CALCULATION OF NDP OF INFANT FORMULA[+]

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Abstract

Samples of infant formula, fortified with specific immunoglobulins were investigated for net dietary protein calories percent (NDP Cals %). Groups of five rats were given the test milk for eleven days. The results indicate that the values for NDP Cal% obtained meet the dietary requirement for infants in their second half of life .

المستخلص

تضمنت الدراسة تقييم قيم البروتين المستفيد NDP Cals% لعينات مأخوذة من حليب الأطفـــال والمدعم بكلوبيولينات مناعية. أظهرت النتائج أن قيم صافي البروتين المستفيد تلائم المتطلبات الغذائيـــة للرضع في النصف الثاني من السنة الأولى من العمر.

Introduction

Of young mammals, including human infants, milk is the first food ingested and, in most cases, it continues to be the sole constituent of the diet for a considerable period of time [1] Human milk provides a adequate nutrition to facilitate optimal growth in term infants , and has potential beneficial effects on immunity [2,3] , obesity[4] and other infections [5] . While human milk is superior for the newborn infant , milk substitutes play a necessary role in infant nutrition when breast-feeding is not possible , desirable or not sufficient [6] .

For human , bovine milk is an excellent substitute [7]. It is clear that human milk has a different biochemical profile form that of cow's milk .

Immunoglobulins or antibodies contribute to the immunobiological superiority of breast milk [8]. Transfer of antibodies from breast milk or infant formula is, therefore , highly desirable [9] fortification has beneficial effects on growth[10] Today a variety of different infant formula are available on the world markets.

These infant formulas can be divided into standard infant formula intended for the normal infants to be used when breast-feeding is not possible and special

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formulas intended for groups of infants with unique nutritional requirements. Artificial feeding of antibody- containing preparation [11,12] was available . Therefore, this study aims to estimate the net protein utilization (NPU) value of infant formula. fortified with specific immunoglobulin .

Materials , Subjects & Methods:

Milk immunoglobulins concentrate preparation

Bovine colostrun from local breed cows at the College of Veterinary Medicine , University of Baghdad or from private animal farms were used for this study . The technique used for preparation of E . coli antigens was according to the method of Hilpert et al., [13] Isolation of colostral whey proteins (CWP) was based on Al-Mashikhi & Nakai method [14].Immunologoblins were isolated from colorstral using sephadex G-200.the column of sephadex G-200 was equilibrated with 0.1M Tris-HCl buffer, pH 8.0, containing 0.5M NaCl .Sodium dodecyl sulfate- polyacrylamide gel electrophoresis was carried out in a vertical slab unit (electrophoresis system type LKB,Sweden), according to the method of Laemmli [15] .

Milk samples and processing

Samples of the infant frmula were used. These samples were fortified with 0.01 of the prepared immunoglobulin concentrate .

Assessment of net dietary protein calories percent (NDP Cals %)

Rat assay method [16] was carried out to determine NDP Cals % value .

Animals

Eight rats , hooded local strain optained from Animal House College of Veterinary Medicine-Baghdad, were used . They were weaned at 21 days. The rats were divided into two groups:- The first group was fed on the non-protein diet obtained from Itervet Lab. Ltd. Camberidage (control group), and the second group was fed on test – protein diet (assay group). The diets fed for 11 days . Uneaten diet was calculated and the nitrogen (N) intake was calculated by using kjeldahl method. At the end of the period the animals were killed and body water was determined.

Calculation

The following equations are used to calculate the body N of the killed animal [13]:

$\text{Log } (4.8-y) = 0.437 - 0.0123x$

where, y = N (in gram) / H 2O(in gram) , N = nitrogen x = age in days .

Net protein utilization (NPU) was calculated by applying the equation :

NPU = B – (BK – IK) / I

where B and BK are the total body N of the animals on the test and non-protein diets respectively and I, IK are the intake of N in two groups .

Protein calorie percent (protein Cals %) is calculated according to the following equation:

Protein calories % = N% x 6.25 x 4/Cals/g .

The net dietary protein calories percent (NDP Cals%) are calculated as follows[10]:

NDP Cals % = NPU x protein Cals% .

Diets

The basal non. Protein diet was composed of 20% fat, 50% maize starch, 10% glucose, 10% potato starch, 5% vitamin (0.06g thiamine hydrochloride, 0.20g riboflavin, 0.04g pyridoxinehydrochloride, 1.2g calcium pantothenate, 4.0g nicotinic acid, 4.0g inositol, 12.0g p- aminobenzoic acid, 0.04g biotin, 0.04g folic acid, 0.001g cyanocobalamin, 12.0g choline chloride, 800IU Vit. A, 60IU Vit. D, 2.5mg 2-methyl - 1:4 – naphthoquinine and 0.26% -toco -pherol) and 5% minerals .

The protein diet was composed of 20% fat, 50% maize starch, 10% glucose, 10% test-protein, 5% vitamin (as in the non-protein diet) and 5% minerals.

Results

The values of NPU, protein Cals% and NDP Cals% are presented in Table (1). Mean values are 0.78, 10% and 7.8 for NPU, protein Cals % and NDP Cals% respectively. The determined NDP Cals % is also similar to that obtained from the nomograph for the production of protein, (7.8 versus 7.0), Fig.(1).

Table (2), shows the mean weight gain of rats . All rats gained weight with exception of rats in control group which were on protein-free diet. 140 gm , 12.94 gm/ day for mean weight gain and daily weight gain respectively.

Discussion

Proteins are pre-eminently bodybuilding materials, also serve as a source of energy . the metabolism and then the nutritive value of closely depends on the protein: calorie ration and the adequacy of the total calorie intake [17]. Assessment of protein in term of quality may be carried out by net protein utilization measurements [18].The assessment "of protein values" of foods in relation to the subjects needs is of importance not only for the individual or the family but also on a national and word scale[19].

So it is extremely important that all protein food mixtures are subjected to procedures that include protein values tests, because the volume of the infant stomach

and the limit imposed on food intake must be a factor of importance, indicating the need to provide protein-rich foods to children in this age group [20].

Also when you re-examine the data of NPU published by FAO[21], using growing rats and that published by Mitchell [22] using children, Table (3), there is generally a good agreement between the rat and human values. In this study NDP cals % were higher than obtained previously [23], (7.8 vs 7.6). this difference may be due to the fortification that of the formula with immunoglobuling [24,25]. Further studies should address the nutritional benefits of consuming fortified formulas and costs associated with the introduction of new formula.

Table (1) The values of NPU, protein Cals % and NDP Cals % of Bilady fortified infant formula.

Test	NPU (1)	Protein Cals%	NDP Cals % (2)
Protein diet	0.78	10	7.80
Non-protein diet	0.00	0	0.00

(1) NPU = Net protein utilization
(2)NDP cals % = NPU x protein Cals%

Table (2) The mean weight gain of the studied rats.

Group	Mean weight gain (g)	Daily weight gain (g / day)
Assay	140	12.94
Control	-	-

Table (3) : The comparison between values of NPU measured in rats and children*.

Diet	Children	Rats
Cow's milk	81	82
Sesame	54	54
Rise	63	95
Wheat	49	48

*Ref. No. [20]

References

1. Ebrahim, G.J. Nutrition in mother and child health. London. Macmillan Education Ltd 1989.
2. Grodner M, Anderson SL , Deyoung S, Foundation and clinical application , Mosby Inc., 2nd , Missouri .
3. Myers RG , Hfeld EM, Early childhood counts, World Bank, Washington Dc, 2000.
4. Lafta RK, Kadhim MJ , Childhood obesity in Iraq. Annals of Saudi Medicine, 2005, 25 (5): 389 – 393

5. AL- Sawaf FB, Breast feeding . circumcision and urinary infection in children. 21st Annual Meeting of Arabmed in Europe , Aug . b-12, 2004 Turkey, (Abstract).
6. Friend, B.A.; Shahani, K.M. and Mathur, B.N.; Newer advances in human milk substitutes for infant. Feeding . J Appl Nutr. 1983; 35 (2): 88-115.
7. Packard, V. S, Human milk and infant formula, Academic Press New York, 1982.
8. Howie , P.W.; Forsyth, J.S.; Ogston, S.A.; Clark, A. and Florey, C.V. Protective effect of breast feeding against infection. BMJ 1990 ; 300: 11-6.
9.Xanthou, M.; Bines, J. and Walker; W.A. Human milk and intestinal host defense in newborns: An update. Advances in Pediatrics 1995; 42: 171-208.
10. Bhat BA, Gupta B, Effects of human milk fortification on Morbidity factors in very law Birth weight Infants. Annals of Saudi Medicine, 28-31, 23(12): 2003
11. Guarino , A.; Canani, R. B.; Russo, S.; Albano, F.; Canai, B.M.; Ruggeri, F.M.; Doneli, G. and Rubino, A. Oral immunoglobulins speed recovery from rotaviral gastreoenteritis. Pediatrics, 1994; 93:12-16.
12. Lissner, R.; Schmidt, H. and Krach, H. A standard Immunogolobulin preparation produced from bovine colostra shows antibody reactivity and neutralization activity against Shiga-like toxine and EHEC-Hemolysin of E. coli 0157: H7. Infection. 1996;24 (5): 44/378- 49/383.
13. Hilpert, H.; Amster , J.; Pahud, J. and Gerber, H. Test on the immunobiological activity of specific bovine anti-E. coli milk antibodies. Nestle Research News: 1974/1975; pp. 130-134.
14. Al-Mashikhi, S.A. and Nakai, S. Isolation of bovine immunoglobulins and lactoferrin from whey proteins by gel filtration techniques. J Dairy Sci. 1987; 70: 2486-2492.
15. Laemmli, U.K. cleavage of structural proteins during the assembly of the head of bacteriophage T4. Nature 1970; 227: 680-5.
16. Miller, D. S. and Bender, A.G. The determination of the net utilization of protein by a shortened method, Br. J Nutr 1955; 9 (4): 382-388.
17. Friedman, M. Nutritional value of protein from different food sources. A review. J. Agric .
Food Chem. 1996; 44: 6-29.
18. FAO / WHO. Protein quality evaluations, Food and Agricultural Organization of the UN. Rome, Italy 1991; p.66.
19. Allison, J.B. In mammalian protein metabolism, Vol. 2. Munro, H.N.& Allison, J.B. (eds) New York. Academic press ; 1964.
20. Millward , D.J. Protein requirements of infants. Am. J. Clin. Nutr. 1989; 50: 406-407.
21. FAO / WHO/ DNU. Energy and protein requirements. Report of a Joint Expert consultation. WHO Technical report series No.724 Geneva; 1985.
22. Mitchell , H.H. Comparative nutrition of man and domestic animals. Vol. II, Academic Press. London ; 1964.
23. Tawfeek H. Fortification of Infant Formula with Some Anti-Enteropathogenic Escherichia coli Colostral Antibodies. Ph D. Thesis College of Veterinary Medicine. University of Baghdad.1999.
24. Martin, D. W., Mayes , P.A. and Rodwell, V.W. Harpers Review of Biochemistry, 19th ed .Lange medical publications , Calif. 1983 chapter 3.page 112-115.
25. Baum, Stuart J. Introduction to organic and Biological chemistry, 3rd ed . Macmillan Publishing Company, New York. 1982 chapter 14. page 243-245.