar, G. (2005).** Physico-Chemical and Nutritional Studies In Barnyard Millet. *Karnataka J. Agric. Sci.*, **18**(1): 101-105.

**Yadav, D.N., Sharma, G. K. and Bawa, A. S. (2008).** Optimization of soy – fortified instant upma mix ingredients using response surface methodology. *J. Food Sci Technol.*, **45** (1): 56 – 60.

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