

**INTERNATIONAL JOURNAL OF FOOD AND  
NUTRITIONAL SCIENCES**

**IMPACT FACTOR ~ 1.021**



**Official Journal of IIFANS**

## NUTRITIONAL QUALITY, AMINO ACID PROFILE AND SENSORY EVALUATION OF THE MALTED BLENDED FLOUR PRODUCTS DEVELOPED FOR HIV SUBJECTS

Kavitha D S<sup>1\*</sup> and R P Lalitha Reddy<sup>2</sup>

\*Corresponding Author: Kavitha D S, ✉ kavithads@yahoo.com

Received on: 7<sup>th</sup> June, 2016

Accepted on: 7<sup>th</sup> September, 2016

People living with HIV (Human Immune deficiency Virus) cannot have enough foods, due to illness and medicines which reduce appetite and modify the taste of food. Germinated and sprouted foods are easily digested and absorbed. It improves taste and flavour to manage altered taste and increase appetite. The present study aimed at developing Malted Blended Flour (MBF) with locally available cereal, millet and pulse. The proximate composition and amino acid profile of MBF was analysed. The amino acid profile of the supplement was on par with the FAO standards. The MBF provide 386 k.Cal and 16.56% protein for 100 g of the supplement. Incorporation of milk proteins like Whey protein concentrate and skimmed milk powder to malted flour helps to improve nutritive value and protein quality. Several products like roti, dosa, malt, dumpling, were prepared and subjected to sensory evaluation by the HIV subjects. The products developed by the MBF were acceptable with above average sensory scores and comparable with control (ragi) products.

**Keywords:** HIV/AIDS, Amino acid profile, Malting, Sensory evaluation, Ragi/Finger millet, Whey protein

### INTRODUCTION

Malnutrition is a serious threat for people living with HIV/AIDS. HIV makes an impact on body's nutritional status. The risk of malnutrition increases significantly during the course of the infection. Even though good nutrition cannot cure AIDS or prevent HIV but it can help to maintain and improve the nutritional status of a person with HIV/AIDS. Poor nutrition quickens the progression from HIV to AIDS, while good nutrition slows it down. Adequate nutrition is necessary to maintain the immune system. It helps to manage opportunistic infection, optimizes the benefits of ART drugs and prolong the lives of people living with HIV. Many of the conditions associated with HIV/AIDS affects food intake, digestion and absorption, while others influence the function of the body. Lack of food intake may be due to oral

candidiasis of mouth or GI tract ulceration or irritation making it difficult to swallow. Mouth infections including candidiasis can alter taste and reduce appetite (FAO/WHO, 2007). Many of the symptoms of these conditions, e.g., diarrhea, weight loss, nausea, vomiting are manageable with appropriate nutrition. Though often food intake is reduced due to soreness or painful swallowing, modifying texture and type of foods can help to ensure adequate food intake. Several steps can be taken to improve the quality of the food by adding foods high in energy and protein. Adding germinated, sprouted seeds to locally available foods is one measure of improving the quality of food. Since sprouted foods are easily digested and absorbed and help the body to digest and absorb other foods. It improves taste and flavour also manage altered taste and increase appetite in HIV.

<sup>1</sup> Dietician, KIMS Hospital & Research Centre, K.R.Road, V.V. Puram, Bangalore-4, Karnataka, India.

<sup>2</sup> Department of Food and Nutrition, Smt. VHD Central Institute of Home Science, Seshadri Road, Gandhi Nagar, Bangalore, Karnataka 560001, India.

A nutritional supplement was developed from Malted ragi/finger millet, wheat and green gram blended with skimmed milk powder and whey protein concentrate. Malting improves its digestibility, sensory and nutritional quality as well as pronounced effect in lowering antinutrients (Malleshi and Deshikachar, 1986). There are various benefits of malting such as vitamin C is elaborated, Phosphorous availability is increased and lysine and tryptophan is synthesised (Dulby and Tsai, 1976). Finger millet is the cereal of choice for the preparation of porridges for children and for the sick and old in India. Since olden times Finger Millet or ragi is also used to prepare beverages either with milk or lukewarm water with addition of sugar. The incorporation of malted green gram, wheat, Skimmed milk powder to malted ragi improves nutritive value of the malted mix especially protein, energy, iron, calcium and B-complex vitamins (Khader and Maheshwari, 2012). As cereals limit in amino acid lysine and tryptophan, incorporating pulses rich in lysine and limiting in sulphur containing amino acids improve the amino acid profile of the supplement and increase the protein quality.

Therefore the present study was conducted formulating of supplement from locally available cereal (wheat), millet (finger millet) and pulses (green gram), malted and blended with milk proteins in order to make the blend energy and protein dense. The products developed by the malted blended flour was evaluated by HIV subjects against ragi products used as control.

## MATERIALS AND METHODS

### Selection of Sample (Panellist)

Ten HIV subjects who were attending the ART centre receiving ART treatment were selected as judges/panelist for the sensory evaluation. The subjects were between the age group of 20-55 yrs. The subjects did not have any sensory changes like candidiasis, vomiting or diarrhea which could alter the sensory evaluation. They were familiar with the products given as they consumed these products in their day to day life. The subjects were asked to indicate the extent of acceptability of the products in terms of colour, flavour, appearance, and texture (mouth feel).

### Preparation of Supplement

Ragi, green gram and wheat were procured from local market. They were cleaned, washed, germinated (Malleshi and Deshikachar, 1986) roasted and milled to flour. Later it is sieved and mixed with 10% Skimmed milk powder and 5% of

Whey Protein concentrate (WPC 80%). Skimmed milk powder was obtained from Nandini Milk Parlour of KMF, Karnataka and WPC was obtained from Nakoda dairy products, Basavangudi, Bangalore.

The Malted Blended Flour (MBF) was used to prepare different products like porridge (Three different types: a) with milk and sugar, b) with buttermilk and salt, c) with plain water). Dosa, Roti and Dumpling were made and compared with products prepared from ragi (control).

### Proximate Composition Analysis

The proximate composition of the Malted blended flour was analysed. Nutrients such as moisture, protein, ash, and fat were analysed as per AOAC (1980). Carbohydrate was calculated by differential method.

### Sensory Evaluation

The products were prepared and given to untrained HIV subjects, who were familiar with the products which was traditionally consumed. The products were given to the subjects one at a time. They were asked to rank each product immediately after tasting in terms of appearance, taste, flavour, texture (mouth feel), and overall acceptability of malted products in comparison with control products. They were asked to drink water after tasting each product to wash away the taste of previous product.

### Amino Acid Analysis

Amino acid analysis is an important application area in protein chemistry and food analysis. It is a process which determines the quantities of each individual amino acids. The amino acid profile of the Malted blended flour was analysed. The analysis is done in four steps using amino acid analyser. It includes 1) Hydrolysis, 2) Derivatization, 3) Separation of derivatized amino acids, 4) Data interpretation and calculation. For 17 amino acids pre column derivatization of amino acids with 6-amino quinoyl-N-hydroxy succinimidyl carbamate (AQC) followed by reverse phase HPLC separation with fluorometric detection is used. For Tryptophan analysis alkaline hydrolysis followed by reverse phase HPLC separation with fluorometric detection is used.

### Ethical Approval

The Institutional Ethics committee KIMS hospital and research centre, where the study was undertaken, has approved the study and informed consent was obtained from the participants before recruitment.

## RESULTS AND DISCUSSION

The proximate composition of the Malted Blended Flour (MBF) used as a supplement for HIV subjects is given in Table 1.

Swaminathan *et al.* (2010) reported that the protein content of 15 g and 400 KCal of energy for the supplementary food prepared from whole wheat and soya bean flour. The banana – soy blend developed for the HIV subjects provided 459 Kcal and 15 g of protein for 100 g of the supplement (Womono *et al.*, 2011). Similar results were also seen in the present study with protein content of 16.56 g and 386 KCal of energy for 100 g of the supplement.

The amino acid composition of the supplemented food is presented in Table 2. The leucine, tryptophan and cysteine content in the supplementary food was higher than the FAO/WHO reference pattern while all the other amino acids like histidine, isoleucine, lysine, phenylalanine, tyrosine, threonine, tryptophan and valine content in the supplemented food were comparable to that of FAO/WHO reference protein (FAO/WHO/UNU, 1985). The protein of the food supplement was calculated on the basis of most limiting amino acid in each mixture. Cysteine is the main source of the sulfhydryl group of GSH (Glutathione stimulating hormone). HIV patients are often depleted of GSH and other antioxidant (Look *et al.*, 1994).

The results of the sensory evaluation of the products (porridge with milk, buttermilk and water, roti, dosa and dumpling) prepared were evaluated by HIV subjects and presented in Tables 3, 4 and 5. The data shows average likeness of the MBF products with respect to appearance, taste, flavour, texture (mouth feel) and overall acceptability. The dosa and roti was judged the best compared to other products. The dosa made of MBF was scored higher than

the control products, and was described as soft and crispy texture compared to the ragi dosa by the consumers (HIV subjects). Taste is an important parameter when evaluating sensory attributes of food. The products might be appealing and having high energy but without good taste the product

**Table 1: Proximate Composition of Malted Blended Supplement**

Components	Amount (%)
Protein (%)	16.56
Moisture (%)	2.5
Fat (%)	1.6
Carbohydrate (%)	76.54
Energy (KCal)	386

**Table 2: Essential Amino Acid Composition (g%) of Protein in the Supplementary Food**

Essential Amino Acid	Food Supplement	FAO/Who Reference Pattern
Isoleucine	4.4	4
Leucine	9	7
Lysine	5.4	5.5
Methionine+cysteine	18.4	3.5
Phenylalanine+tyrosine	6.5	6
Histidine	2.5	2.4
Threonine	4.5	4
Tryptophan	2.6	1
Valine	5.3	5

**Table 3: Mean Organoleptic Scores for the Products Prepared with Ragi**

Products	Appearance	Color	Texture	Taste	Flavour	Overall Acceptability
Dumpling	8.80±0.42	8.60±0.52	8.3±0.67	8.4±0.70	8.40±0.70	8.50±0.44
Roti	7.20±1.03	7.30±1.25	7.0±1.41	7.2±1.40	7.0±1.25	7.14±1.20
Dosa	7.60±1.17	7.6±0.70	7.90±0.70	7.8±0.90	7.9±0.88	7.76±0.76
Malt (plain)	8.50±0.53	8.3±0.48	7.60±0.70	8.3±0.67	8.3±0.48	8.2±0.34
Malt (milk and sugar)	8.67±0.5	8.6±0.52	8.0±0.82	8.3±0.82	8.3±0.82	8.36±0.54
Malt (buttermilk)	8.20±0.63	8.5±0.53	8.1±0.32	8.2±0.79	7.9±0.99	8.18±0.53

**Table 4: Mean Organoleptic Scores for the Products Prepared with Malted Blended Flour**

Products	Appearance	Colour	Texture	Taste	Flavour	Overall Acceptability
Dumpling	8.00±0.71	8.00±0.94	7.80±1.03	8.4±0.52	8.30±0.82	8.10±0.64
Roti	7.30±0.67	7.40±0.70	7.50±0.85	7.00±0.94	7.0±1.05	7.24±1.69
Dosa	7.40±0.97	6.90±1.10	7.80±0.63	7.6±0.84	7.80±0.79	7.50±0.75
Malt (plain)	7.90±0.57	7.9±0.57	7.90±0.88	7.90±0.88	8.10±0.99	7.94±0.63
Malt (milk and sugar)	7.30±1.34	7.20±1.40	7.40±1.65	7.70±1.64	7.40±1.26	7.40±1.40
Malt (with buttermilk)	8.00±1.16	8.30±0.95	8.3±0.82	8.5±0.85	8.20±0.79	8.26±0.78

**Table 5: Overall Acceptability of the MBF Products in Comparison with Ragi**

Production	Overall Acceptability		f-test	S.Emi	CD
	Ragi	MBF			
Dumpling	8.50±0.44	7.94±0.63	5.32*	0.172	0.511
Roti	7.14±1.20	7.40±1.20	0.20(NS)	0.414	—
Dosa	7.76±0.70	8.26±0.78	2.27	0.235	—
Malt (plain)	8.20±0.34	7.50±0.75	7.23*	0.184	0.546
Malt (milk and sugar)	8.36±0.54	8.10±0.64	0.96	0.187	—
Malt (buttermilk)	8.18±0.53	7.24±0.69	11.66*	0.195	0.579

is unacceptable. The products of MBF had good taste and all the products like dosa, roti, dumpling and malt prepared with milk, buttermilk and water were accepted by the subjects and sensory score was above average for all the products.

Dosa is the traditional food in South India and occupies a very important place in dietary up gradation of nutritional quality by supplementing it with high quality protein from less expensive sources will result in much greater potential (Dendy and Dobraszczyk, 2001).

Tripathy *et al.* (2003) reported that ragi dosa and ragi malt were best accepted at 30% blend of whey protein concentrate. Ragi dosa at 30% WPC had a better sensory profile compared with that of control.

## CONCLUSION

Fortified blended foods in the context of HIV/AIDS provide a value addition to the food basket because of their high energy and nutrient density. Finger millet being staple food in different parts of India and especially in south Karnataka is promoted as an extremely healthy food. Inherent quality of finger millet makes it superior compared to other cereals

and also qualify for malting and preparation of malted products. Traditionally consumed food products which are culturally acceptable and low cost can improve nutritional and sensory attributes when blended with Skimmed milk powder and whey protein concentrate improves the protein quality of the MBF. Adding milk powder influence flavour which in turn improves acceptability of the product.

Hence it can be concluded that the high protein, high energy dense malted blended supplement prepared food products can be recommended as supplement to improve nutritional status and health of vulnerable population such as malnourished HIV subjects.

## REFERENCES

- Anonymous G (1990), *Official Methods of Analysis of the Association of Official Analytical Chemists*, 20th Edition, AOAC, Washington DC.
- Dendy DAV and Dobraszczyk B J (2001), "Rice, Cereals and Cereal Products Chemistry and Technology", Chapter 12, pp. 276-314, Aspen Publication, USA.
- Dulby A and Tsai C (1976), "Lysine and Tryptophan Increases During Germination of Cereal Grains", *Cereal Chemistry*, Vol. 53, pp. 222-224.
- FAO (2009), "Nutrition and HIV/AIDS-Keyhole Gardens in Lesotho-Rome", available from <http://km.fao.org/agrihealth/images/FSNL-fact-sheet-keyhole-gardens.pdf>
- FAO/WHO/UNU (1985), "Expert Consultation, Energy and Protein Requirements", in *FAO/WHO, Nutrition Meetings*, Report Series No. 724, FAO/WHO, Geneva.
- Look M P, Rockstrob J K, Rao G S, Krauzer KA, Barton S, Sudhop T, Huch J and Stockinger K (1997), "Serum

- Selenium, Plasma Glutathione (GSH) and Erythrocyte Peroxidase (GSH-Px) Levels in Asymptomatic versus Symptomatic Human Immunodeficiency Virus-1 (HIV-1) Infection”, *Eur. J. Clin. Nutr.*, Vol. 51, pp. 266-272.
- Malleshi N G, Desikachar H S R and Venkat Rao (1986), “Protein Quality Evaluation of Weaning Food Based on Malted Ragi and Green Gram”, *Plant Food Human Nutrition*, Vol. 36, pp. 223-330.
  - Swaminathan S, Padmapriyadarsini C, Yoojin L, Sukumar B, Iliayas S, Karthipriya J, Sakthivel R, Gomathy P, Thomas B E, Mathew M, Wanke C A and Narayanan P R (2010), “Nutritional Supplementation in HIV-Infected Individuals in South India: A Prospective Interventional Study”, *Clinical Infectious Diseases*, Vol. 51, No. 1, pp. 51-57.
  - Tripathy S, Vijayalakshmi D and Jayaprakasha H M (2003), “Utilization of Whey Protein Concentrate in Ragi (*Eleusine coracana*) Based Food Products”, *Journal of Food Science and Technology*, Vol. 40, No. 2, pp. 157-161.
  - Vijaya Khader and Uma Maheswari K (2015), “Development and Evaluation of Amylase Rich Malted Mixes (ARMMS) to Improve the Nutritional and Health Status of Pre School Children”, *AJAEES*, Vol. 4, No. 3, pp. 259-265.
  - Wamono E B K, Kaaya A N, Ng’anga Z, Wamue G, Manyama A, Mwangi M and Muyonga J H (2011), “Nutrient-Enhancement of *Matooke* Banana for Improved Nutrient Intake of People Living with HIV/AIDS in Rakai District, Uganda”, *African Journal of Food, Agriculture, Nutrition and Development*, Vol. 11, p. 4.
  - WHO (2009), “Nutrition and Support for People Living with HIV/AIDS: A Training Course”, Geneva, Switzerland, available from [http://www.who.int/nutrition/publications/hivaids/PLWHIV\\_course-facilitators-guide.pdf](http://www.who.int/nutrition/publications/hivaids/PLWHIV_course-facilitators-guide.pdf)

