



Paper for discussion: Recent evidence on the duration of exclusive breastfeeding and introduction of complementary foods.

Agenda Item: 2

Please see paper and annexes attached.

RECENT EVIDENCE RELATING TO THE DURATION OF EXCLUSIVE BREASTFEEDING AND INTRODUCTION OF COMPLEMENTARY FOODS

1. At the last SMCN meeting in September 2011, Members discussed the duration of exclusive breastfeeding and the timing of introduction of complementary foods. The Secretariat has conducted an initial scoping of the literature to address the question:
 - **Are there new data that introducing complementary foods before six months has short/intermediate/long term consequences for the infant?**
2. The Kramer and Kakuma Cochrane Review 'Optimal duration of exclusive breastfeeding' (last updated in 2009) has been used as the starting point to identify recent papers that have been published in this area. A literature search was carried out in PubMed using the search term 'exclusive breastfeeding' and was limited to papers published in English in the past three years.
3. **Annex 1** provides a list of the papers resulting from the PubMed search considered to be the most relevant to the SMCN review.
4. **Annex 2** lists the papers provided to SMCN Members as hard copies. These papers have been selected to help set the scene for the deliberations of the Committee. They have been grouped into a number of topics:
 - Optimal duration of exclusive breastfeeding
 - Breastfeeding and infection rates
 - Duration of exclusive breastfeeding and long-term health outcomes
 - Breastfeeding and risk of sudden infant death syndrome
 - Effects of long chain polyunsaturated fatty acid supplementation on infant and child development
 - Dietary diversification/food acceptance

ANNEX 1: LIST OF PAPERS RESULTING FROM PUBMED SEARCH

PAPERS IDENTIFIED FOLLOWING PUBMED SEARCH (JANUARY 2012)

SEARCH TERM: 'Exclusive Breastfeeding'

LIMITS: Past 3 years (since Kramer Cochrane review last updated in 2009); Papers in English

LONG-TERM EFFECTS OF BREASTFEEDING

Obesity/body composition/growth

Brion MJ, Lawlor DA, Matijasevich A, Horta B, Anselmi L, Araújo CL, Menezes AM, Victora CG, Smith GD. **What are the causal effects of breastfeeding on IQ, obesity and blood pressure? Evidence from comparing high-income with middle-income cohorts.** *Int J Epidemiol.* 2011 Jun;40(3):670-80.

Chivers P, Hands B, Parker H, Bulsara M, Beilin LJ, Kendall GE, Oddy WH. **Body mass index, adiposity rebound and early feeding in a longitudinal cohort (Raine Study).** *Int J Obes (Lond).* 2010 Jul;34(7):1169-76.

De Kroon ML, Renders CM, Buskermolen MP, Van Wouwe JP, van Buuren S, Hirasing RA. **The Terneuzen Birth Cohort. Longer exclusive breastfeeding duration is associated with leaner body mass and a healthier diet in young adulthood.** *BMC Pediatr.* 2011 May 10;11:33.

Durmuş B, van Rossem L, Duijts L, Arends LR, Raat H, Moll HA, Hofman A, Steegers EA, Jaddoe VW. **Breast-feeding and growth in children until the age of 3 years: the Generation R Study.** *Br J Nutr.* 2011 Jun;105(11):1704-11.

Gillman MW. **Early infancy as a critical period for development of obesity and related conditions.** *Nestle Nutr Workshop Ser Pediatr Program.* 2010;65:13-20; discussion 20-4.

Gubbels JS, Thijs C, Stafleu A, van Buuren S, Kremers SP. **Association of breast-feeding and feeding on demand with child weight status up to 4 years.** *Int J Pediatr Obes.* 2011 Jun;6(2-2):e515-22.

Harvey NC, Robinson SM, Crozier SR, Marriott LD, Gale CR, Cole ZA, Inskip HM, Godfrey KM, Cooper C; Southampton Women's Survey Study Group. **Breast-feeding and adherence to infant feeding guidelines do not influence bone mass at age 4 years.** *Br J Nutr.* 2009 Sep;102(6):915-20.

Koletzko B, von Kries R, Closa R, Escribano J, Scaglioni S, Giovannini M, Beyer J, Demmelmair H, Anton B, Gruszfeld D, Dobrzanska A, Sengier A, Langhendries JP, Rolland Cachera MF, Grote V. **Can infant feeding choices modulate later obesity risk?** *Am J Clin Nutr.* 2009 May;89(5):1502S-1508S.

Kramer MS. **Breastfeeding, complementary (solid) foods, and long-term risk of obesity.** Am J Clin Nutr. 2010 Mar;91(3):500-1. [DN: Editorial on Schack-Nielsen *et al* paper]

O'Tierney PF, Barker DJ, Osmond C, Kajantie E, Eriksson JG. **Duration of breastfeeding and adiposity in adult life.** J Nutr. 2009 Feb;139(2):422S-5S.

Roggero P, Gianni ML, Orsi A, Piemontese P, Amato O, Liotto N, Morlacchi L, Taroni F, Fields DA, Catalano PM, Mosca F. **Quality of growth in exclusively breast-fed infants in the first six months of life: an Italian study.** Pediatr Res. 2010 Dec;68(6):542-4.

Schack-Nielsen L, Sørensen Tia, Mortensen EL, Michaelsen KF. **Late introduction of complementary feeding, rather than duration of breastfeeding, may protect against adult overweight.** Am J Clin Nutr. 2010 Mar;91(3):619-27.

Taveras EM, Rifas-Shiman SL, Belfort MB, Kleinman KP, Oken E, Gillman MW. **Weight status in the first 6 months of life and obesity at 3 years of age.** Pediatrics. 2009 Apr;123(4):1177-83.

Cardiovascular disease risk

Parikh NI, Hwang SJ, Ingelsson E, Benjamin EJ, Fox CS, Vasan RS, Murabito JM. **Breastfeeding in infancy and adult cardiovascular disease risk factors.** Am J Med. 2009 Jul;122(7):656-63.e1.

Labayen I, Ruiz JR, Ortega FB, Loit HM, Harro J, Villa I, Veidebaum T, Sjostrom M. **Exclusive breastfeeding duration and cardiorespiratory fitness in children and adolescents.** Am J Clin Nutr. 2012 Jan 11. [Epub ahead of print]

Other health and developmental outcomes

Baker RD, Greer FR; Committee on Nutrition American Academy of Pediatrics. **Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0-3 years of age).** Pediatrics. 2010 Nov;126(5):1040-50.

Hauck FR, Thompson JM, Tanabe KO, Moon RY, Vennemann MM. **Breastfeeding and reduced risk of sudden infant death syndrome: a meta-analysis.** Pediatrics. 2011 Jul;128(1):103-10.

Kramer MS, Matush L, Bogdanovich N, Aboud F, Mazer B, Fombonne E, Collet JP, Hodnett E, Mironova E, Igumnov S, Chalmers B, Dahhou M, Platt RW. **Health and development outcomes in 6.5-y-old children breastfed exclusively for 3 or 6 mo.** Am J Clin Nutr. 2009 Oct;90(4):1070-4.

Ladomenou F, Moschandreas J, Kafatos A, Tselentis Y, Galanakis E. **Protective effect of exclusive breastfeeding against infections during infancy: a prospective study.** Arch Dis Child. 2010 Dec;95(12):1004-8.

Lamberti LM, Fischer Walker CL, Noiman A, Victora C, Black RE. **Breastfeeding and the risk for diarrhea morbidity and mortality.** BMC Public Health. 2011 Apr 13;11 Suppl 3:S15.

McCrorry C, Layte R. **The effect of breastfeeding on children's educational test scores at nine years of age: results of an Irish cohort study.** Soc Sci Med. 2011 May;72(9):1515-21.

McNiel ME, Labbok MH, Abrahams SW. **What are the risks associated with formula feeding? A re-analysis and review.** Breastfeed Rev. 2010 Jul;18(2):25-32. Review.

Oddy WH, Li J, Whitehouse AJ, Zubrick SR, Malacova E. **Breastfeeding duration and academic achievement at 10 years.** Pediatrics. 2011 Jan;127(1):e137-45.

Oddy WH, Robinson M, Kendall GE, Li J, Zubrick SR, Stanley FJ. **Breastfeeding and early child development: a prospective cohort study.** Acta Paediatr. 2011 Jul;100(7):992-9.

Rebhan B, Kohlhuber M, Schwegler U, Fromme H, Abou-Dakn M, Koletzko BV. **Breastfeeding duration and exclusivity associated with infants' health and growth: data from a prospective cohort study in Bavaria, Germany.** Acta Paediatr. 2009 Jun;98(6):974-80.

Timing of introduction of complementary foods

Baker JL, Michaelsen KF, Rasmussen KM, Sørensen TI. **Maternal prepregnant body mass index, duration of breastfeeding, and timing of complementary food introduction are associated with infant weight gain.** Am J Clin Nutr. 2004 Dec;80(6):1579-88.

Friel JK, Hanning RM, Isaak CA, Prowse D, Miller AC. **Canadian infants' nutrient intakes from complementary foods during the first year of life.** BMC Pediatr. 2010 Jun 17;10:43.

Kehler HL, Chaput KH, Tough SC. **Risk factors for cessation of breastfeeding prior to six months postpartum among a community sample of women in Calgary, Alberta.** Can J Public Health. 2009 Sep-Oct;100(5):376-80.

Kramer MS. **"Breast is best": The evidence.** Early Hum Dev. 2010 Nov;86(11):729-32.

Nielsen SB, Reilly JJ, Fewtrell MS, Eaton S, Grinham J, Wells JC. **Adequacy of milk intake during exclusive breastfeeding: a longitudinal study.** Pediatrics. 2011 Oct;128(4):e907-14.

Nwaru BI, Erkkola M, Ahonen S, Kaila M, Haapala AM, Kronberg-Kippilä C, Salmelin R, Veijola R, Ilonen J, Simell O, Knip M, Virtanen SM. **Age at the introduction of solid foods during the first year and allergic sensitization at age 5 years.** Pediatrics. 2010 Jan;125(1):50-9

Schiess S, Grote V, Scaglioni S, Luque V, Martin F, Stolarczyk A, Vecchi F, Koletzko B; European Childhood Obesity Project. **Introduction of complementary feeding in 5 European countries.** J Pediatr Gastroenterol Nutr. 2010 Jan;50(1):92-8.

Tarrant RC, Younger KM, Sheridan-Pereira M, White MJ, Kearney JM. **Factors associated with weaning practices in term infants: a prospective observational study in Ireland.** Br J Nutr. 2010 Nov;104(10):1544-54.

Wijndaele K, Lakshman R, Landsbaugh JR, Ong KK, Ogilvie D. **Determinants of early weaning and use of unmodified cow's milk in infants: a systematic review.** J Am Diet Assoc. 2009 Dec;109(12):2017-28.

Wasser H, Bentley M, Borja J, Davis Goldman B, Thompson A, Slining M, Adair L. **Infants perceived as "fussy" are more likely to receive complementary foods before 4 months.** Pediatrics. 2011 Feb;127(2):229-37.

Development of allergy

Anderson J, Malley K, Snell R. **Is 6 months still the best for exclusive breastfeeding and introduction of solids? A literature review with consideration to the risk of the development of allergies.** Breastfeed Rev. 2009 Jul;17(2):23-31. Review.

Des Roches A, Bégin P, Infante-Rivard C, Paradis J, Paradis L. **Peanut allergy and the impact of maternal consumption during pregnancy and breast-feeding.** J Allergy Clin Immunol. 2011 Jul;128(1):248-9; author reply 249-50.

Grimshaw KE, Allen K, Edwards CA, Beyer K, Boulay A, van der Aa LB, Sprickelman A, Belohlavkova S, Clausen M, Dubakiene R, Duggan E, Reche M, Marino LV, Nørhede P, Ogorodova L, Schoemaker A, Stanczyk-Przyluska A, Szepefalusi Z, Vassilopoulou E, Veehof SH, Vlieg-Boerstra BJ, Wjst M, Dubois AE. **Infant feeding and allergy prevention: a review of current knowledge and recommendations. A EuroPrevall state of the art paper.** Allergy. 2009 Oct;64(10):1407-16.

Joseph CL, Ownby DR, Havstad SL, Woodcroft KJ, Wegienka G, MacKechnie H, Zoratti E, Peterson EL, Johnson CC. **Early complementary feeding and risk of food sensitization in a birth cohort.** J Allergy Clin Immunol. 2011 May;127(5):1203-10.e5.

Schiess SA, Grote V, Scaglioni S, Luque V, Martin F, Stolarczyk A, Vecchi F, Koletzko B; European Childhood Obesity Project. **Introduction of potentially allergenic foods in the infant's diet during the first year of life in five European countries.** Ann Nutr Metab. 2011;58(2):109-17.

Silvers KM, Frampton CM, Wickens K, Epton MJ, Pattermore PK, Ingham T, Fishwick D, Crane J, Town GI; New Zealand Asthma and Allergy Cohort Study Group.

Breastfeeding protects against adverse respiratory outcomes at 15 months of age. *Matern Child Nutr.* 2009 Jul;5(3):243-50.

Xu X, Dailey AB, Freeman NC, Curbow BA, Talbott EO. **The effects of birthweight and breastfeeding on asthma among children aged 1-5 years.** *J Paediatr Child Health.* 2009 Nov;45(11):646-51.

Yang YW, Tsai CL, Lu CY. **Exclusive breastfeeding and incident atopic dermatitis in childhood: a systematic review and meta-analysis of prospective cohort studies.** *Br J Dermatol.* 2009 Aug;161(2):373-83.

Breastfeeding and behaviour

Burnier D, Dubois L, Girard M. **Exclusive breastfeeding duration and later intake of vegetables in preschool children.** *Eur J Clin Nutr.* 2011 Feb;65(2):196-202.

Heikkilä K, Sacker A, Kelly Y, Renfrew MJ, Quigley MA. **Breast feeding and child behaviour in the Millennium Cohort Study.** *Arch Dis Child.* 2011 Jul;96(7):635-42.

Mennella JA, Ventura AK. **Early feeding: setting the stage for healthy eating habits.** *Nestle Nutr Workshop Ser Pediatr Program.* 2011;68:153-63; discussion 164-8.

Mennella JA, Lukasewycz LD, Castor SM, Beauchamp GK. **The timing and duration of a sensitive period in human flavor learning: a randomized trial.** *Am J Clin Nutr.* 2011 May;93(5):1019-24.

Shim JE, Kim J, Mathai RA; STRONG Kids Research Team. **Associations of infant feeding practices and picky eating behaviors of preschool children.** *J Am Diet Assoc.* 2011 Sep;111(9):1363-8.

LCPUFAs

Cheatham CL, Nerhammer AS, Asserhøj M, Michaelsen KF, Lauritzen L. **Fish oil supplementation during lactation: effects on cognition and behavior at 7 years of age.** *Lipids.* 2011 Jul;46(7):637-45.

Collins CT, Makrides M, Gibson RA, McPhee AJ, Davis PG, Doyle LW, Simmer K, Colditz PB, Morris S, Sullivan TR, Ryan P. **Pre- and post-term growth in pre-term infants supplemented with higher-dose DHA: a randomised controlled trial.** *Br J Nutr.* 2011 Jun;105(11):1635-43.

de Jong C, Kikkert HK, Fidler V, Hadders-Algra M. **The Groningen LCPUFA study: no effect of postnatal long-chain polyunsaturated fatty acids in healthy term infants on neurological condition at 9 years.** *Br J Nutr.* 2010 Aug;104(4):566-72.

Dziechciarz P, Horvath A, Szajewska H. **Effects of n-3 long-chain polyunsaturated fatty acid supplementation during pregnancy and/or lactation on neurodevelopment and visual function in children: a systematic review of randomized controlled trials.** J Am Coll Nutr. 2010 Oct;29(5):443-54.

Gale CR, Marriott LD, Martyn CN, Limond J, Inskip HM, Godfrey KM, Law CM, Cooper C, West C, Robinson SM; Group for Southampton Women's Survey Study. **Breastfeeding, the use of docosahexaenoic acid-fortified formulas in infancy and neuropsychological function in childhood.** Arch Dis Child. 2010 Mar;95(3):174-9.

Holme A, MacArthur C, Lancashire R. **The effects of breastfeeding on cognitive and neurological development of children at 9 years.** Child Care Health Dev. 2010 Jul;36(4):583-90.

Isaacs EB, Ross S, Kennedy K, Weaver LT, Lucas A, Fewtrell MS. **10-year cognition in preterms after random assignment to fatty acid supplementation in infancy.** Pediatrics. 2011 Oct;128(4):e890-8.

Jensen CL, Voigt RG, Llorente AM, Peters SU, Prager TC, Zou YL, Rozelle JC, Turcich MR, Fraley JK, Anderson RE, Heird WC. **Effects of early maternal docosahexaenoic acid intake on neuropsychological status and visual acuity at five years of age of breast-fed term infants.** J Pediatr. 2010 Dec;157(6):900-5.

PCBs

Aliyu MH, Alio AP, Salihu HM. **To breastfeed or not to breastfeed: a review of the impact of lactational exposure to polychlorinated biphenyls (PCBs) on infants.** J Environ Health. 2010 Oct;73(3):8-14.

ANNEX 2: LIST OF PAPERS PROVIDED

OPTIMAL DURATION OF EXCLUSIVE BREASTFEEDING

1. Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. *Cochrane Database of Systematic Reviews* 2002, Issue 1. (Updated in 2009).
2. Fewtrell MS. The evidence for public health recommendations on infant feeding. *Early Human Development* 2011; 87: 715-721.
3. Dutch State Institute for Nutrition and Health. Van Rossum CTM, Buchner FL, Hoekstra J. Quantification of health effects of breastfeeding. Review of the literature and model situation. RIVM report. 350040001/2005.
4. Ip S, Chung M, Raman G, Trikalinos TA, Lau J (2009). A summary of the Agency for the Healthcare Research and Quality's evidence report on breastfeeding in developed countries. *Breastfeeding Medicine* 4: S17-S30.
5. Nielsen SB, Reilly JJ, Fewtrell MS, Eaton S, Grinham J, Wells JC. Adequacy of milk intake during exclusive breastfeeding: a longitudinal study. *Pediatrics*. 2011 Oct;128(4):e907-14.
6. Wasser H, Bentley M, Borja J, Davis Goldman B, Thompson A, Slining M, Adair L. Infants perceived as 'fussy' are more likely to receive complementary foods before 4 months. *Pediatrics* 2011; 127(2): 229-37.

BREASTFEEDING AND INFECTION RATES

7. Duijts L, Jaddoe, VWV, Hofman A, Moll HA. Prolonged and exclusive breastfeeding reduces the risk of infectious diseases in infancy. *Pediatrics* 2010; 126: e18-e25.
8. Fisk CM, Crozier SR, Inskip HM, Godfrey KM, Cooper C, Roberts GC, Robinson SM, the Southampton Women's Survey Study Group. Breastfeeding and reported morbidity during infancy: findings from the Southampton Women's Survey. *Maternal and Child Nutrition* 2011; 7:61-70.
9. Quigley MA, Kelly YJ, Sacker A. Infant feeding, solid foods and hospitalisation in the first 8 months after birth. *Arch Dis Child* 2009; 94: 148-150.
10. Quigley MA, Cumberland P, Cowden JM, Rodrigues LC. How protective is breast feeding against diarrhoeal disease in infants in 1990s England? A case-control study. *Arch Dis Child* 2006; 91: 245-250.

DURATION OF EXCLUSIVE BREASTFEEDING AND LONG-TERM HEALTH OUTCOMES

11. Arenz S, Rückerl R, Koletzko B, von Kries R. Breast-feeding and childhood obesity – a systematic review. *International Journal of Obesity* 2004; 28: 1247-1256.
12. Cope MB, Allison DB. Critical review of the World Health Organization's (WHO) 2007 report on 'evidence of the long-term effects of breastfeeding: systematic reviews and meta-analysis' with respect to obesity. *Obesity Reviews* 2008; 9: 594-605.
13. Horta B, Bahl R, Martines J, Victora C (2007). Evidence on the long-term effects of breastfeeding: systematic reviews and meta-analysis. World Health Organization Publication: Geneva, Switzerland.
14. Kramer MS. Breastfeeding, complementary (solid) foods, and long-term risk of obesity. *Am J Clin Nutr.* 2010 Mar;91(3):500-1. [DN: Editorial on Schack-Nielsen et al paper]
15. Schack-Nielsen L, Sørensen Tla, Mortensen EL, Michaelsen KF. Late introduction of complementary feeding, rather than duration of breastfeeding, may protect against adult overweight. *Am J Clin Nutr.* 2010 Mar;91(3):619-27.
16. Labayen I, Ruiz JR, Ortega FB, Loit HM, Harro J, Villa I, Veidebaum T, Sjostrom M. Exclusive breastfeeding duration and cardiorespiratory fitness in children and adolescents. *Am J Clin Nutr.* 2012 Jan 11. [Epub ahead of print]

BREASTFEEDING AND RISK OF SUDDEN INFANT DEATH SYNDROME

17. Hauck FR, Thompson JM, Tanabe KO, Moon RY, Vennemann MM. Breastfeeding and reduced risk of sudden infant death syndrome: a meta-analysis. *Pediatrics.* 2011 Jul;128(1):103-10.

EFFECTS OF LONG CHAIN POLYUNSATURATED FATTY ACID SUPPLEMENTATION ON INFANT AND CHILD DEVELOPMENT

18. Delgado-Noguera MF, Calvache JA, Bonfill Cosp X. Supplementation with long chain polyunsaturated fatty acids (LCPUFA) to breastfeeding mothers for improving child growth and development (Review). *Cochrane Database of Systematic Reviews* 2010, Issue 12.
19. Simmer K, Patole S, Rao, SC. Longchain polyunsaturated fatty acid supplementation in infants born at term (Review). *Cochrane Database of Systematic Reviews* 2008, Issue 1.

DIETARY DIVERSIFICATION/FOOD ACCEPTANCE

20. Cooke L, Fildes A. The impact of flavour exposure in utero and during milk feeding on food acceptance at weaning and beyond. *Appetite* 2011; 57: 808-811.
21. Nicklaus S. Children's acceptance of new foods at weaning. Role of practices of weaning and of food sensory properties. *Appetite* 2011; 57: 812-815.
22. Mennella JA, Ventura AK. Early feeding: setting the stage for healthy eating habits. *Nestle Nutr Workshop Ser Pediatr Program*. 2011;68:153-63; discussion 164-8.