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Abstract	:	A comprehensive analysis of the functional properties of fish protein hydrolysate (FPH) is necessary before its incorporation into food products. This work aimed to optimise the fermentation process for the Malaysian fish sausage FBPs with Lactobacillus casei in terms of protein yield and antioxidant activities using response surface methodology (RSM). The second aim was to fractionate the FPH using ultrafiltration (UF) through 3, 5, and 10 kDa and to characterise the fractions in relation to peptide yield, antioxidant activities, and functional properties. The RSM optimisation elevated protein yield, 2,2-diphenyl-1-picrylhydrazyl (DPPH), and 2,2-azinobis (3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) radical scavenging activities were effectively raised by 16.3%, 50.5%, and 21.7%, respectively. The DPPH (EC50: 4.4 mg/mL) and ABTS (EC50: 0.2 mg/mL) radical scavenging activities and protein solubility (79.9%) of the 10 kDa fraction were significantly higher than other fractions. However, lower MW fractions exhibited the highest emulsion activity index (5 kDa: 16.3 m2/g) and foaming expansion (3 kDa: 25.0%), which were 1.3 and 12.5 times higher than the FBPs, respectively. Surface hydrophobicity increased significantly in the FPH and UF fractions relative to FBPs by 23.9–26.3%, with no discernible difference between FPH and UF fractions. This study's findings can serve as a theoretical foundation and data in support of FBPs' optimisation of the fermentation process to produce bioactive FPH with high protein yield. The bioprocessing aspect outlined in the study significantly enhanced the antioxidant activity and functionality of the FPH.