

Functional Feeding and The Significance of The Protein Energy Theory for Rumen Digestion: A Comment Paper

D. A. Flores

Skye Blue (SB) Internet 1440 Barberry Drive
Port Coquitlam, BC V3B 1G3 Canada

ABSTRACT

This paper discusses a role for peptides or oligosaccharides with microbial cell protein (MCP) synthesis and their molecular mechanisms: oligomeric chaperoning of enzymes and/or other proteins with the protein synthetic machinery and allosteric interactions regarding the type of metabolic process. Further modifications to improve oligomeric performance as a feed interventive would be for peptides: longevity, primary structure regards limiting amino acids in microbial metabolism, possible leader sequences for uptake into the cellular milieu, critical sequences directly relating to the structural dynamics of chaperoning, and finally considerations for transcription factors (TF) with mitogenesis for boosting rumen microbial cell growth and development. Finally, proteinergic strategies, for e. g., the enrichment of germ seed proteins by seed protein companies jumpstarts the boosting of rumen microbial protein supply for meat and milk production with this type of functional feeding for livestock.

Keywords: rumen, digestion, functional feeds, nutritionals, microbial protein, synthesis, peptides, oligosaccharides

INTRODUCTION

The Protein Energy Theory is about the interplay between protein accessibility with microbes and oligosaccharides (e. g. water-soluble carbohydrates, WSC) and polysaccharides and their energy dynamics for human microbial digestion.

Recent developments with the theory for rumen digestion involving prebiotic agents to microbial digestion of peptides/amino acids and oligosaccharides/sugars from proteins and carbohydrates/water-soluble carbohydrates (WSC), respectively, are further elaborated in this paper since Flores (1991) treated the subject and implicated, 1) cell transport systems for peptide uptake and, also mentioned, are the well-studied fructans (a WSC), 2) the contention that peptides were used more efficiently with an energy dynamic regarding the ATP pool in the cell, and 3) other factors not covered thus far, as metabolites or nutrients, for e. g., ATP, NADPH, THF and B12, that can act as mitogens involving cell division for growth and development with cell division and its microbial protein cell (MCP) synthesis.

These could also occur via cell signaling including cell receptor binding for peptide oligomers and also saccharide oligomers and the biochemical cascades translating eventually to nuclear transcription factors (TF) at the cell nucleus with DNA expression.

CONJECTURES IN THE PROTEIN ENERGY THEORY AND CELL STRUCTURALLY-BASED MODELING

Described are the following 3 factors described that determine how bioactive ligand action affects cellular protein-making machinery:

1. There have been offered quantitative approaches as in the a) “random slot” selection mechanism with modification to make it more likely for the enzyme or protein to assume conformational function; and b) secondary structural properties describing changes with non-Markovian diffusion. To elaborate further, on the previous point, one has to realize that there are two molecular pools or populations between the cell protein machinery (e. g. enzymes) and the bioactive ligands that combine by cross reaction in order to assume their enhanced form.
2. Further to this, the mathematics that describes the modeled interactions in chaperoning for ligand and the protein enzyme, for e. g., can be taken care of by descriptions in quantitative equational form describing the kinetics, i. e. the equilibrium point(s) and the rate(s) of processes involving protein and their ligands in the process of cellular protein synthesis. A dual crossover for peptides and their cellular protein synthetic enzymes and oligosaccharides for their fibrolytic catabolic enzymes and, on the other hand, peptides for fibrolytic enzymes and oligosaccharides for cellular protein synthetic enzymes might be a possible schema with the obverse also true as held by this stipulation.
3. There is also involved in the Protein Energy Theory the matter of cell membrane receptor binding and possibly transport-limiting processes entailed between ligand and receptor and the biochemical cascade that proceeds along two possible routes: a) a nuclear related action for cell mitogenesis, and b) hastening the cell’s protein synthetic machinery via ligand binding.

PRACTICAL IMPLICATIONS FOR PROTEIN ENERGY THEORY

The theory with peptides and oligosaccharides suggests in practice the selection, pretreatment and extraction of seed grains used for ruminant feeds included with high-producing, higher-quality protein stimulants as functional supplements from peptides that have been designed for better performance, thus: a) longevity in the rumen milieu including partially protecting them from exposure to proteases by increasing effectively their half-life; b) calculating which peptides and their amino acids are most rate-limiting for synthesis based on their amino acid composition; c) the need to elucidate possible leader sequences that would allow entry into the microbial cell’s internal milieu; d) finding primary sequences that stimulate microbial protein synthesis, in some way, including critical tertiary structural considerations, chaperoning the enzymatic process involved with the cell molecular machinery; and e) mitogenic factors in the nucleus involved with the transcription process and TFs, involving as was already mentioned previously for: ATP, NADPH, THF and B12, that have an effect on the growth and development of cells.

CONCLUDING REMARKS

A recent enumeration in the literature brings to our attention other nutritional which claim functional properties to animal feeding. Thus, functional amino acids (FAA) (e. g. HIS, ARG, LYS, LEU), proteins (e. g. alpha-lactoferrin from milk), polysaccharides (e. g. from algae),

polyunsaturated fatty acids (PUFA) and vitamin D2/D3. Other nutritional not mentioned here are: other vitamins and minerals (both micro and macro) and the many other phytoactive compounds.

It is believed at this time that functional feed ingredients are seen as: refined or extracted compounds predominantly from plant sources, specialized protein or energy concentrate supplements, fine chemical/biochemical additives and, as bulk matrices, 'as is' or subject to steam explosions, drying, ensiling, milling and pelleting/extrusion.

Indeed, any current proteinergic approaches are for, e. g., use of enriched germ seed proteins from purification by seed protein companies for functional feeding is a strategy to supply high quality proteins with their amino acids from ruminal microbes in livestock in order to jumpstart the boosting of the animal's protein nutrition to increase meat and milk output from production.

Cleantech biofermentation, as it is called, will dictate if there are catalytic amounts of functional oligomers feeds given or in larger bulk amounts. In some cases, these will be either on a bulk matrix basis in unprocessed or processed form, or as extracted/enriched for the bioactive ingredients that are mixed in feed.

Declaration of Conflict of Interest

The author declares no conflict of interest involved with this paper.

ACKNOWLEDGMENTS

The author wishes to thank with gratitude management and staff and for the premises for his home-based business without which the preparation of the work on this paper would not have been made possible.

References

D. A. Flores. 1991. Biotechnology and the Improvement of Silage (Tropical and Temperate) Rumen Digestion: a minireview. Appl. Microbiol. Biotechnol. 35 (3): 277-282.