

## Prof. Atul Singhal

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Atul Singhal is a Professor in Paediatric Nutrition at the University College London Institute of Child Health, and Honorary Consultant Paediatrician at Great-Ormond Street Hospital. He graduated in Medicine from the Royal Free Hospital, London in 1986 and has been a consultant in paediatrics since 1998. Previously, he was the Director and Deputy Director of the Childhood Nutrition Research Centre, UCL Institute of Child Health.

He has broad interests in paediatric nutrition, but his current research focuses on the influence of early nutrition for long-term health, the effects of nutritional interventions to reduce long-term cardiovascular risk, and nutritional interventions for obesity.

## The importance of human milk for the long term health of term infants

The idea that nutrition may act during a critical window early in development to permanently affect, or 'program' (1), long-term health first emerged from studies in animals (2), but is now strongly supported in humans. Nutrition throughout the life course, including fetal life, infancy, the preschool, or toddlers years, and in adolescence impacts on long-term health, a hypothesis known as the developmental origins of adult disease hypothesis (3), based on the concept of nutritional programming.

In humans, the strongest evidence for nutritional programming has been obtained for the long-term benefits of breast-feeding. Breast-feeding, not only has benefits for short-term health, but has been shown to have major advantages for long-term cognitive function (4,5), atopic disease (6), bone health (7) and risk of obesity (8,9) and cardiovascular disease (10). There is particularly strong evidence that breast-feeding can improve later cognitive development, a hypothesis supported by several systematic reviews, evidence of a dose-response association (11), data from a cluster randomised trial (12), as well as evidence of benefits of breast-feeding on visual development (13) and structure of the brain (11,14). The mechanisms for these effects are uncertain, but include differences between human milk and formula in concentrations of biologically active factors such as nucleotides (13), lipids, and the milk fat globular membrane, and differences in patterns of growth (15).

This presentation will give an overview of the role of human milk intake on long-term health, focusing particularly on benefits for cognitive function and risk of obesity (13,14). It will highlight the key role of promoting exclusive breast-feeding

(13), optimising the pattern of infant weight gain (15), and the importance of experimental (randomised) studies in interpreting the effects of early nutrition on later health. Finally, it will consider the implications of nutritional programming for nutritional, clinical and public health practice.

### References

1. Lucas A. Programming by early nutrition in man. The childhood environment and adult disease. CIBA Foundation symposium 156. Bock GR and Whelan J. Wiley, Chichester; 1991; 38-55.
2. McCay CM: Is longevity compatible with optimum growth? *Science* 1933; 77: 410-411.
3. Bateson P, et al. Developmental plasticity and human health. *Nature* 2004; 430: 419-21.
4. Isaacs EB, et al. Early diet and general cognitive outcome at adolescence in children born at or below 30 weeks gestation. *J Pediatr* 2009; 155: 229-234.
5. Belfort MB, et al. Infant feeding and childhood cognition at ages 3 and 7 years: effects of breastfeeding duration and exclusivity. *JAMA Pediatr* 2013; 167: 836-888.
6. Kramer MS. Breastfeeding and allergy: the evidence. *Ann Nutr Metab* 2011; 59 Suppl 1:20-6.
7. Fewtrell MS, et al. Early diet and peak bone mass: 20 year follow-up of a randomized trial of early diet in infants born preterm. *Bone* 2009; 45:142-9.
8. Patro-Golab B, et al. Nutritional interventions or exposures in infants and children aged up to 3 years and their effects on subsequent risk of overweight, obesity and body fat: a systematic review of systematic reviews. *Obes Rev* 2016 ; 17:1245-1257.
9. Woo Baidal JA, et al. Risk factors for childhood obesity in the first 1,000 days; a systematic review. *Am J Prev Med* 2016; 50: 761-779.
10. Singhal A. The role of infant nutrition in the global epidemic of non-communicable disease. *Proc Nutr Soc* 2016; 75: 162-168.
11. Isaacs EB, et al. Impact of breast milk on intelligence quotient, brain size, and white matter development. *Pediatr Res* 2010;67: 357-62.
12. Kramer MS, et al. PROBIT Study Group (Promotion of Breastfeeding Intervention Trial). Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus. *JAMA*. 2001;285:413-420.
13. Singhal A, et al. Infant nutrition and stereoacuity at age 4-6 years. *Am J Clin Nutr* 2007; 85: 152 -159.
14. Sean CL, et al. Breastfeeding and early white matter development: A cross-sectional study. *NeuroImage* 2013; 82: 77-86.
15. Singhal A, et al. Early origins of cardiovascular disease; is there a unifying hypothesis? *Lancet* 2004; 363:1642-5.