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ORIGINAL REPORT

BREASTFEEDING: A Basic Strategy for Health Promotion (Mini-Review)

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Abstract

Breast milk, the quintessential infant nutrition is unique in its composition and temporal biochemical dynamism. Its production begins in early gestation and is potentiated at birth in response to physiologic demand. Early initiation of breastfeeding ensures the baby receives colostrum which transits gradually to mature milk in the first 2 weeks post-partum. The nutritive and anti-infective components synergistically work to ensure nurture and survival of the young infant.

Introduction

Breastfeeding is the cornerstone of child health and survival. According to the World Health Organization (WHO), breastmilk is the ideal food that provides all that is essential for the proper development of the young child. Globally only 44% of young infants are exclusively breastfed and this has changed little in the last two decades. Also, for 3 out of every 5 newborn infants, breastfeeding is not initiated as required within the first hour of life[1]. It has been estimated that the risk of mortality would reduce by 50% if breastfeeding continues for 12-23 months of age[2]. It is an established fact that breastmilk can provide all the energy and nutrients that infants need for the first six months of life. This informed the adoption of Weight and Development Nomograms of exclusively breastfed infants as the reference against which babies on alternative feeding methods are measured[3]. It must be reemphasized that human breast milk is specific to the human species[4]. It is both dynamic and complex. For instance the composition of breast milk changes during a feed, from one feed to another, within a single day and over time, in response to the growing infant's need[5]. Also, it contains countless bio-active constituents including; immune-protective agents, various enzymes, hormones and several other essential nutrients coexisting in an intricate balance that protects against several diseases while also promoting optimal growth and development. Among documented long term benefits are lower mean blood pressure, low total cholesterol and higher performance in intelligence (6,7)

COLOSTRUM

Colostrum is the thick yellow milk present during pregnancy and for the first 48-72hours after birth. Its production begins in early gestation from about the 12th week (Lactogenesis I) with a **post-partum** boost under the influence of hormonal changes during labour and delivery; (rapid drop in progesterone and increased levels of prolactin, cortisol and insulin**),** increased blood flow with enhanced oxygen and glucose uptake, and a sharp rise in citrate concentration (Lactogenesis 2 or secretory activation)[4.] It is often small in quantity (about 40-50ml is produced within the first 24hours) but provides an ideal nutrient and immunological substance that facilitates the newborn's transition from the sterile intrauterine milieu to the unsterile extrauterine environment[8]. This being the rationale for its informal designation as baby's first immunization. It contains much more proteins and much less fat and lactose compared with mature milk. Its rich content of betacarotene (a Vitamin A precursor) is responsible for its yellow colour. Vitamin A is a critical nutrient for early retinal development and also protects against infections. White blood cells in colostrum constitute a further source of protection against infection and the presence of immunoglobulin, secretory immunoglobulin A (IgA) in particular enhances the protective property of colostrum. Compared with mature milk it contains 10 times IL-6, 7 times IgM and 9 times IgA. Lactose in colostrum prevents hypoglycaemia and facilitates evacuation of meconium from the gut and consequently enhances the excretion of bilirubin.

The concept of Oral Colostrum Care (OCC) in preterm babies has further demonstrated clinical benefits of colostrum. Small amounts of colostrum is directly administered at intervals into the oral cavity with expectations that it or some of its components is/are absorbed by the oropharyngeal mucus membranes. This is reportedly associated with higher weight at 36 week postmenstrual age, increased urine levels of immunoglobulin A and Lactoferrin and significant decrease in the risk for clinical sepsis. It is also associated with altered colonization of the oral cavity with lasting benefial effects.[9]

MATURE HUMAN MILK

Breastmilk production starts by the 12th week of gestation with Lactogenesis I. This extends until the delivery of the baby. Lactogenesis II begins to occur between the 2nd and 4th postpartum day evidenced by the milk "coming-in" in greater quantity, the mother's breast is full and the baby's swallowing pattern becomes distinct. The milk is described as transitional between the 4th and 10th postnatal day when mature milk gradually replaces colostrum and it becomes mature milk at about the 14th postnatal day, coinciding with peak Prolactin levels (Lactogenesis III) [4].

Water content.

The average volume of milk produced per day ranges between 600-900ml and 80% of this volume is water[10]. The human milk can therefore sufficiently meet the water need of exclusively breastfed infant even in the tropical environment.

Lipids in Breastmilk

Lipids account for 44% of the energy requirement of the exclusively breastfed infant. Phospholipids and Triacylglycerols are the primary fats in breast milk. Over 150 fatty acids are present in breastmilk. Notable among these are the long chain polyunsaturated fatty acids which are unique to human milk [omega-3 fatty acids such as Docosahexanoic acid (DHA) and omega-6 fatty acids Arachidonic acid (ARA) which are important for brain and retinal development and functions]. Breast milk also contains Cholesterol which is very relevant to the development and maintenance of membrane integrity and functions [11].

Proteins in Breastmilk

The average total protein content of breastmilk is 0.9g/100ml. This is the least protein content of all animal milk. The two major human milk protein components are whey and casein. Human milk protein is principally whey. Whey protein contains water, electrolytes and important proteins including alpha-lactalbumin, lactoferrin, lysozyme and immunoglobulins that contribute to disease resistance.

Some other Nitrogenous compounds in Breastmilk with critical bioactive properties include: Epidermal growth factor (EGF) which contributes to the development and function of the intestinal mucosa, Taurine, a free amino-acid associated with bile acid conjugation and neurotransmission, Nucleotides – relevant in certain metabolic and immune functions and Carnitine necessary for lipolysis of long-chain fatty-acids[12].

Carbohydrates in Breastmilk

Lactose, composed of glucose and galactose, is the major carbohydrate in breastmilk and a veritable source of glucose. Its galactose component is needed for the production of galactolipids, an essential requirement for the infant's brain development. Other carbohydrates in human milk include: Monosaccharides – for example Galactose, and Oligosaccharides. Oligosaccharides are short-chain non-digestible sugars which promote the establishment of normal intestinal flora by acting as prebiotics. They also work to help maintain the integrity of intestinal mucosa lining and prevent invasive enteric infections and inflammation. On the average, the concentration of Oligosaccharides in breast milk is 1g/dl.[12]

Glycoproteins – Together with the oligosaccharides constitute the bifidus factor. They stimulate the growth and colonization of the newborn gut with Lactobacillus bifidus, a non-pathogenic bacterium which protects against invasive entero-pathogens.

Minerals

The profiles of minerals found in mammalian milk are similar but the concentration, ratio and bioavailability are highly species-specific. The human milk contains all the minerals needed for newborn and infant growth. It is noteworthy that the lower quantities of minerals in human milk results in substantially lower solute load to the infant's immature renal system. For example, Iron and zinc are essential minerals for normal brain development and function as well as some enzyme activities. About 50% and 40%, respectively of the iron and zinc in human milk are absorbed compared to 4% and 31% for iron-fortified infant formula. The iron content of human milk is lower but has a superior bioavailability compared to Cow milk or iron-fortified formula. Also, the presence of iron as Lactoferrin increases its bioavailability while reducing its availability for the growth of bacteria[13].

Vitamins

Colostrun and early transitional milk are major source of Vitamin A, Beta-carotene and Vitamin E. Vitamin A is essential for the maintenance of the integrity of mucosal lining thus protecting against infection and for early retinal development while Vitamin E works to protect the red blood cells against heamolysis. Vitamin E is also believed to prevent intraventricular haemorrhage in preterm infants. Vitamin D exists in human milk in the fat-soluble and aqueous forms. It serves principally to promote adequate skeletal growth and development. Its adequacy in breastmilk is dependent on sufficiency in maternal diet and exposure to sunlight. The recommendation for supplementary vitamin D for infants therefore also includes exclusively breastfed babies[1] The Vitamin K content of human milk is poor and there is little or no transplacental transfer to the fetus, hence the need for supplementation at birth for all babies to prevent Haemorrhagic Disease of the Newborn (HDN).

Enzymes in Breastmilk

About a score of bioactive enzymes have been identified in human milk. Their roles include synthesis of milk, compensation for insufficient digestive enzymes, transport of minerals and as anti-infective agents[12].

Some other components of breast milk include the bioactive hormones such as; Thyroxine, Prolactin, Epidermal Growth Factor EGF, Leptin and Gastrin, and Prostaglandins

Cellular Components

Breastmilk contains about 4000 cells per cubic millilitres. These include Neutrophils (prevents infection), Macrophages (participates in phagocytosis and secrets lysozymes to kill bacteria), T and B lymphocytes (provides immune protection), immature granulocytes as well as probiotic bacteria[14].

The Entero-Mammary pathway

The exposure of maternal bronchi and gut T and B cell to antigenic material (bacteria and viruses) is speculated to stimulate the production of immunoglobulins and lymphoblasts. The latter mature and get distributed throughout the body, including the breast tissue from where these cellular components, and consequently immunoglobulins are secreted in breastmilk for the protection of the infant against potential threats (viruses and bacteria).[15]

Conclusion

Breastfeeding has stood the test of time as a simple, cost effective, affordable intervention with limitless capacity to promote the health, development and survival of the world's infants. The uniqueness lies in its complexity and dynamic disposition. All these add up to make breastmilk the ideal, unique, incomparable and utmost nutrition for all infants and these make breastfeeding an all-time health promotion strategy for the survival of infants globally.

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