



# Summary human milk research



# Breastfeeding is the best source of nutrition for infants

*Ausnutria acknowledges that breastfeeding is the best food for infants from 0-6 months and supports prolonging breastfeeding to two years of age.*

# Table of contents

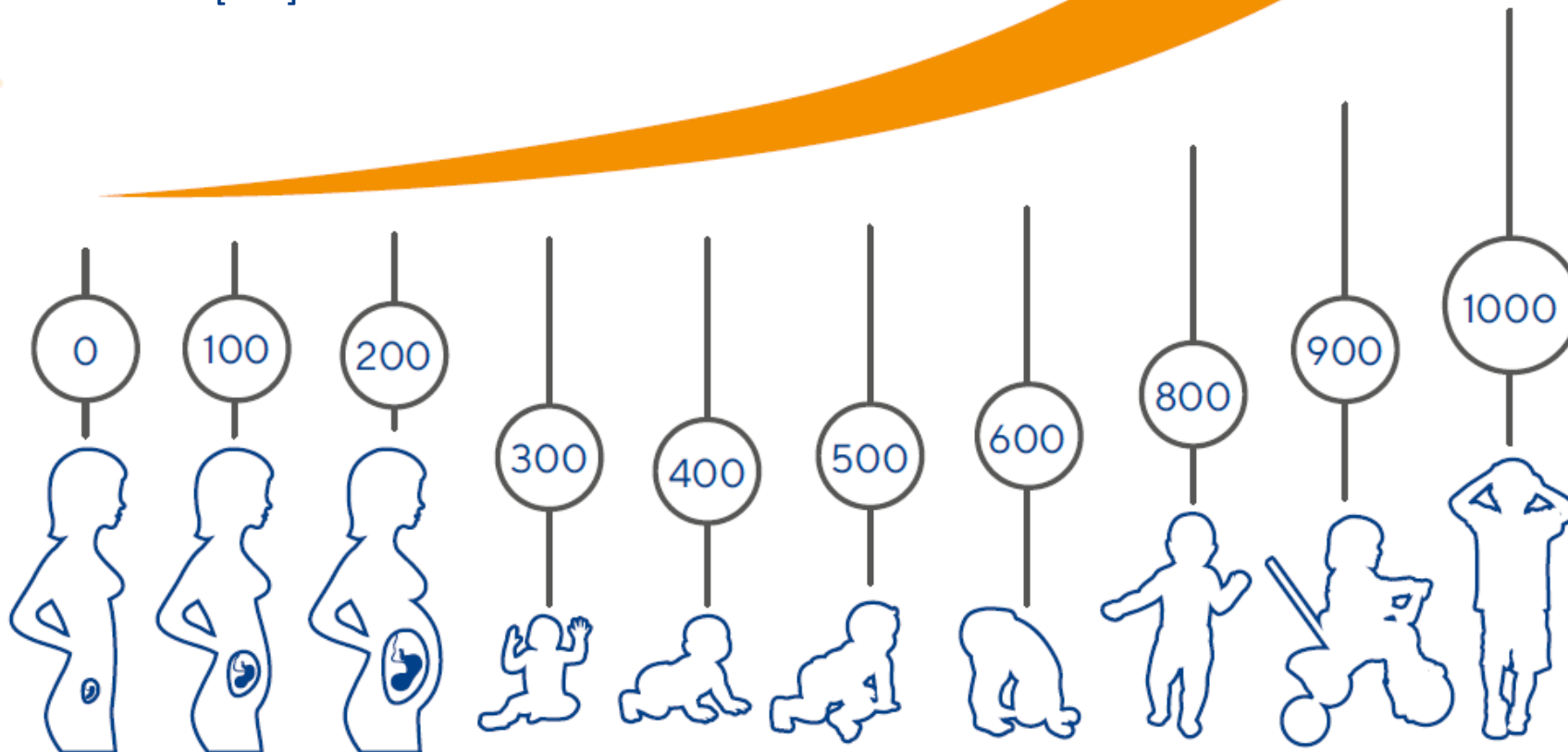
1. The first 1000 days
2. Breastfeeding:
  - Clinical benefits for mother
  - Clinical benefits for the infant
3. Composition of human milk
  - Factors that influence human milk composition
  - Complexity of human milk composition
  - During different lactation stages
4. Factors influencing breastfeeding rates



# First 1000 Days

An important time for the growth and development of infants [1-3].

The different developmental stages lay the foundation for lifelong health. Alterations or a delay in the maturation can have a negative impact on the long-term health outcome [1,2,3].



# Breastfeeding

## Clinical benefits for the mother [4,5,6,7,8]

- Possible health advantages of breastfeeding have been studied thoroughly
- The level of evidence differs for different health outcomes.
- Most convincing evidence shows that breastfeeding helps with the recovery after birth, reduces the chance of postpartum infertility and premenopausal breast cancer
- Other interesting facts:
  - Woman who breastfeed longer have lower rates of: heart diseases, type 2 diabetes and high blood pressure.
  - Breastfeeding triggers the release of oxytocin that causes the uterus to contract and may decrease the amount of bleeding after giving birth.
  - Breastfeeding possibly makes it easier to lose the gestational weight gained: a breastfeeding mom burns 500 extra calories each day.
  - Breastfeeding moms have lower rates of breast cancer and ovarian cancer.

### Health advantages of breastfeeding for mothers

HEALTH OUTCOMES FOR WHICH BREASTFEEDING IS PROTECTIVE	LEVEL OF EVIDENCE
<b>Slow maternal recovery from childbirth</b>	Convincing
<b>Reduced period of postpartum infertility</b>	Convincing
<b>Premenopausal breast cancer</b>	Convincing
<b>Postmenopausal breast cancer</b>	Probable
<b>Ovarian cancer</b>	Probable
<b>Rheumatoid arthritis</b>	Probable
<b>Maternal depression</b>	Possible
<b>Reduced maternal-infant bonding</b>	Possible
<b>Endometrial cancer</b>	Possible
<b>Osteoporosis and bone fracture</b>	Possible
<b>No or slow return to pre-pregnancy weight</b>	Possible

# Breastfeeding

## Clinical benefits for the infant [9]

- Human milk is a dynamic, multi-faceted fluid containing nutrients and bioactive factors needed for the infant's health and development.
- Many studies have been performed to investigate the health benefits of breastfeeding for the infant.

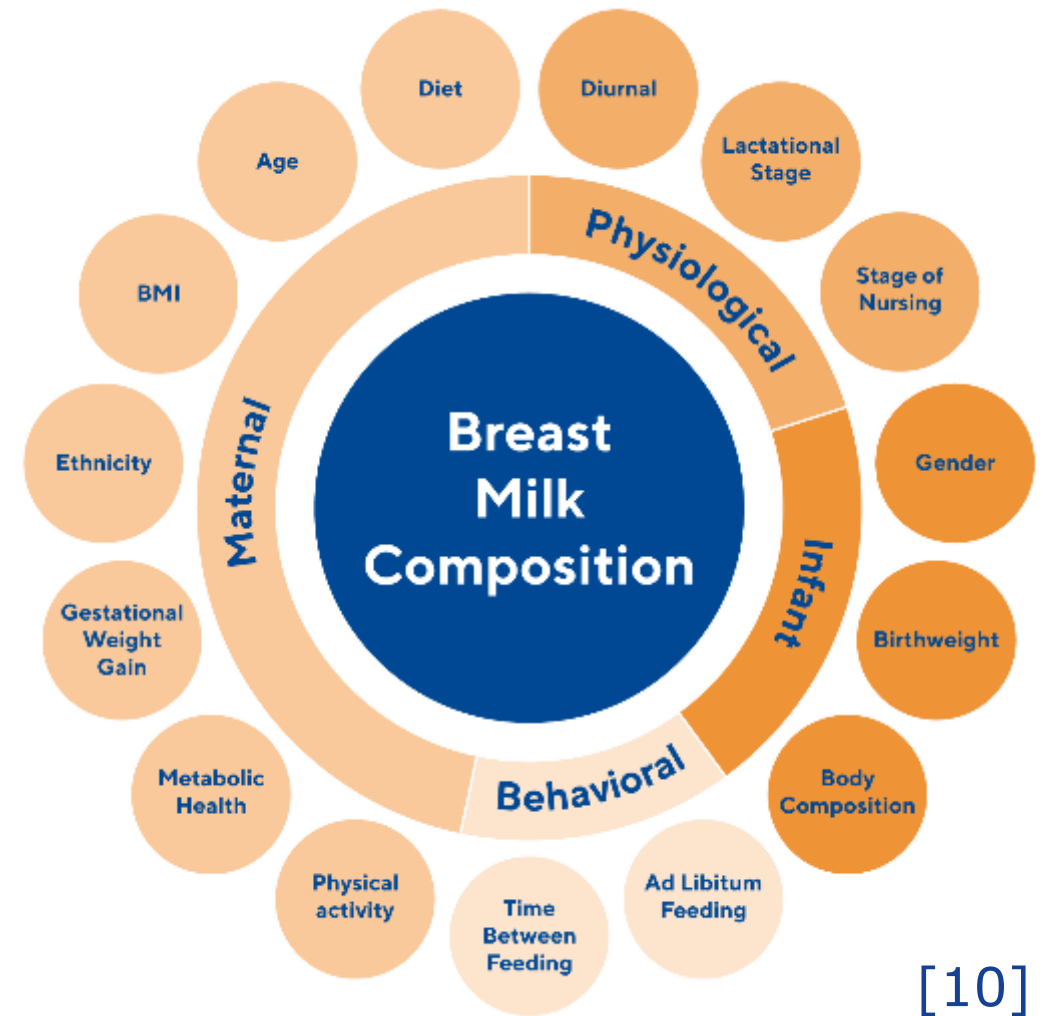
### Health advantages of breastfeeding for the infant

HEALTH EFFECT	LEVEL OF EVIDENCE	RELEVANT STUDIES
<b>Obesity</b>	Convincing	Von kries et al. 1999 Weng et al 2012 Horta & Victora 2013
<b>Type 2 Diabetes</b>	Convincing	Taylor et al. 2005 Ip et al. 2007 Horta & Victora 2013
<b>Gastrointestinal Infection</b>	Convincing	Rebhan et al. 2009 Lamberti et al. 2011 IVAC 2013
<b>Respiratory infections (pneumonia)</b>	Convincing	Agostoni et al. 2009 Horta & Victora 2013b
<b>Hypertension</b>	Probable	(systolic pressure only) Horta & Victora 2013a
<b>Asthma</b>	Probable	Dogaru et al. 2014 Kramer & Kakuma 2012
<b>Cognitive Development</b>	Probable	Kramer et al. 2008 Whitehouse et al. 2011 Horta & Victora 2013. Anderson JW et al. 1997
<b>Type 1 Diabetes</b>	Possible	Sadauskaitė-Kuehne et al. 2004 Cardwell et al. 2012 Patelarou et al. 2012
<b>Eczema</b>	Possible	Florh et al. 2011 Agostoni et al. 2009 Kramer & Kakuma 2012
<b>Atopy</b>	Insufficient	Grimshaw et al. 2009
<b>Inflammatory Bowel Disease</b>	Insufficient	Klement et al. 2004 Horta et al. 2007 Ip et al. 2007

# Factors that influence breast milk composition

Breast milk is not a uniform, constant, factory-made product; rather, it is a biological product produced by women with markedly varying genotypes, phenotypes and diets.

To add to the complexity, the composition of breast milk is influenced by a many of maternal, infant, and environmental factors.



[10]

# Complexity of human milk

A few of the many components... [4]

## Carbohydrates

Lactose  
Oligosaccharides (>200)

## Proteins

Aminoacids  
Whey  
 $\alpha$ -Lactalbumin  
Caseins  
Serum Albumin  
Non-protein Nitrogen  
Creatine  
Urea  
Uric Acid  
Nucleotides  
AMP  
CMP  
UDP  
CDP  
UDPH  
UDPAH  
UDPGA

## Growth factors

IL-1 $\beta$ , IL-2  
IL-4, IL-6  
IL-8, IL-10  
G-CSF, M-CSF  
PDGF, VEGF  
HGF- $\alpha$ , HGF- $\beta$

EGF, TNF- $\alpha$   
IGF-1, TGF  $\beta$ 1  
TGF  $\beta$ 2

## Peptides

Whey peptides  
Casein peptides  
 $\beta$ -Defensin 1  
 $\beta$ -Endorphins  
Gastrin  
Neurotensin  
Somatostatin

## Hormones

Insulin, Leptin  
Adiponectin  
Cortisol, T3, T4  
TSH, TRH, Prolactin  
Oxytocin, Ghrelin

## Enzymes

BSSL  
Amylase  
Catalase  
Histaminase  
Phosphatase  
Lysozyme  
Xanthine Oxidase  
Antiproteases

## Immune factors

sIgA  
IgA2  
IgG  
IgD  
IgM  
IgE

## Lipids

Triacylglycerols (TAG)  
Diacylglycerols (DAG)  
Monoacylglycerols (MAG)  
Fatty acids (FA; esterified  
& free)  
SFA (16:0)

MUFA (18:1)  
PUFA n-3 (ALA)  
PUFA n-6 (LA, DHA)  
MCFA (10:0, 12:0)  
LCFA (18:0, 20:0)

## Phospholipids

Phosphatidylcholine  
Sphingomyelin  
Phosphatidylethanolamine  
Phosphatidylserine  
Phosphatidylinositol  
Lysophospholipids  
Plasmalogens

## Sphingolipids

Gangliosides  
(GM1, GM3, GD3)  
Glycosphingolipids  
Ceramides  
Glucosylceramides  
Galactosylceramides

## Sterols

Cholesterol  
Squalene  
Lanosterol  
Sitosterol  
Dimethylsterol

## Minerals

Na (Sodium)  
Mg (Magnesium)  
P (Phosphorus)  
K (Potassium)  
Ca (Calcium)  
Fe (Iron)  
Mn (Manganese)  
Cu (Copper)  
Zn (Zinc)  
Se (Selenium)  
I (Iodine)

## Vitamins

Vitamin A  
Vitamin B6  
Vitamin B9  
Vitamin B12  
Vitamin C  
Vitamin D  
Vitamin K  
Thiamin  
Riboflavin  
Vitamine E  
Pantothenic Acid  
Carotenoids  
Niacin  
Biotin  
Choline  
Inositol

## Cells and others

Leukocytes  
Macrophages  
Lymphocytes  
Stem Cells  
mRNA  
microRNA  
Carnitine  
Taurine  
Chromium  
Molybdenum  
Fluoride





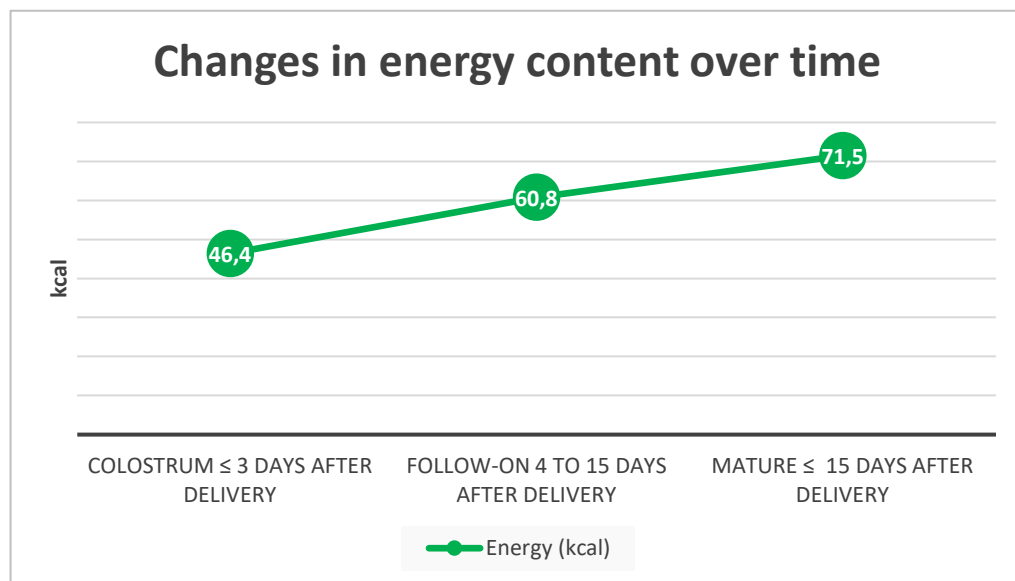
# Lactation stages



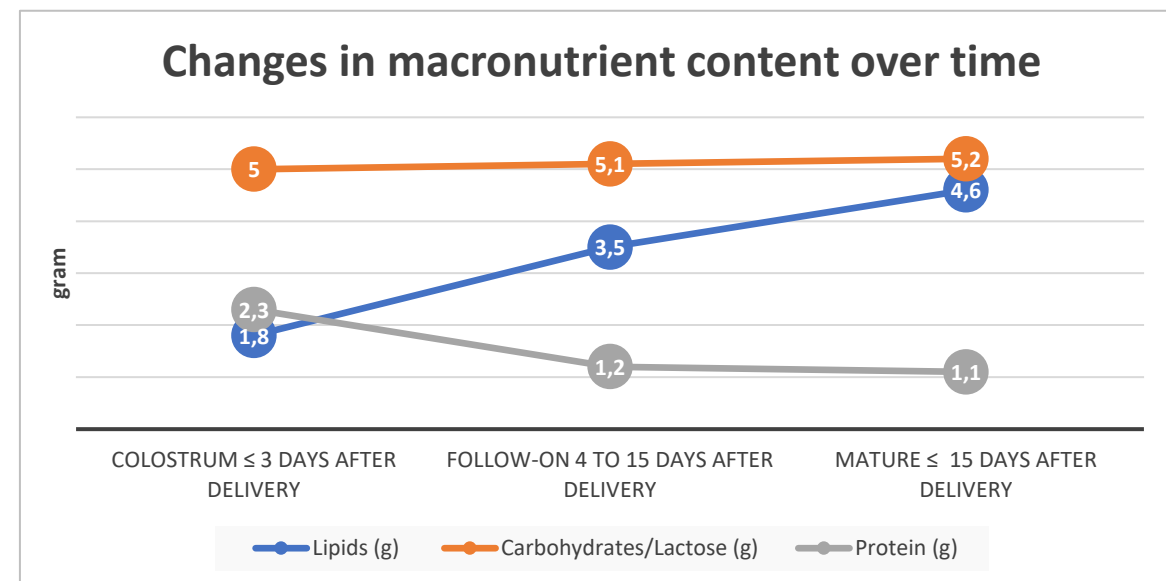
Two main stages are identified in the lactation process (lactogenesis) [4,9].

- 1. Lactogenesis I** is the first stage of lactation which describes the secretion of colostrum  
Colostrum  $\leq 5$  days after delivery
- 2. Lactogenesis II** encompasses the transition from colostrum (transitional milk) to the secretion of mature milk.  
Transitional Milk : 5 to 15 days after delivery  
Mature Human Milk:  $\geq 15$  days after delivery

# Human milk composition changes over time [11]



In human milk of mothers <35 years of age



In human milk of mothers <35 years of age

Human milk is the sole source of nutrition during the first 6 months of life and fulfils the specific needs of infants who are growing and developing.\*

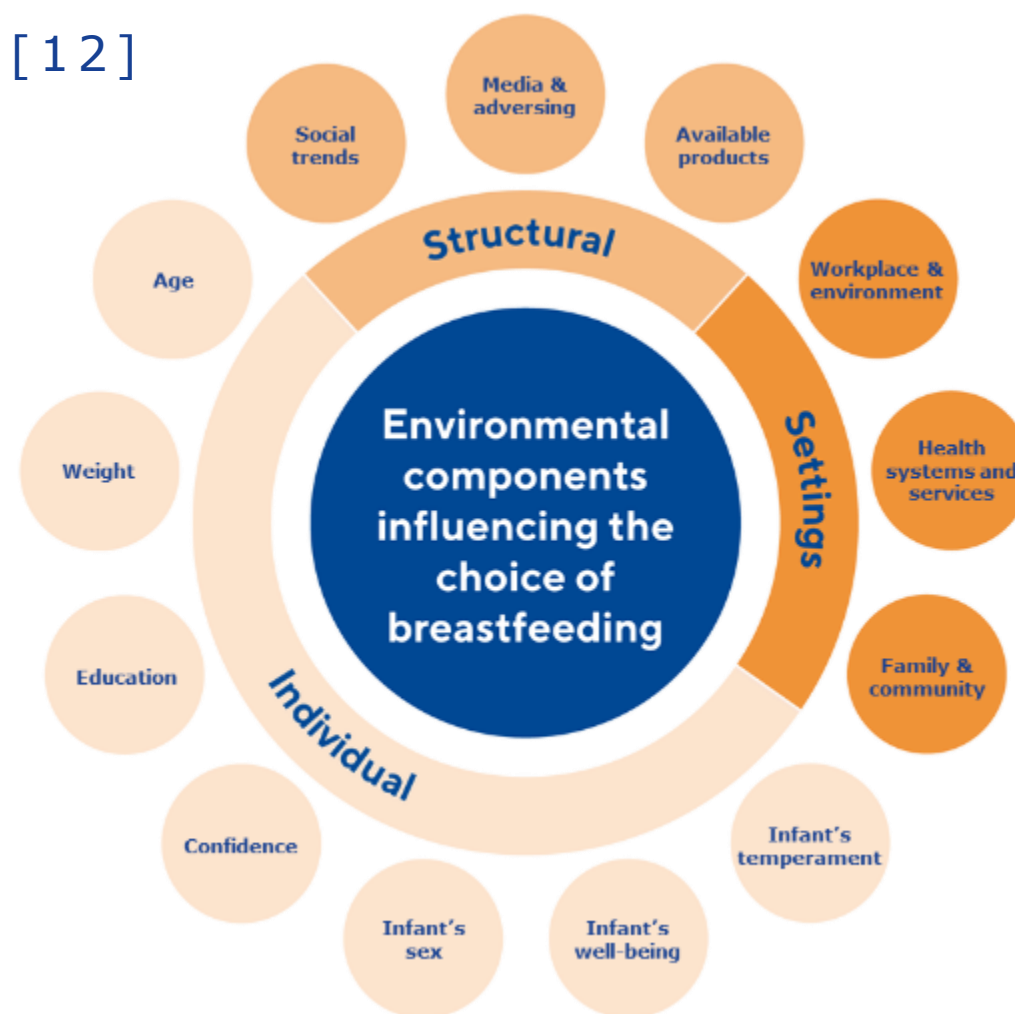
\* However, supplementation of Vitamin D/K is recommended

# Determinants influencing breastfeeding rates [12]

Structural determinants are social factors that effect the whole population, these determinants are controlled by (local) legislation, policies and media.

Individual settings can have an influence on a woman's choice to breastfeed.

At an individual level, women's breastfeeding behaviour is influenced by personal attributes and attributes of her baby.



# Reasons why women stop breastfeeding [10]

Breastfeeding duration varies between different socio-economical status (SES)

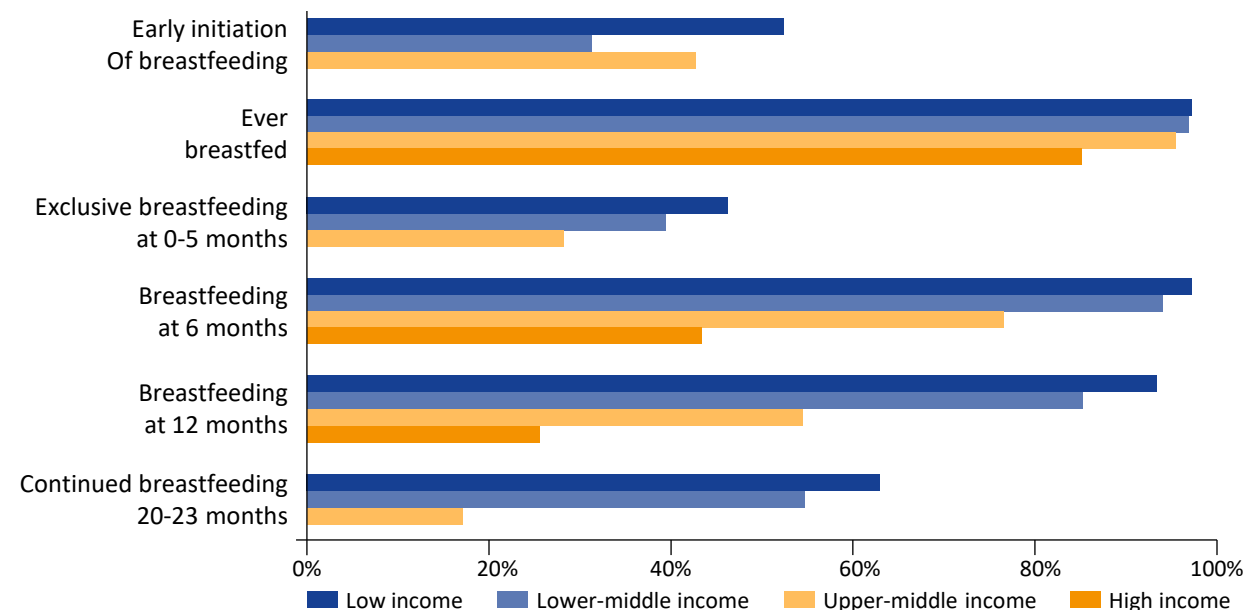
Research indicate that the major considerations for mothers to stop breastfeeding include:

## 1. Concern about maternal or child health

- Infant nutrition
- Maternal illness
- Infant illness

## 2. Concerns about processes associated with breastfeeding

- Infant nutrition
- Lactation and milk expression



Breastfeeding indicators by country income group in 2010, figure adapted from Fields et al. 2016

## References

- 1) Reilly, Armstrong et al. 2005
- 2) Whitaker, Dietz 1998
- 3) Costello et al. 2015
- 4) Lawrence & Lawrence 2011
- 5) Collaborative Group on Hormonal Factors in Breast Cancer 2002
- 6) Jordan, Na et al. 2017
- 7) Kramer et al. 2010
- 8) Allen, J. et al. Benefits of Breastfeeding. NSW Public Health Bulletin.
- 9) The Early Nutrition eAcademy
- 10) Fields et al. 2016
- 11) Lubetzky, Sever et al. 2015
- 12) Odom et al. 2013

# **“SCIENCE TO NOURISH LIFE AND GROWTH”**