# Innovative Processing of Chicken Heart Protein Hydrolysates: A Physico-Chemical Study Post Lactobacilli Fermentation

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## I. INTRODUCTION

In the recent years, there is tremendous increase in production and consumption of chicken meat, and at the same time, production of slaughterhouse by-products has also been increased greatly. Unfortunately, by-products generated during processing are not properly utilized. Recent studies have indicated that chicken heart is a good source for protein hydrolysates having several biological properties, such as antioxidant, antimicrobial and others functional activities. Using proteolytic microorganisms to ferment food proteins is an emerging method for production and processing of protein hydrolysates on an industrial scale. In contrast to traditional enzymatic breakdown, fermentation emerges as a financially viable approach to produce food-grade protein hydrolysates and bioactive peptides. LAB fermentation represents an environmentally friendly and sustainable technology, wherein lactic acid bacteria (LAB) aid in waste preservation while recovering crucial biomolecules. This study aims to evaluate the freeze-dried chicken heart hydrolysates produced by LAB fermentation, focusing on their physico-chemical characterization.

## II. MATERIALS AND METHODS

Freeze dried *Lactobacillus helveticus*-292 and *Latiplantibacillus plantarum*-025 were obtained from National Collection of Dairy Culture (NCDC), ICAR- National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana. Chicken heart was hygienically obtained from the Post-Harvest Technology (PHT) section of ICAR-Central Avian Research Institute (CARI), Izatnagar, Uttar Pradesh. The bacterial count in working cultures was adjusted to $10^7$ cfu/mL.Fermentation temperature was maintained at 37°C for 16 h. Freeze drying of hydrolysates was done at a temperature below -50°C and a pressure below 150mTorr in a Freeze dryer (ilShinBioBase, South Korea). The water activity was estimated using a digital water activity meter (4TE Dew Point water activity meter, Aqua lab, Malaysia). The Fourier Transform Infrared Spectroscopy was done using Ailent Cary 630 Spectrometer (California, United States) [1]. The particle surface morphology of the freeze-dried heart hydrolysates was studiedusing Scanning Electron Microscope (EMCRAFTS, South Korea) at an acceleration voltage of 20kV [2].

## III. RESULTS AND DISCUSSION

Heart hydrolysates prepared with *L. helveticus* fermentation showed significantly ($p<0.05$) higher protein % than hydrolysates fermented with *L. plantarum*as shown in table 1.

**Table 1**:Physico-chemical properties of freeze-dried raw chicken heart (Hc) and chicken heart hydrolysates (2Hh16 and 2Hp16)

| Parameters | Hc | 2Hh16 | 2Hp16 |
|---|---|---|---|
| **Yield %** | $15.45\pm0.33^{c}$ | $21.11\pm0.43^{a}$ | $19.93\pm0.25^{b}$ |
| **aw** | $0.56\pm0.009^{a}$ | $0.47\pm0.005^{c}$ | $0.51\pm0.001^{b}$ |
| **Protein** | $73.75\pm0.80^{c}$ | $84.41\pm0.34^{a}$ | $81.33\pm0.51^{b}$ |

n=6, Mean ± Standard Error bearing different superscripts within row differ significantly ($P<0.05$). Hc- Freeze-dried raw heart; 2Hh16- 2% *L. helveticus*, 16 h; 2Hp16- 2% *L. plantarum*, 16 h.

FTIR spectra for peak positions in freeze-dried raw heart (Hc) as well as for the heart hydrolysates (2Hh16 and 2Hp16) are shown in Fig 1a. Hc, 2Hh16 and 2Hp16 revealed their amide I peaks at 1639.00, 1638.06 and 1639.78$cm^{-1}$, respectively. Higher wavenumber coupled with higher amplitude of amide I band of 2Hp16 than Hc indicated towards the comparatively higher

disintegration of molecular structure in 2Hp16 than Hc due to bacterial degradation of the molecular structures of heart proteins. Greater amplitude of amide II bands of 2Hh16 and 2Hp16 than Hc suggested greater loss of molecular order of protein in 2Hh16 and 2Hp16 than Hc owing to microbial breakdown of protein molecules in treated samples than control Hc. The SEM micrographs revealed that both 2Hh16 and 2Hp16 had smaller particle size, surface cracking and rough texture in comparison to Hc as shown in figure 1b.

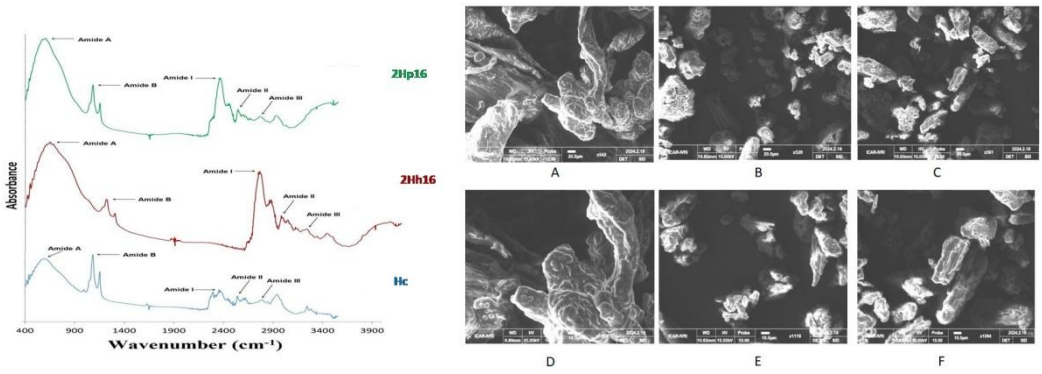


**Fig. 1: (**a) FTIR spectrum of Hc- Freeze-dried raw heart; 2Hh16- 2% L. helveticus, 16 h; 2Hp16- 2% L. plantarum, 16 h. Fig. 1. (b). Scanning electron micrographs of freeze-dried raw heart, Hc (A: x500, D: x1000), freeze-dried heart hydrolysate fermented with L. helveticus, 2Hh16 (B: x500, E: x1000) and freeze-dried heart hydrolysate fermented with L. plantarum, 2Hp16 (C: x500, F: x1000).

## IV. CONCLUSION

This study examined the characteristics of chicken heart hydrolysates produced through bacterial fermentation using *L. helveticus* and *L. plantarum*. The analysis demonstrated that the physico-chemical properties of the hydrolysates were influenced by the specific bacterial culture used. Thus, fermentation process with Lactobacillus bacteria presents a promising method for generating protein hydrolysates from chicken heart. These findings suggest potential applications for incorporating chicken heart hydrolysate obtained by fermentation process with LAB into novel functional food products.

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