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Comparison of Nitrogen Bioaccessibility from Salmon and Whey Protein Hydrolysates using a Human Gastrointestinal Model (TIM-1)

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ABSTRACT

Background: The TIM-1 system is a computer-controlled multi-compartmental dynamic model that closely simulates *in vivo* gastrointestinal tract digestion in humans. During digestion, the compounds released from meal matrix by gastric and intestinal secretions (enzymes) are progressively absorbed through semipermeable membranes depending on their molecular weight. These absorbed (dialysed) compounds are considered as bioaccessible, which means that they can be theoretically absorbed by the small intestine in the body.

Methods: Salmon protein hydrolysate (SPH), whey protein hydrolysates extensively (WPH-High) or weakly (WPH-Low) hydrolysed, non-hydrolysed whey protein isolate (WPI) and mixtures of WPI:SPH (90:10, 80:20) were digested in TIM-1 using the conditions for a fast gastrointestinal transit that simulate the digestion of a liquid meal in human adults. During digestion (2 hours), samples were collected in intestinal compartments (duodenum, jejunum, and ileum) and in both jejunal and ileal dialysates to determine their nitrogen content. All the products were compared in terms of kinetics of nitrogen absorption through the semipermeable membranes (bioaccessible nitrogen) and nitrogen distribution throughout the intestinal compartments at the end of the 2 hour digestion.

Results: After a 2 h-digestion in TIM-1, SPH was the protein substrate from which the highest amount of nitrogen (67.0%) becomes available for the small intestine absorption. WPH-High had the second highest amount (56.0%) of bioaccessible nitrogen while this amount decreased to 38.5–42.2% for the other protein substrates. The high nitrogen bioaccessibility of SPH is consistent with its richness in low molecular weight peptides (50% < 1000 Da).

Conclusions: The results of this study indicate that SPH provides a higher proportion of bioaccessible nitrogen to a healthy adult compared to all forms of whey proteins, including extensively hydrolysed whey protein hydrolysate. The substitution of non-hydrolysed WPI by

small amounts of SPH (10–20%) improved slightly its nitrogen bioaccessibility, making the mixture particularly suitable for applications such as medical foods that require rapid protein uptake and where the use of extensively hydrolysed whey protein is unfeasible due to its undesirable organoleptic properties.

Keywords: Salmon protein hydrolysate, Whey protein, Nitrogen bioaccessibility, TIM-1