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COMPARATIVE STUDY OF SERUM ALBUMIN LEVEL BETWEEN NORMAL BREAST FED AND ARTIFICIALLY FED INFANTS

Thesis

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INTRODUCTION

In the modern world , four patterns of infant feeding can be distinguished according to the culture :

1- Traditional pre-industrial :

Basically , breast feeding is the rule and is prolonged from one to three years or more . Feeding is given on demand of the infant . Foods other than breast milk are introduced relatively late, usually in late months of the first year or the second which might lead to marasmus .

2- Recently industriliased , poor culture :

Such as poor towns and slums all over the world . Here there is low incidence of breast feeding and for a short duration : only for few months (around three) followed by mixed breast milk and cow's milk formula by bottle .

In this culture , for economic reasons and bad home hygiene , a diluted and contaminated bottle feeding is usually given to the baby with the result of mal-nutrition and infection .

3- Urban educated well-to-do :

This applies to most of the modern world for the past two decades . Here bottle feeding is given in the

majority of cases either from birth or few weeks after birth . The infant feeding is under the control of the mother regarding the concentration and the volume . There is also early introduction of semi-solid food . These infants are liable to develop obesity .

4- Naturalist urban educated :

Partially in response to the over all striving for a great degree of naturalism , an increasing percentage of more educated women in Western countries are becoming actively concerned by nursing their babies on the breast. Usually breast milk is given alone for four to six months followed by introduction of semi solids , thereafter .⁽²⁾

Whatever the reason is, there is a great number of infants growing on artificial milk formula and intensive studies had been done and are still being carried out up till now to find out whether these artificial milk formulae are as efficient as human milk or not .

It is true that we still do not know all the factors in the mother's milk , but it is the sole universally

applicable criterion for evaluating the nutritional value of various milk formulae .

The indicators of human milk adequacy on the infant can be summarised under the following :

- I- Favourable growth and development in early months of life .
- II- Good health , immunity , and relatively low morbidity and mortality rates .
- III- Digestability , low solute load .
- IV- Emotional satisfaction .
- V - Biological characters of the main constituents of breast milk .

I- Favourable growth and development in the early months of life :

The simplest way of assessing growth is by weight curves , although not very accurate as it reflects the caloric content of the food rather than the nutrient value. (3)

Also a close relation exists between the ash content of food and weight gain . For many years serum albumin level was used as better index for the nutrient value of the food. (4)

Sufficient evidences from various parts of the world show that solely breast fed infants grow well for the first four to six months , later on , the growth curve grows flat indicating inadequacy of breast milk . After that age, bottle fed infants tend to have higher weights may be due to early introduction of solid foods .

II- Good health immunity , relatively low morbidity and mortality :

In 1947 , Stevenson found that respiratory tract infection was significantly more common in artificially fed infants especially in the second six months of life than in babies who had breast feeding only for at least three months .(5)

Noval and Kennedy , in 1949 , found exactly the opposite with higher incidence of chest infection in breast fed infants .
(6)

In 1950 , Douglas confirmed the work of Stevenson and added that diarrhoea is more common in artificially fed infants , but he referred this effect to low socio-economic status .
(7)

Any how , breast milk offers some protection factors against infection . They can be summarised as follows :

- 1- Secretory IgA (Immunoglobulin) .
- 2- Lacto ferrin .
- 3- Lysozyme .
- 4- Cellular elements .
- 5- Lacto bacillus bifidus growth factor .
- 6- Less bufferring action of human milk .

I) Milk Immunoglobulin :

All five classes of immunoglobulin have been measured in breast milk with the highest concentration found in colostrum. Concentrations of IgG and IgM are lower in the breast milk , where as that of secretory IgA (SIgA) is higher in the breast milk than the respective immunoglobulin concentration measured in serum . (8) S IgA is not exclusive to milk but is present in all exocrine glands seemingly to protect mucous membrane locally . (9) S IgA consists of two molecules of serum IgA bound together by a polypeptide "J" chain and a glycopeptide secretory component. The biological function of the "J" chain is still undetermined . However , the secretory component has been shown

to protect the immunoglobulin molecule from break down by proteolytic enzymes , such as Trypsin and Pepsin adds to the molecule's resistance to protein changes . (8,9)

Secretory IgA antibodies against many different micro-organisms have been measured in breast milk including polio, echo virus , coxsachi virus , and influenza viral agents . Similarly , S IgA directed against microbial antigens , such as the E Coli , O antigen , and the entero toxins released by E coli and vibrio cholerae . (10)

In older individuals SIgA is normally produced by subepithelial plasma cells in the intestinal tract . While during the early weeks of life the neonate does not secrete this antibody , So SIgA in colostrum and milk act as an antiseptic paint protecting intestinal epithelium surface until the infant's own immune mechanism matures . (11,12,13) This protection is

dramatically demonstrated in certain developing countries where the onset of diarrhoea occurs as commonly at the time of weaning and so the disease is referred to as "weaning diarrhoea" . (14)

The major antibody of the cow's milk is not secretory IgA as in human milk but is IgG . The antibody content of cow milk (which does include small amounts of SIgA as well as the IgG) is destroyed by pasteurization and is therefore, not in either whole milk or currently marketed proprietary formulas .⁽⁸⁾

2) Lactoferrin :

Is an iron-binding protein of external secretion , its concentration in human milk is about 1 mg / ml, the highest of any biological fluid.⁽¹⁵⁾ It competes with pathogenic organisms especially E coli and staphylococci for iron . This protein has a greater affinity for ferrous iron than does transferrin in the blood .^(8,15) Some authors believe that supplementary iron for breast fed infants is contra - indicated due to abolishing this mechanism .⁽¹⁷⁾ Lacto-ferrin is present in trace amounts in cow's milk .

3) Lysozyme :

A specific milk protein , its concentration in human milk is 300 times that found in cow's milk and is stable in an acid environment comparable to that of the gastric content.

It has a direct bactericidal effect by lysing the cell wall of many bacteria⁽⁸⁾. It also has an indirect effect by potentiation of the activity of immune bodies.

4) Cellular Elements :

The cellular content of human milk is under intensive investigation . Breast milk contains up to 4000 leukocyte like cell per C.mm. during the first two weeks of life especially in colostrum and it declines later on . The majority of those cells are macrophages and immuno competent B and T lymphocytes . Neutrophils , however , also have been found in considerable numbers early in lactation . Epithelial cells , possibly originating from the skin of the nipple are occasionally present⁽⁸⁾ .

a. The milk macrophage :

- i- It is an active phagocytic cell .
- ii- This cell is also responsible for the synthesis of several resistance factors of milk including lysozyme, C₃ and C₄ complement components , and lactoferrin .
- iii- It contains IgA both intracellularly and on its surface⁽⁸⁾ .

b. Lymphocyte B-Cells :

B- cells in human milk have been identified being
(8)
IgG , IgM, IgA , IgD (humoral immunity) .

c. Lymphocyte T-Cells :

T-cells represent as much as 50 % of milk lymphocytes
early in lactation and decrease to less than 20 % as
(18)
lactation progresses .

The T. lymphocytes of breast milk represent a unique
subpopulation of T-cells that function to meet the
needs of a local immune system so resist infection
(8)
to the baby's intestinal tract .

The actual migration of milk lymphocytes through the
wall of the G.I. tract in new born animals or man,
(8)
has never been reported .

d. Breast Milk Neutrophil :

The function of the breast milk neutrophil has not been
well defined and the presence of these cells may be
related to breast engorgement during the initial days
(8)
of lactation .

5) Bifidus Factor ::

Is a nitrogen- containing polysaccharide and its concentration in human milk equals 40 times that of cow's milk .⁽¹⁹⁾ This encourages the growth of colonies of bacillus bifidus (lacto-bacillus) . So due to the phenomena of bacterial interference , the bifidus factor gives protection against virulent strains of bacteria and also secretion of lactic and acetic acid by these organisms giving rise to acidic stool and the acid environment inhibits the growth of certain bacteria as E. coli and shigella .⁽²⁰⁾

6) Less Buffering Action of Human Milk :

Human milk is less than cow's milk in its buffering action leading to pronounced effect of gastric juice on micro-organisms .

III - Digestability and Low Solute Load :

The emptying time of the stomach is more rapid for human milk rather than for whole cow's milk .

The curd of breast milk is fine and flocculant readily broken down in the stomach . The fat of cow's milk is less readily digested than that of breast milk .