

# Milk Made More Nutritious

Clifford J Hawkins BSc PhD DSc

## Background

Many people in Australia suffer from intolerance to milk who are not "lactose intolerant". Indeed, many of the people "diagnosed" to be "lactose intolerant" are not affected by lactose but are affected by the proline-rich proteins in milk. Over 30% of Australia's population has the gene for food intolerance. This gene is an evolutionary gene that is handed-down to each child and to all their children. The obvious symptoms of the disease are becoming recognized these days in children because their immune system is becoming sensitized in utero or early in life through vaccinations. Milk intolerance is also not well recognized. People will say, "I do not like milk!" or "I stopped drinking milk when I was young!" or "after I had a particular illness, I could not stand milk!"

Foods that cause food intolerance and allergy have proline-rich proteins that are rich in peptides that make it very difficult for our digestive systems to break down these proteins and these peptides contain amino acids that stimulate the immune system if you have the gene for food intolerance. The casein proteins and beta-lactoglobulin are rich in such peptides (see below).

Pasteurization of milk, depending on the temperature profile, can partially break down the casein proteins to produce segments of the proteins that are bitter. These bitter components will contain the peptide groups that cause the casein intolerance. Bacterial contamination of the milk prior to pasteurization can also lead to cleavage of the casein proteins and the formation of bitter segments.

These problems of milk can be removed by treatment of the milk with Biohawk's ginger. It is designed to target and cleave specifically the peptide groups that cause the problems (highlighted yellow). This improved digestibility of the milk proteins also makes milk more nutritious for all people. The same applies to baby formulas based on milk (and soy).

The casomorphin problem for milk is also removed as the peptide is broken down for both a1 and a2 milk.

## Milk Protein Structures

Some of the published structures for the various proline-rich digestion-resistant milk proteins are shown below with groups highlighted where the Biohawk products will cleave the proteins:

### Kappa casein (Bos taurus)

MMKSFFLVVITLALTL**P**FLGAQEQNQE**P**IRCEKDERFFSDKIAKY**I**PIQYVLSR**Y**PSYGLNYYQQ**K**PVALINNQFL**P**  
**Y**PYYA**K**PAAVR**S**PAQILQWQVLSNTV**P**AKSCQA**Q**P**T**TMAR**H**PH**P**LS**F**MA**I**PP**K**KNQDKTE**I**PT**I**NTIASG**E**P**T**S**I**  
**P**TEAVESTVATLED**S**P**E**VIE**S**P**E**INTVQVTSTAV  
**Rennet digestion**

### Beta casein (Bos taurus) a2

MKVLILACLVALALARELEELNV**P**G**E**IVESLSSES**E**SITRINKKIEKFQSEEQQQTEDELQDK**I**HPFAQTQSLV**Y**PF**P**  
**G**PI**P**NSL**P**C**N**IPPLTQ**T**PVVV**P**PFL**Q**PEVMGVSKVKEAMAP**K**QKEM**P**F**P**K**Y**P**V**E**P**FTESQSLTLTDVENLHPLPL  
 LQSWMH**Q**PH**Q**L**P**P**I**VMF**P**P**Q**SVLSLSQSKVL**P**V**P**Q**K**AV**P**Y**P**C**R**DMPIQAFLLYQ**E**PVLGPVR**G**PF**P**II

**Y**PF**P**G**P**I**H** Beta casein a1 (bovine casomorphin 8 with BCM7 underlined)

**Y**PF**P**G**P**I**P** Beta casein a2 (bovine casomorphin 8 with BCM7 underlined)

### Alpha-S1 casein

MKLLILTCLVAVALA**F**P**K**H**P**IKHQGL**P**Q**E**VLNENLLRFFVAP**F**P**E**VFGKEKVNELSKDIGSESTEDQAMEDIKQMEA  
 ESISSEEV**P**NSVEQKHQKEDV**P**S**E**RYLGYLEQLLR**L**KKYKV**P**Q**L**EIV**P**NSAEER**L**HSMKEGIHAQK**E**P**M**IGVN  
 QELAYF**Y**P**E**LF**R**QFYQLDA**Y**P**S**GAWYYV**P**LGTQYTD**A**PS**F**SD**I**PN**P**I**G**SENSEKTT**M**PLW

### Alpha-S2 casein

MKFFIFTCLLAVALAKNTMEHVSSEESIISQETYKQEK**N**MA**I**NP**S**KENLCSTFCKEVVRNANEEY**S**IGSSSEESA  
 EVATEEVKITVDDKHQKALNEINQFYQK**F**P**Q**YLQYLYQG**P**IVL**N**PWDQV**K**RNAV**P**I**P**T**L**NREQLSTSEENSK**T**  
 VDMESTEVFTK**K**TKL**T**EE**E**K**N**RLN**F**L**K**KISQR**Y**QK**F**AL**P**Q**Y**L**K**TVYQH**K**AM**K**P**W**I**C**P**K**TK**V**I**P**Y**R**YL

### Beta lactoglobulin

MKCLLLALALTCGAQALIVTQTMKGLDIQKVAGTWYSLAMAASDISLLDAQS**A**PLRVYVEEL**K**PT**P**E**G**DL  
 EILLQKWENGEC**A**QK**K**IAEKTK**I**PAVFKIDALNENKVLVLDTDYKKYLLFCM**E**NS**A**E**P**E**Q**SLACQCLVR  
**T**P**E**VDD**E**AL**E**KFDK**A**L**K**AL**P**M**H**IRLS**F**N**P**T**Q**LEEQ**C**H**I**

The red "P" shows the proline amino acid. This secondary amino acid puts a fixed 90o bend in the protein chain that reduces the ability for proteases to break the chain near it. Multiple prolines throughout the protein make it very difficult to digest the protein. The yellow highlighting identifies peptide groups that introduce resistance to cleavage but also stimulate the immune system if you have the gene for food intolerance. Biohawk's products target these peptides specifically and cut the protein chain at the second peptide bond after the proline.