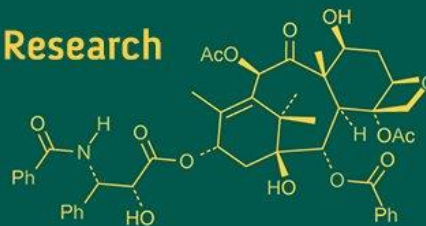


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## Promotion of biofortified pearl millet hybrid VPMH-14 to address anemia in women and children in Koppal District, Karnataka

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### Abstract

Anaemia is the nutritional deficiency disorder and 37 per cent of pregnant women and 40 per preschool children in developing countries are anaemic according to world health organization. According to NFHS-5 data, in Koppal district about 55 per cent of pregnant women and 71 per cent in preschool children were suffering from anaemia. Biofortified food crops provide sufficient levels of micronutrients to targeted populations. To address the problem a biofortified pearl millet hybrid with high iron (75 ppm), zinc (42 ppm) and higher potential yield was promoted through front line demonstration from 2022-23 to 2024-25 in farmers field of Koppal district. The result concluded that cultivation of biofortified pearl millet hybrid VPMH-14 increased yield by 26.12 per cent. About 97 per cent of the pregnant women (78) and preschool children (80) liked the products (*roti* and *khichadi*) prepared from the biofortified pearl millet hybrid VPMH-14.

**Keywords:** Anaemia, Koppal, Karnataka, VPMH-14, pregnant women, nutritional deficiency disorder

### Introduction

Anemia is the nutritional deficiency disorder and 37 per cent of pregnant women and 40 per preschool children in developing countries are anemic according to world health organization. More than 40% of early age children in these nations are stunted due to Zn deficiency, while 30% are anaemic due to Fe deficiency (Belay *et al.*, 2021) [3]. According to NFHS-5 data, in koppal district about 55 per cent of pregnant women and 71 per cent in preschool children were suffering from anemia. Anemia not only result in disease, poor health, delayed development in children.

Pearl millet is a very important staple diet food for millions of people, as well as an essential source of dietary energy and nutritional security for the huge rural communities in these regions (Basavaraj *et al.*, 2010) [2]. Pearl millet is also the cheapest source of Fe and Zn, in addition to calories and protein (Parthasarathy *et al.*, 2006) [9]. Given its high nutritional value, pearl millet can contribute significantly to improve the nutritional status of millions. Pearl millet can be grown in adverse agro-climatic situations like saline and alkaline soil, low precipitation, high temperature, low or high pH, poor fertile soils where it is difficult to take up other food crops like maize and sorghum. Off-late, due to increasing health awareness especially about nutri-cereals and millets, the crop is gaining importance among the consumers as preferred choice of food crop.

All of the released and commercially cultivated pearl millet, however, has low amounts of micronutrients, particularly Fe (42 mg kg<sup>-1</sup>) and Zn (32 mg kg<sup>-1</sup>), (Govindaraj *et al.*, 2019) [5]. Crop biofortification, which refers to the breeding of cultivars with higher levels of micronutrients, is increasingly being recognized as a cost-effective and sustainable approach to overcome these deficiencies in the food chain. The wide range variations in Fe and Zn content, as well as their genetic inheritance, are well known (Pujar *et al.*, 2020) [11]. Biofortified food crops provide sufficient levels of micronutrients to targeted populations. To address the problem, UAS Dharwad recently during 2021-22 released biofortified pearl millet hybrid VPMH-14 rich in iron (75 ppm), zinc (42 ppm) content with higher yield (Table 1).

**Table 1:** Nutritional composition of biofortified pearl millet hybrid VPMH-14 (per 100g)

Nutrients	Biofortified pearl millet hybrid VPMH-14
Moisture (g)	11.33
Protein (g)	10.74
Fat (g)	6.40
Total minerals (g)	1.59
Carbohydrate (g)	69.64
Energy (K cal)	380
Crude fibre (gm)	3.49
Zinc (ppm)	42
Iron (ppm)	75

Analysis: EEU, Quality Control Laboratory, Agricultural Campus Hyderabad

Hence, a study was planned with the following objectives

### Objectives

- To promote biofortified pearl millet hybrid VPMH-14 through front line demonstration during 2022-23 to 2024-25 in farmers field of Koppal district.
- To assess the acceptance of pearl millet hybrid VPMH-14 food products by pregnant women and preschool children.

### Material and Methods

#### Raw materials

Pearl millet hybrid VPMH-14 seeds procured from ARS Bijapur and distributed 30 farmers of nelgeri, bandryal and agoli villages of Koppal district during Kharif season of year from 2022-23 to 2024-25 as a front-line demonstration in ICAR Krishi Vigyan Kendra Koppal. The result was compared with local pearl millet hybrid Kaveri. The recommended package of practices was followed to conduct the demonstration and to raise the good crop condition.

#### Preparation of pearl millet products

The local products such as roti and khichadi are prepared and sensory evaluated in comparison local hybrid food products by semi trained panel members using nine-point ranking scale.

The pearl millet products are further evaluated for the consumer evaluation in nelgeri, agoli and bandryal villages. (Especially roti by the pregnant women and Khichdi by the preschool children (4-6 years)).

#### Results and Discussion

Biofortified pearl millet hybrid VPMH-14 was cultivated during Kharif season from 2022-23 to 2024-25 in three different villages of Koppal district (Nelgeri, Bandryal and Agoli respectively). The average yield and economics of Pearl millet hybrid VPMH-14 (Years 2022-23 to 2024-25) were depicted in the Table 2.

**Table 2:** Average yield and economics of Pearl millet hybrid VPMH-14 (Years 2022-23 and 2024-25)

Detail	Yield (q/ha)	Increase in percentage	(Rs.)		B:C Ratio
			Total income	Gross income	
Local (Hybrid Kaveri)	15.2	26.12	32930	20403	2.63
Demonstration (VPMH-14)	19.2		41716	30732	3.81

The result shows that biofortified hybrid VPMH-14 recorded higher yield 19.2 q/ha compared to local hybrid Kaveri (15.2 q/ha). Similarly, there was increase in percentage of yield by 26.12 percent from 2021-22 to 2023 to 2024 in different villages of Koppal district. The gross income was also recorded higher (50.62%) in biofortified hybrid VPMH-14 compared to local hybrid Kaveri. Similar result also seen in the studies of Parmar SK, *et al.*, 2023 <sup>[10]</sup>, where the biofortified pearl millet hybrid GHB 1231 (Sawaj Shakti) recorded higher average grain yield over local hybrid (26.18%). After the harvest the crop was subjected to incorporate in local food. Since the crop was rich in iron and zinc (75 and 42ppm respectively) and as study was focused on addressing the anemia the pearl millet daily used popular product like roti and khichadi were prepared and subjected to organoleptic evaluation and consumer acceptance. The results were depicted in table 3 and 4 and figure 1 and 2. The roti and khichadi prepared using pearl millet hybrid VPMH-14 were highly acceptable compared with products prepared from local hybrid. (Over all acceptability 8.4 and 8.4 respectively). The taste and aroma were scored almost same in both the food. The colour of the pearl millet hybrid VPMH-14 products was slightly darker compared to local. Overall, both products were accepted. Similar results are also seen in the studies of Kalash P, *et al.*, 2023 <sup>[7]</sup> and Hyey

SL, *et al.*, 2017 <sup>[6]</sup>. Both products were subjected to consumer acceptance. As the study was concentrating on addressing anemia in women and children, children between age of 4 to 6years for Khichadi and roti for pregnant women were evaluated. Results found that 78 pregnant women and 80 preschool children (97 percent respectively) liked the products (Khichadi and Roti) prepared from the biofortified pearl millet hybrid VPMH-14. No one disliked the product (Table 5). Similar results are also seen in the studies of Kalash P, *et al.*, 2023 <sup>[7]</sup> and Hyey SL, *et al.*, 2017 <sup>[6]</sup>.

Hence the study concluded that Biofortification, a method for increasing micronutrient content of staple crops, is a promising strategy for combating major global health problems, such as iron and zinc deficiency. Pearl millet due to its nutritional superiority and richness in micronutrients such as iron and zinc and can mitigate malnutrition and hidden hunger. Biofortified pearl millet hybrid VPMH-14 was found to be promising crop not only in terms of high yield but also nutritional quality. Biofortified pearl millet hybrid food products were found to be highly accepted in vulnerable groups therefore, have a higher likelihood of being consumed as part of the daily diet among them. Hence it improves iron status, growth, immune function, and cognition among young children and nutritional status of pregnant women.

**Table 3:** Mean score values sensory quality attributes of roti prepared by pearl millet hybrid VPMH-14

Sensory attributes	Colour	Taste	Aroma	Texture	Over all acceptability
Pearl millet Roti Hybrid (VPMH-14)	8.7	8.3	8.4	8.2	8.5
Pearl millet Roti Local hybrid (Kaveri)	8.5	8.3	8.2	8.3	8.4

\* Nine point hedonic scale

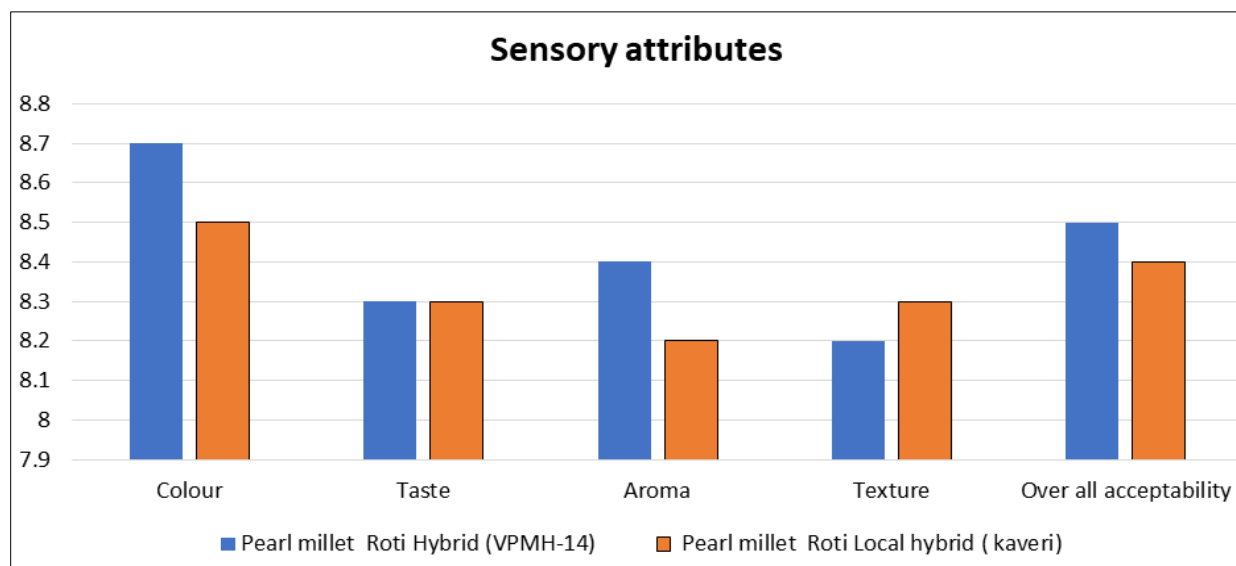
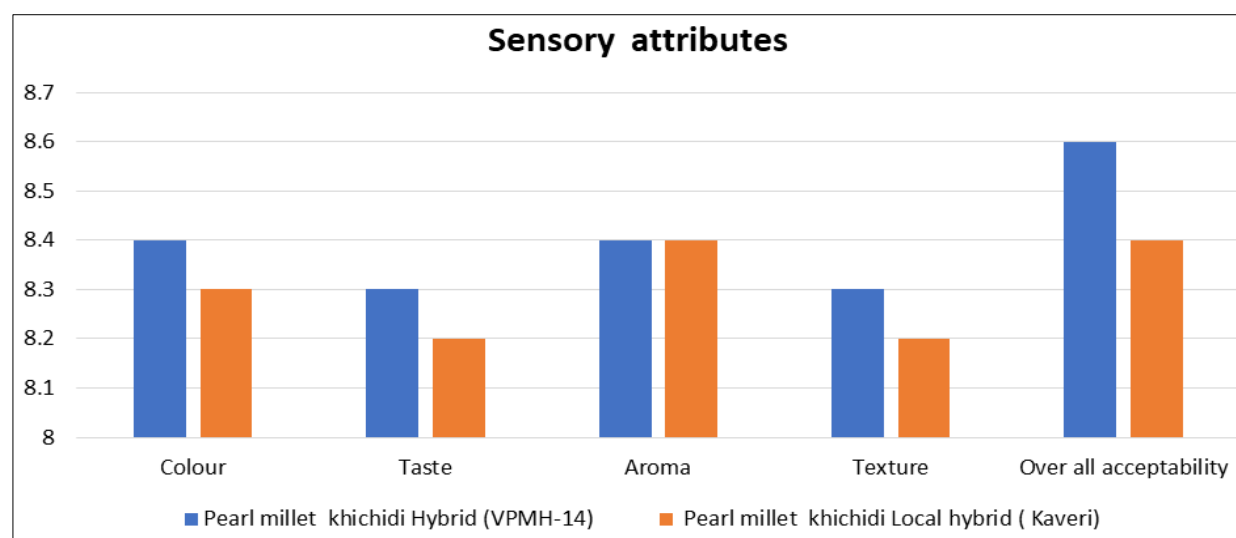
**Table 4:** Mean score values of sensory quality attributes of *khichidi* prepared by pearl millet hybrid VPMH-14

Sensory attributes	Colour	Taste	Aroma	Texture	Over all acceptability
Pearl millet khichadi Hybrid (VPMH-14)	8.4	8.3	8.4	8.3	8.6
Pearl millet khichadi Local hybrid (Kaveri)	8.3	8.2	8.4	8.2	8.4

\* Nine-point hedonic scale

**Table 5:** Consumer acceptability of *khichidi* prepared by pearl millet hybrid VPMH-14

Food product	Like	Dislike	Neutral
Pearl millet khichadi (VPMH-14)	80	-	2
Pearl millet Roti (VPMH-14)	78	-	4

**Fig 1:** Mean score values sensory quality attributes of roti prepared by pearl millet hybrid VPMH-14**Fig 2:** Mean score values sensory quality attributes of Khichadi prepared by pearl millet hybrid VPMH-14

## Conclusion

Anaemia remains a critical nutritional challenge, particularly among pregnant women and preschool children in Koppal district. The introduction of biofortified pearl millet hybrid VPMH-14, rich in iron (75 ppm) and zinc (42 ppm), demonstrated significant potential in addressing this issue. The hybrid not only enhanced yield by 26.12% over local varieties but also improved farm income and demonstrated high consumer acceptance. Nearly all pregnant women and preschool children preferred products like roti and khichadi prepared from VPMH-14. These findings highlight the practical relevance of biofortified

crops in combating hidden hunger. Future research should focus on large-scale adoption, long-term nutritional impact assessments, and integration into public health programs.

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