storage at room temperature.

The chemical spoilage indices *viz*; TMA, TVB-N, TBA, pH, FFA, a_w were found to increase as the storage period advances. All these parameters were within the acceptable value till the end of storage period of 12 months. Total plate count (cfu/g) of the soup tablet increased during the storage period and it reached upto 6.8 X 10^5 cfu/g. There was only 3 log cycles increase during the storage period. Bacteria of public health significance were assessed during storage period. *E. coli, Vibrio* sp., *Salmonella* sp. and *S. aureus* could not be detected in the samples during the storage study.

Utilization of yellowfin tuna protein hydrolysate in health beverage formulation

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Seafood is an easily available and cheapest food source meeting the protein requirements of approximately 2.9 million people, globally. There is a high potential in marine processing industries to convert and utilize this food and their by-products as valuable functional ingredients. Among the by-products, hydrolysates or bioactive peptides can be utilized as a potential source of natural ingredient and in this context more focus is given by researchers on improving the bio-availability and bio-accessibility of these marine protein hydrolysates for validating as functional ingredients for healthy foods. Functional foods defined to be those with specific health benefits, hold a strong market position world-wide and the functional beverage sector accounts for approximately 12.5% of the world functional food market. A wide range of customers (47%) opined that fortified foods and drinks satisfy their recommended nutritional requirements (Sloan, 2003). In this regard, fortified supplements in the form of blended drinks are a good option which has enhanced taste as well as improved nutritional value. Recently there has been an exceptional demand in the food industry for inexpensive proteins and bioactive peptides for human consumption. Several attempts have been made on utilization of protein hydrolysate in the formulation of various products but, still there is immense scope for its utilization in beverages especially in health-based energy drinks on account of its superior functionalities (Singh *et al.*, 2009). Additionally, alternative uses for co-products of the fish processing industry are highly sought-after as these co-products are excellent sources of nutrients like protein. The utilization of protein hydrolysate from cannery discards like tuna red meat for such health formulations is an ideal approach. The current study was conducted to formulate a health beverage incorporating protein hydrolysate from yellowfin tuna red meat.

Tuna protein hydrolysate (TPH) derived from yellowfin tuna red meat under optimum hydrolytic conditions was used. Based on RSM, 12 different ingredient combinations were prepared and subjected to sensory analysis to derive the best combination of health mix. The sensorily selected health mix was added with different levels of TPH *viz.*, 2.5, 5, 7.5 and 10% referred to as HM1, HM2, HM3 and HM4, respectively (Fig. 1). Health mix without addition of TPH was kept as control *viz.*, HM. Nutritional, functional, antioxidant, physical and sensory properties of the samples were assessed. Incorporation of protein hydrolysate in the HM improved the

Fig.1. Health mix formulations with tuna protein hydrolysate

nutritional status *viz.*, protein, fat and ash contents of the health mix (Table 1). Moisture content varied from 5-5.6%. Addition of FPH improved the functional properties *viz.*, foaming capacity and emulsifying properties. Antioxidant property *viz.*, DPPH radical scavenging activity also revealed slight increase from 21.78% for HM to 26.64% for HM4. The colour parameters of the health mix indicated an increase in lightness and yellowness values, whereas a decrease in redness values were observed for samples containing higher levels of protein hydrolysate. Sensory studies indicated highest acceptability for control followed by health mix with lower level of protein hydrolysate. HM2 exhibited slight detection of fish flavor whereas it was prominent in HM3 and HM4 (Fig. 2). Studies revealed the potential of tuna protein hydrolysate for incorporation in health beverage formulation for its quality enhancement.

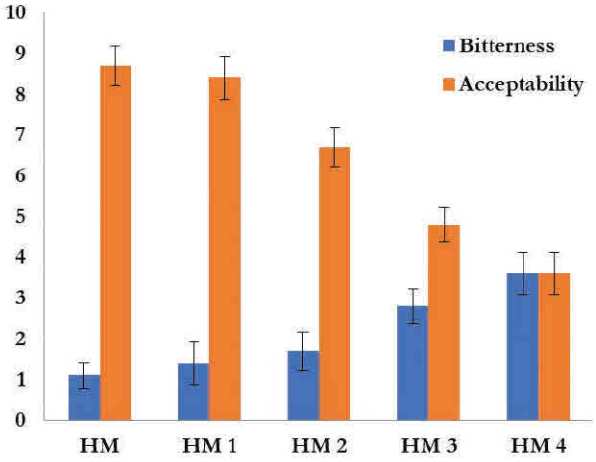

Fig.2. Variations in sensory properties of health mix samples

Table 1. Proximate composition of health mix samples

Sample	Moisture	Protein	Fat	Ash	Carbohydrate
HM	5.61±0.16	9.69±0.14	1.23±0.01	0.93±0.02	82.54±0.16
HM1	5.23±0.11	11.82±0.32	1.36±0.05	0.95±0.02	80.64±0.35
HM2	5.19±0.12	12.84±1.04	1.49±0.06	1.05±0.08	79.43±1.04
HM3	5.17±0.10	14.36±0.48	1.45±0.04	1.20±0.06	77.82±0.56
HM4	5.01±0.15	15.10±0.26	1.45±0.08	1.76±0.11	76.68±0.11

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