

**IMPORTANCE OF ALPHA-LACTALBUMIN IN  
INFANT NUTRITION**

By

Dr Dan Alaro

# Learning Objective

Describe the roles of  $\alpha$ -lactalbumin as an important nutrients for infants.

## Protein Composition : Human milk

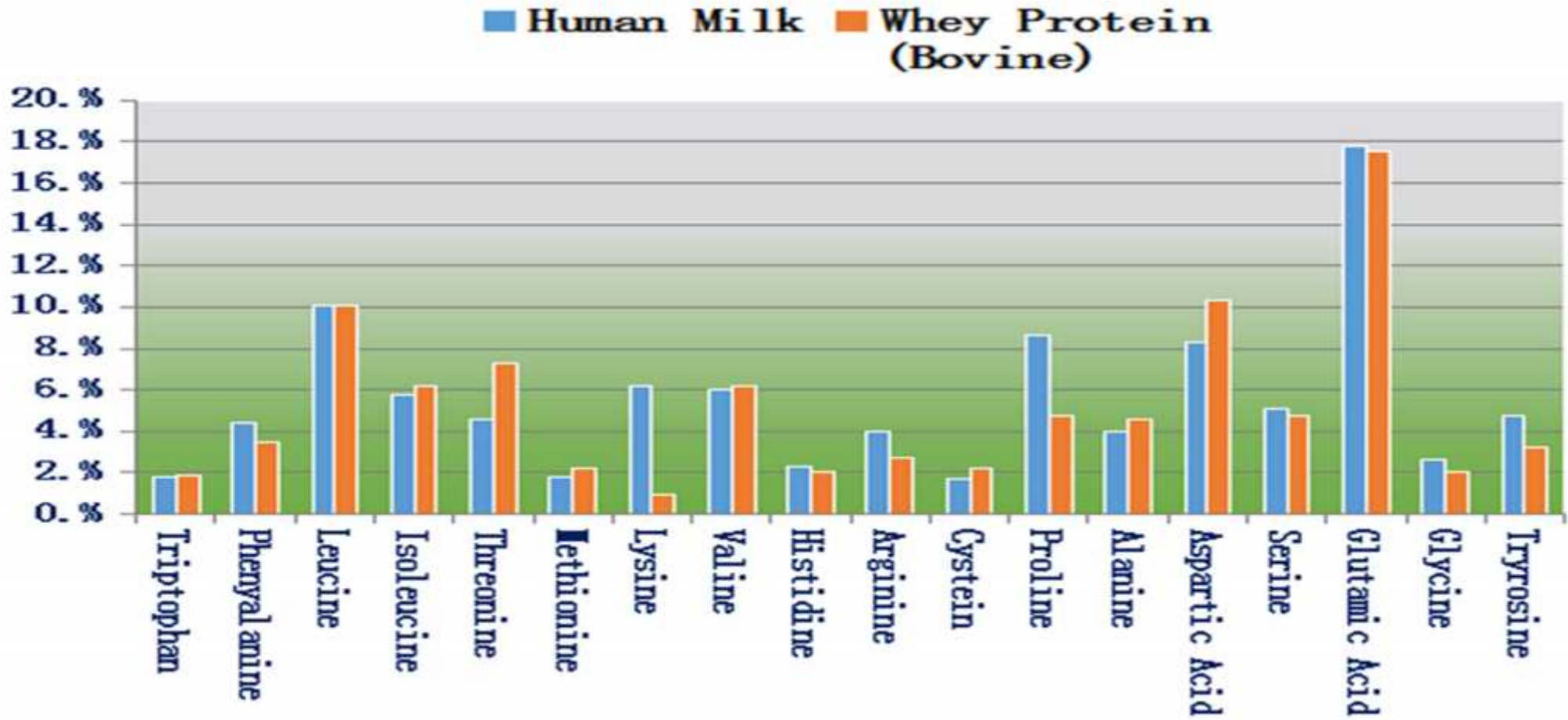
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### ❑ **The whey-to Casein ratio affects amino acid composition and thus affects protein quality**

- Casein & Whey proteins constitutes the principal proteins in breast milk.
- Whey-to-casein ratio in breast milk is variable and ranges from 90:10 to 50:50 during the normal course of lactation.

*Kunz C, Lönnerdal B. Re-evaluation of the whey protein/casein ratio of human milk. Acta Paediatr. 1992;81:107-112.*

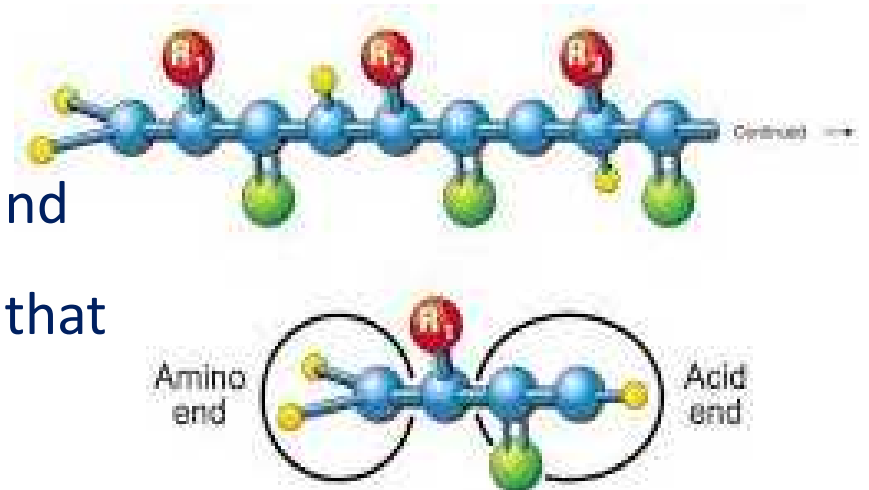
## Amino acid composition : Human milk



## Growth & Protein requirement during infancy

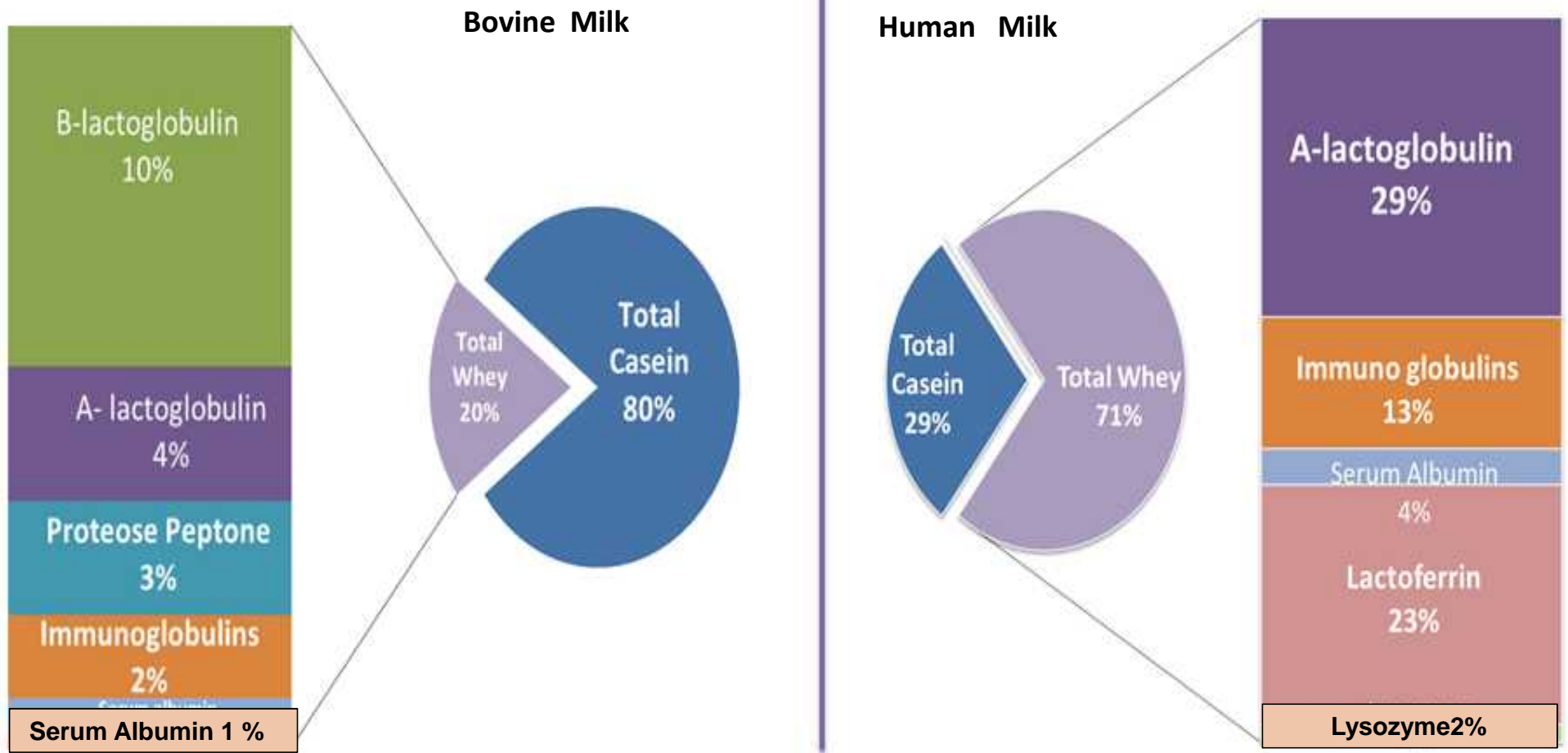
❑ Protein quality is measured in terms of amino acid composition

❑ A high-quality protein is highly digestible and contains essential amino acids in amounts that closely meet human needs



Committee on Nutrition, American Academy of Pediatrics. Pediatric Nutrition Handbook. Kleinman RE, ed. 5th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2004:55-97, 103-106,229-240, 271, 551-592.

# Protein Composition : Human milk Vs Cows Milk



Renner et al ,1983 , (in Modified form )

# Role of Alpha-lactalbumin



**1) Nutrition**



**2) Immunity & protection from pathogens**



**3) Absorption of micronutrients**



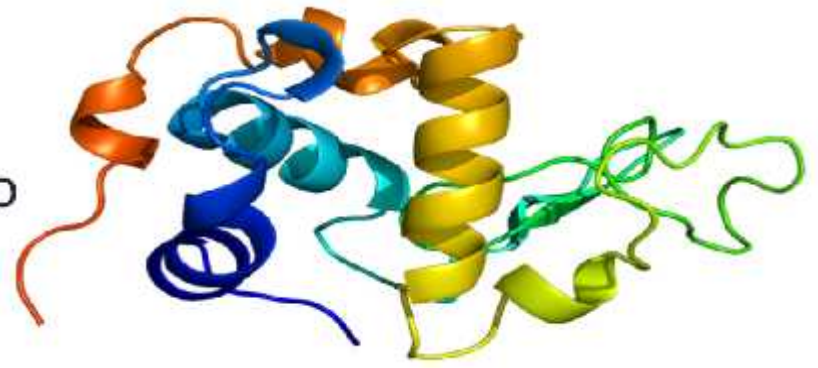
**4) Milk formation**



## 1) Nutritional Role of alpha-lactalbumin:

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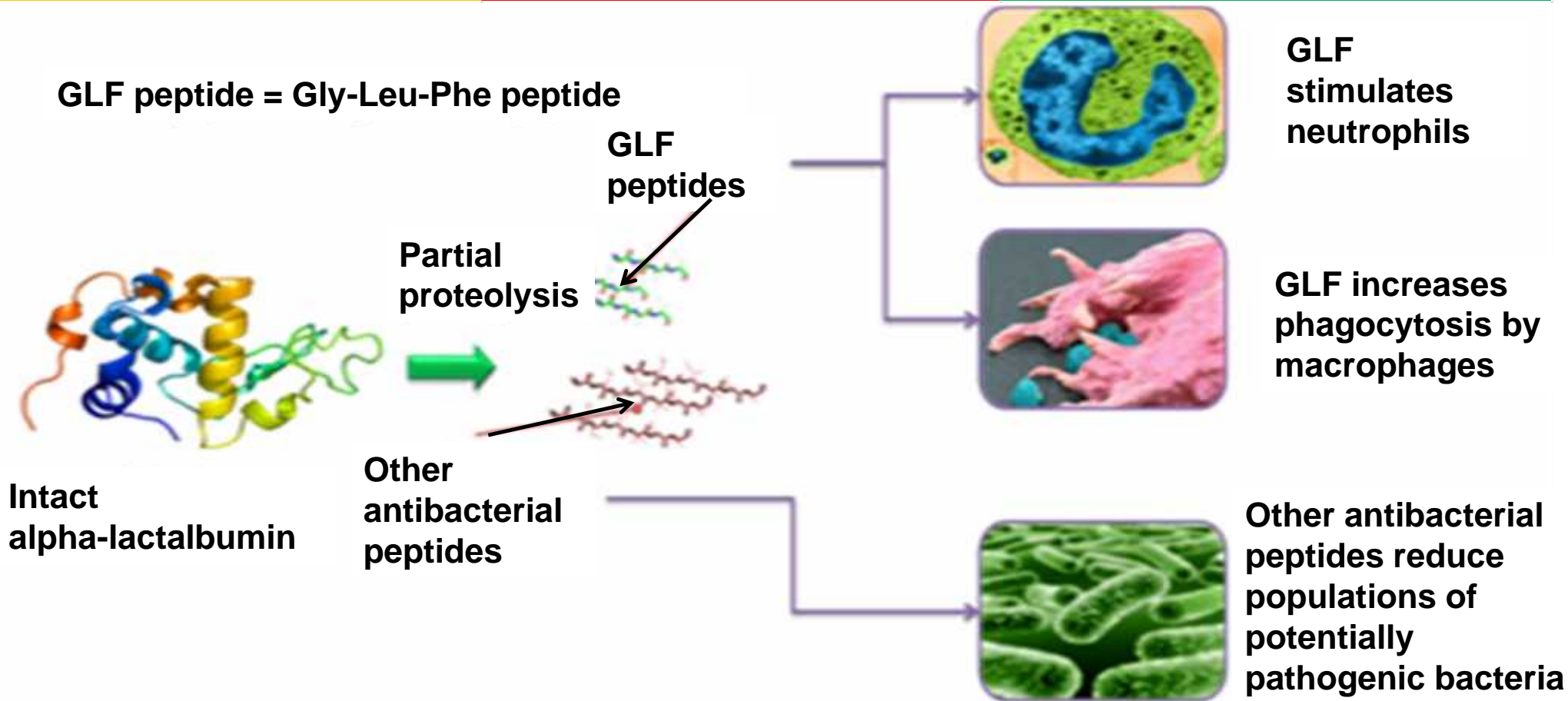
- ❑ Alpha-lactalbumin is particularly rich in **tryptophan**, **lysine**, and **cystein**.
- ❑ **Tryptophan** is a precursor of serotonin, a neurotransmitter that regulates response to stress, sleep- wake rhythm and other physiologic process.
- ❑ **Cystein** is a constituent of the tripeptide glutathione and a precursor of **taurine**.



- Renner E (1983) *Milk & Dairy Products in Human Nutrition* (Friedrich Pustet Germany)
- Yogman mw, Zeisel SH, Roberts C Assessing effect of Serotonin precursors on newborn behaviors *J.Psychiatric Res* 1982 17 123-33
- Heine WE Klein PD Reads PJ; *The Importance of -lactalbumin in infant Nutrition. J. Nutrition*, 1991: 121: 277- 83
- Lo CW *Human milk:Nutritional properties . Walker . WA Watkin JB.Ed Nutrition in Pediatrics. Hamilton, Canada, Decker 1996. 436-48*



## 2) Immunity & Protection



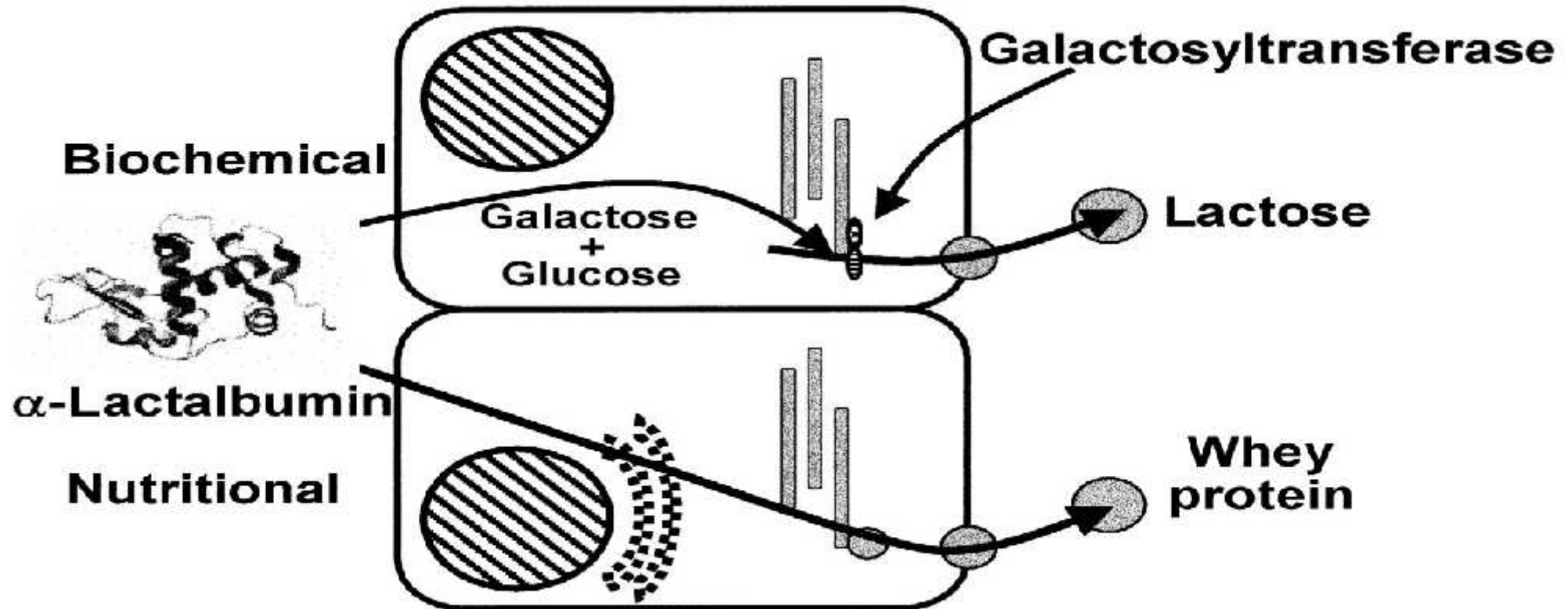
Pellegrini A et al. Isolation and identification of three bactericidal domains in the bovine alpha-lactalbumin molecule. *Biochim Biophys Acta* 1999; 1426(3): 439-448.

### 3) Absorptive role of alpha-lactalbumin

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- ❑ Intact alpha-Lactalbumin probably has only a limited ability to bind micro-nutrients and improve their absorption through the intestinal wall.
- ❑ However, during digestion, smaller peptides with the capacity to form complexes with cations are formed.
- ❑ Increased zinc absorption from formulas enriched with cows' milk alpha-Lactalbumin has been shown in infant rhesus monkeys

## 4) Milk formation



# Summary



1) Nutrition



2) Immunity & protection from pathogens



3) Absorption of micronutrients



4) Milk formation



# QUESTIONS ?

$\alpha$ -lactalbumin

The secret  
“super-ingredient”  
of breast milk



# Other benefits of $\alpha$ -Lactalbumin in infant feeding

- Improved amino acid profile

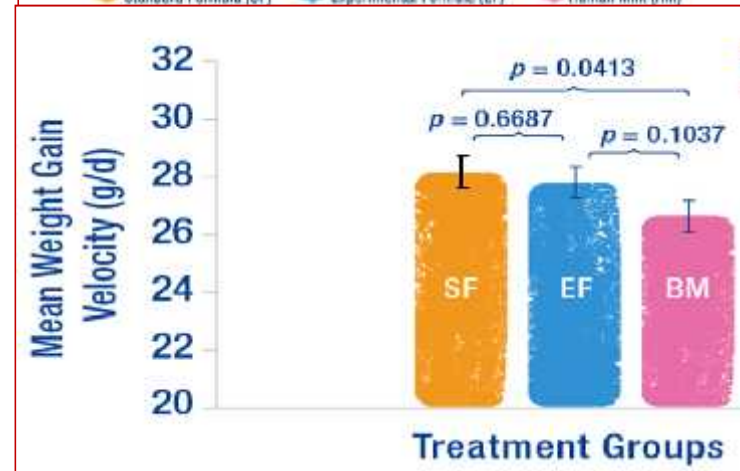
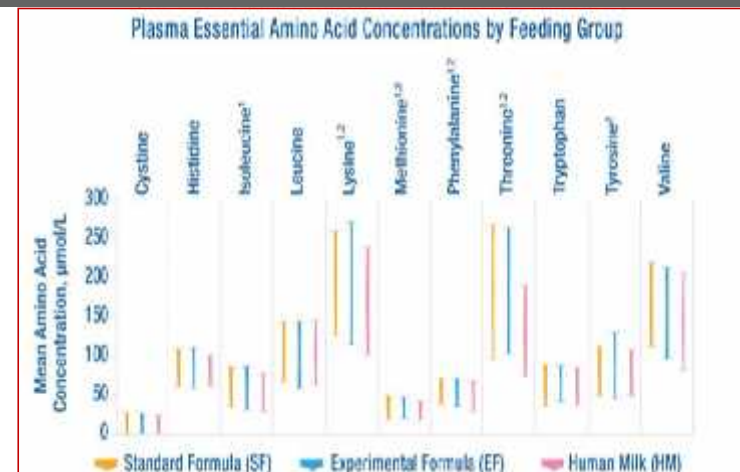
( ↑ Protein Quality)



- Support optimal Growth and development



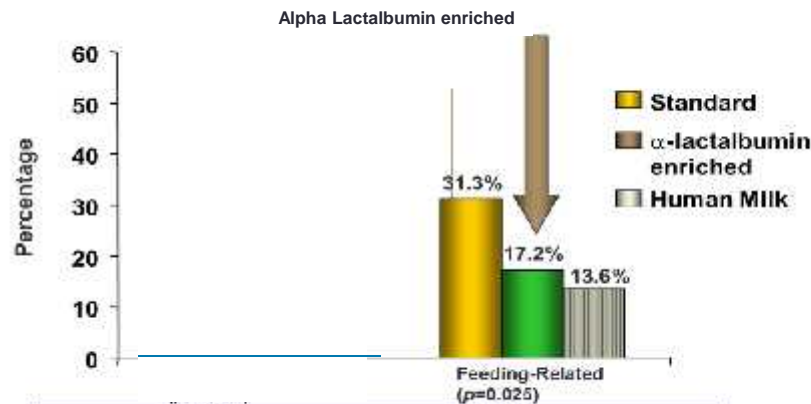
- Cognitive development is intimately related to overall growth and development of a child including brain growth & development.



# Other benefits of $\alpha$ -Lactalbumin in infant feeding

- Improvement of GI events in infant feeding.

Infants With Reported GI AEs

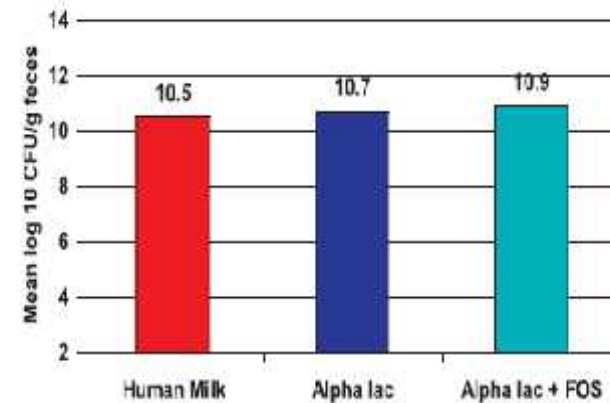


**Infants fed  $\alpha$ -lactalbumin enriched feeds had fewer GI Adverse Events**

Davis A et al JPGN 2005

- Prebiotic Effect to support in support of immune response

Fecal Bifidobacteria Concentrations Similar Among the Feeding Groups at Week 8



# References

- 1 Lönnerdal B. *Biological Effects of Novel Bovine Milk Fractions* 2011; 2. Kelleher SL et al. *Am J Clin Nutr* 2003; 77(5): 1261-1268. 17. Kunz C, Lönnerdal B. *Re-evaluation of the whey protein/casein ratio of human milk. Acta Paediatr.* 1992;81:107-112.  
  
Lönnerdal B. *Nutritional and physiologic significance of human milk proteins. Am J Clin Nutr.* 2003;77:1537S-1543S.
- 2 Marshall K. *Therapeutic applications of whey protein. Alt Med Rev.* 2004;9:136-156.
- 3 *Food and Nutrition Board, Institute of Medicine of the National Academies. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC: The National Academies Press; 2005:5-13, 35,167-170, 283, 457, 620, 621, 630.*
- 4 *Food and Nutrition Board, Institute of Medicine of the National Academies. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington, DC: The National Academies Press; 2005:5-13, 35, 167-170, 283, 457, 620, 621, 630.*
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- 12 *Lien EL Davies AM Euler Multicentre study group.2014 Growth and Safety in term infants fed reduced protein formula with added bovine alpha lactalbumin J. Pediatric .Gastroent. Nutr. 170 -176*
- 13 *Koletzko B, Von kries Closa R Escribano J. Scaghioni S Grovanini M et al 2009. Lower protein in infant formula associated with lower weight up to age 2ys, a randomised clinical trail AM J Clinical Nutri* 89, 1836 - 18 45
- 14 *Trabulsi J, et al. The effect of 2 different protein concentrations in term infant formula on growth. J Pediatr Gastroenterol Nutr. 2009;48(suppl 3):E78. Abstract PN1-12.*



# Effect of an $\alpha$ -lactalbumin-enriched feeds with lower protein on growth

European Journal of Clinical Nutrition (2011) 65, 167- 174)

Trabulsi J<sup>1</sup>, Capeding R, Lebumfacil J, Ramanujam K, Feng P, McSweeney S, Harris B, DeRusso P.

## Background

Protein Concentration is lower in human milk (HM) than in Infant formula. The objective of this study was to evaluate the effect of alpha-lactalbumin enriched feeds with a lower protein concentration on infant growth, protein markers and biochemistries

## Methods

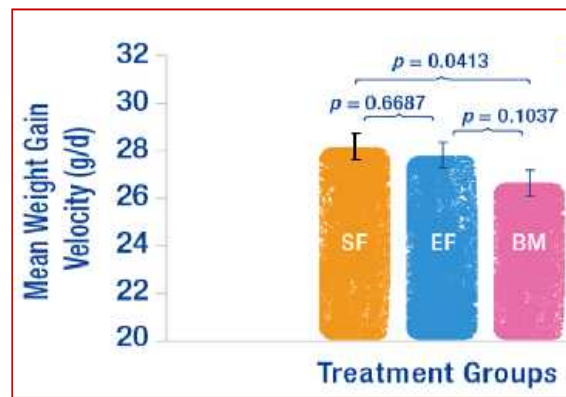
Healthy term formula –Non-breastfed infants (FF) 5-14 days old were randomized in this controlled , double blind trail to standard feed (SF: 14.1 g/l protein, 662kcal/l) or experimental feed (EF: 12.8g/l protein, 622 kcal /l) group (n=112) for 120 days; a HM reference group (n=112) was included.

- Primary outcome was weight gain (g/day) from D0 to D120.
- Secondary outcome included serum albumin, plasma amino acids insulin and incidence of study events.
- Anthropometric measures were expressed as Z-Scores using 2006 World Health Organization growth standards

## Results

1<sup>o</sup> Outcome: Mean weight gain (g/day) did not differ significantly between SF vs EF. (P=0.67) nor between EF vs HM (P=0.11), however weight gain (g/day) was significantly greater in the SF vs HM(P=0.04)

At day 120, mean weight-for- age Z-score (WAZ) and weight for length Z-score (WLZ) did not significantly differ between SF vs EF nor EF vs HM: however the WAZ was significantly greater in SF vs HM (p=0.025)



2<sup>o</sup> Outcome: Mean concentrations of plasma essential amino acids were similar to or slightly higher than in BM-fed infants

EF was able to supply all necessary essential amino acids at a lower protein level than standard formula<sup>14</sup>



## References

European Journal of Clinical Nutrition (2011), 65, 167 174 doi: 10.1038/ejcn.2010.236;published online 10 Nov 2010.

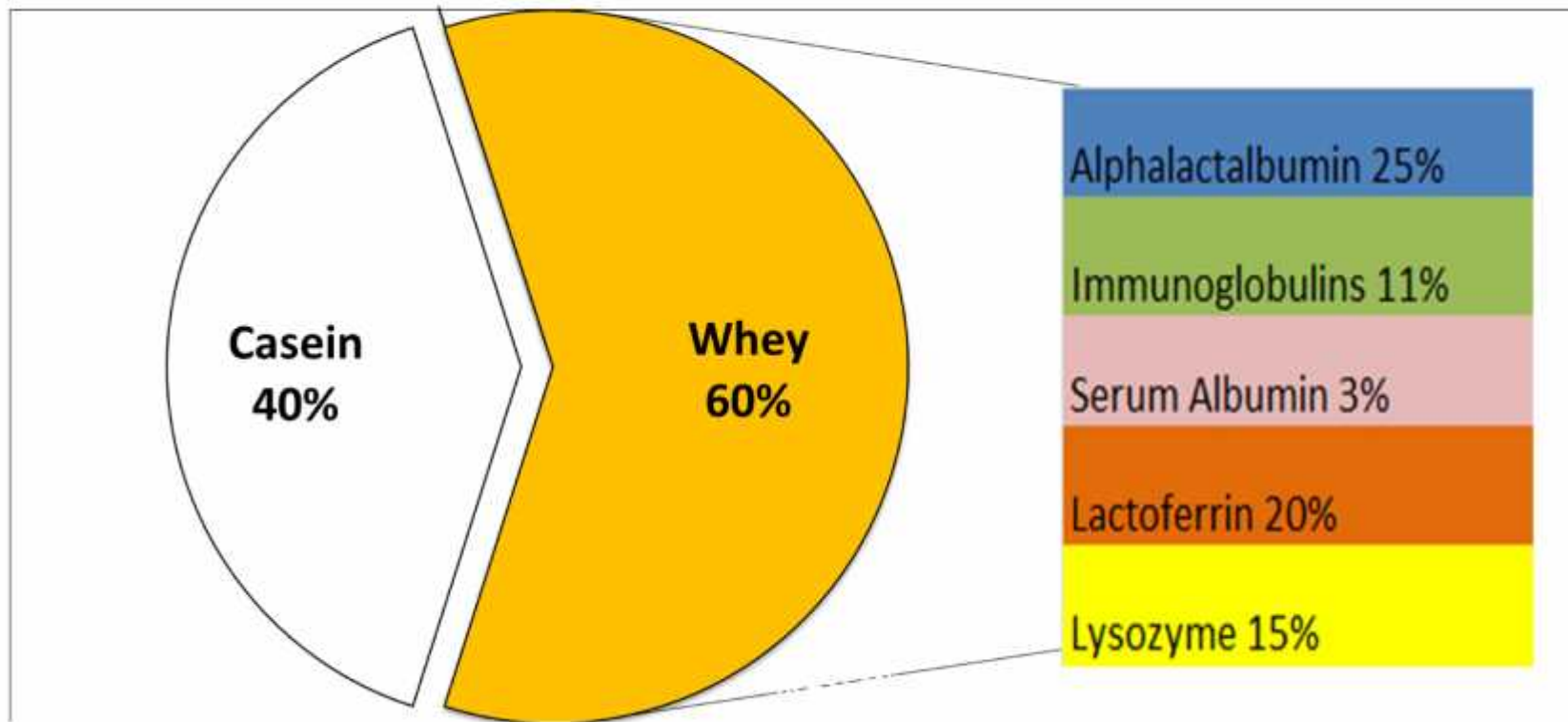
## Conclusion

Alphalactalbumin –enriched feeds containing 12.8 g/l protein was safe and supported age-appropriate growth: weigh gain with EF was intermediate between SF and HM groups and resulted in growth similar to breastfed infants in terms of weight gains(WAZ and WLZ

Infants randomized to the lower protein feeds had growth outcome similar to HM-fed infants in terms if weight gain , WAZ, WLZ

## Alpha-lactalbumin: Principal fraction of Whey protein

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**Whey protein fractions, expressed as a percentage of total protein in human milk**