IMPORTANCE OF ALPHA-LACTALBUMIN IN INFANT NUTRITION

By

Dr Dan Alaro
Learning Objective

Describe the roles of α-lactalbumin as an important nutrients for infants.
Protein Composition: Human milk

- 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.

Amino acid composition: Human milk

[Bar chart showing the amino acid composition of Human Milk and Whey Protein (Bovine)].

- Triptophan
- Phenylalanine
- Leucine
- Isoleucine
- Threonine
- Methionine
- Lysine
- Valine
- Histidine
- Arginine
- Cystein
- Proline
- Alanine
- Aspartic Acid
- Serine
- Glutamic Acid
- Glycine
- Tryptophane
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.

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

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BREAST MILK IS BEST FOR BABIES
1) Nutritional Role of alpha-lactalbumin:

- Alpha-lactalbumin is particularly rich in tryptophan, lysine, and cysteine.

- Tryptophan is a precursor of serotonin, a neurotransmitter that regulates response to stress, sleep-wake rhythm and other physiologic process.

- Cysteine is a constituent of the tripeptide glutathione and a precursor of taurine.

References:
- Renner E (1983) Milk & Diary Products in Human Nutrition (Friedrich Pustet Germany)
2) Immunity & Protection

GLF peptide = Gly-Leu-Phe peptide

Partial proteolysis

GLF peptides

Intact alpha-lactalbumin

Other antibacterial peptides

GLF stimulates neutrophils

GLF increases phagocytosis by macrophages

Other antibacterial peptides reduce populations of potentially pathogenic bacteria

3) Absorptive role of alpha-lactalbumin

- 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

Eric L Lien Am J Clin Nutr 2003;77:1555S-1558S
1) Nutrition

2) Immunity & protection from pathogens

3) Absorption of micronutrients

4) Milk formation
QUESTIONS?

α-lactalbumin

The secret “super-ingredient” of breast milk
Other benefits of 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 α-Lactalbumin in infant feeding

- Improvement of GI events in infant feeding.
  - Prebiotic Effect to support in support of immune response

**Infants With Reported GI AEs**

- Infants fed α-lactalbumin enriched feeds had fewer GI Adverse Events

Davis A et al J PGN 2005
References


7 J.Nutri 121. 277 - 283 1991,

8 Renner E (1983) Milk & Diary Products in Human Nutrition (Friedrich Pustet Germany


13 Koletzko B, Von kries Closa R Escribamo 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

Effect of an α-lactalbumin-enriched feeds with lower protein on growth


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

1º 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).

2º 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.

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.

References
Alpha-lactalbumin: Principal fraction of Whey protein

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