Assessment of Feeding Problems Using SOMA as An Indicator of Risk of Malnutrition

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Abstract

Background: Malnutrition is the main cause of mortality and disease among children under five of age. About 11 million children under five die annually, half of these deaths are caused by malnutrition, with diarrhoeal disease and respiratory infection being the main precipitating causes for high case fatality rates particularly in developing countries.

Aim: To assess the prevalence and nature of feeding difficulties by assessing oral motor dysfunction (OMD).

Methods: 70 mother-infant pairs aged from six to 24 months were assessed using the Schedule of Oral Motor Assessment (SOMA). They were divided into three groups: Group I: 31 infants who are apparently within the normal range of growth and development, Group II: 24 infants presenting with under-nutrition and delay in their growth, Group III: 15 infants presenting with delayed physical or mental development of neurological origin.

Findings: Over one half of cases with malnutrition developed oral motor dysfunction. We also detected OMD in 16.2% of the normal infants. By assessing breastfeeding practices in all the group under study in relation to the presence or absence of OMD we found that poor or suboptimal breastfeeding practices were a characteristic finding in all cases with OMD irrespective of their underlying pathology. Delayed initiation of breastfeeding and delayed introduction of foods beyond 7 months and especially beyond 12 months increased the risk of OMD.

Conclusions: Late introduction of foods beyond the critical age of learning behaviors such as deglutition, chewing and swallowing bulk foods can accentuate feeding problems and cause refusal to feed and culminate in malnutrition.

INTRODUCTION

Early feeding disturbances are quite frequent in the infant population, affecting around 25% to 35% of children [(1)]. The most serious problems occur when inadequate intake of food results in failure to thrive or growth stunting as well as infleuncing development of the central bervous system especially in its early critical years of growth[(2,3)]. Therefore, the brain needs an adequate nutritional intake to achieve optimal development [(4)]. Observations focusing on the evolution of feeding difficulties are thereby important in the prevention of malnutrition and optimize brain development [(3,4)].

Malnutrition is the main cause of mortality and disease among children under-five of age. About 11 million children under five die annually, half of these deaths are caused by malnutrition, with diarrhoeal disease and respiratory infection being the main precipitating causes for high case fatality rates particularly in developing countries[(1,5)]. There is evidence that early malnutrition could "program" the body of the infant to develop health problems later on in life[(6)]. Not breastfeeding is associated with obesity later in life with consequences on development of cardiovascular disease. Furthermore, clinical linkage of feeding disorders and the failure to thrive syndrome from infancy to adolescence has been observed in longitudinal studies that highlight the fact that feeding disorders may persist through time and be associated with developmental, emotional and behavioral difficulties [5,6]. Oral motor skills may be a necessary precursor for language skills. Poor oral movements in infancy interfere with later speech

development, although children who were good at oral movements could fall anywhere on the distribution of language abilities [7].

Reilly et al. [8] were among the first worlers who assessed prevalence and nature of feeding difficulties and oral motor dysfunction using a standardized assessment of oral motor function; Schedule of Oral Motor Assessment (SOMA) [9]. The majority of children in their study had clinically significant oral motor dysfunction. Contrary to maternal report, mealtimes were relatively brief, and this, combined with the severity of oral motor dysfunction, made it difficult for some children to achieve a satisfactory nutritional intake so that one in three children assessed were malnourished. They concluded that SOMA was a useful simple tool to assess oral motor function detect and prevent later complications [8,9].

The Global Strategy of Infant & Young Child Feeding supported by evidence based medical research urges reversal to optimal breastfeeding practices for the prevention of malnutrition [1]. Breastfeeding also represents a fundamental experience for the mother-infant interaction and emotional bonding which promotes a healthy parenting relationship as well stabilizing biological rhythms [10].

There is considerable debate regarding the pathogenesis of early feeding disorders, it is estimated that malnutrition and failure to thrive may include both organic and non-organic factors and that only 16 to 30 percent have their origin in an organic disease that might explain growth problems [2,3].

Our aim in this study was to attempt to define the role of suboptimal breastfeeding practices in the origin of feeding disorders and the possible correlation with the neurological and behavioral as causes in the development of oral motor dysfunction using the Schedule of Oral Motor Assessment (SOMA) as a tool for identifying early feeding problems and predict later development of malnutrition in order to intervene early to correct the feeding disorder and prevent malnutrition.

METHODS

Subjects: The study subjects consisted of a cross sectional observational sample of 70 mother-infant pairs aged from six to 24 months who were selected from the Pediatric department of Benha University Hospital during the period from June 1999 to January 2000. All mother-infant pairs fitting the criteria for selection were included in the study. Inclusion criteria consisted of infants who were exhibiting some degree of feeding difficulty as perceived by the mother and who were breastfed for some time or still breastfeeding but were also offered bottle, pacifier or introduced supplements during the first six months of life. Exclusion criteria demanded no major acute or chronic illness in mother or child, or on special medications or undergoing operative procedure or with major congenital anomaly. **They were divided into three groups: Group I**: 31 infants who are apparently within the normal range of growth and development, **Group II**: 24 infants presenting with undernutrition and delay in their

growth, **Group III**: 15 infants presenting with delayed physical or mental development of neurological origin. The latter were all cases with diagnosed cerebral palsy, other causes of neurological delay due to metabolic or degenerative disease were excluded. All mothers were admitted to the wards and consented to through physical and clinical assessment and to be included in the study. All infants from the three groups were equally distributed in relation to age and sex.

Procedures and measures: A thorough questionnaire was prepared and tested. Interview with the mother assessed the social and biological status of the infant's family. **Breastfeeding practices** were assessed in relation to early initiation and feeding by bottle, offering pacifiers and supplements before six months.

Growth assessment: the weight was measured to the nearest gram, in the nude (with only the local diaper on) using a standardized weight scale (Baby-beam-balanced scale). Length was measured as supine height to the nearest millimeter using a taped flat board with a fixed and sliding board on either side, the baby's back was ensured to be straight and not arched and head in line with body especially in the cases with cerebral palsy where arching is a problem. Mid arm circumference was measured from the left arm, midway between the acromian and olecranon bones with arm loosely hanging on the side. The tape was passed around the arm, correct tension being a critical factor for adequate measurement, to the nearest millimetre. Head circumference was measured as the occipito-frontal diameter after

locating the occipital, glabellar and supraorbital protuberances before measuring to minimize errors using a metal tape passed firmly over these landmarks to give the maximum circumference. **Interpretation**: anthropometrics of weight-for-age (W/A) and height for age (H/A) were assessed using the National Centre of Health and Statistics references (NCHS) as adapted and adopted by the World Health Organization (WHO) reference growth charts and adopted by the Ministry of Health in Egypt, since the study was conducted before emergence of the new Global child growth standards. Also no special references for neurologically impaired children are available. Children weight was below the third centile and weight-for-height below the third centile and midarm circumference less than 12 cm, were classified as severely malnourished, when these parameters were between 60%-80% of the standard weight-for-age they were considered as undernourished.

Developmental assessment: The Denver developmental screening test (DDST-R) which was designed to help health providers detect early indication of developmental deviations in the young child. It is interpreted as follows: abnormal when two or more sectors show two or more delays or one sector with two or more delays plus one or more sector with one delay and in that same sector no passes intersecting the line. II- Questionable: one sector with two or more delays or one or more sectors with one delay and in that same sector. III- Untestable: when refusal are in number large enough to cause the

test to be questionable or abnormal if they were scored as failures. The four areas tested by the DDST-R include personal, social (awareness of and response to people and things in the environment), fine motor adaptive (eye-hand coordination activities), visual and audio-perceptual, language (receptive and expressive), and gross motor (large-muscle coordination activities). **Interpretation**: This was done by scoring of DDST-R findings in an abbreviated version. On the form the screener identifies and administers the three items immediately to the left of the age line in each sector for a total of twenty items if any of these three items in any sector is failed (indicating delay) or refused (indicating a potential delay), a full (DDST-R) must be provided [11,2].

The Schedule of Oral Motor Assessment (SOMA) developed by Sheena Reilly of London University (Reilly et al., 1995). The schedule was administered to all cases under study 1-2 hours after the child's main meal. The examination took an average of twenty minutes. First the child's oral motor skills are challenged with a variety of textures. Variation is noted in birth the age at which the infant first solids are introduced and when foods of increasing texture are offered to them. Some infants will therefore have had a wide range of oral motor experiences to a variety of different tastes and textures where as others have had limited experience. Second: the manner in which the liquid and food is presented should be standardized. Third the utensils constructed of clear, non breakable plastic so that lip and

tongue movements are clearly visible and as the amount of liquid in the bottle or cup. Fourth: five oral motor challenge (OMC) categories ranging from liquid (OMC-1), puree (OMC2), semi solid (OMC-3), solids (OMC-4), cracker (OMC-5). The oral motor control required for drinking is assessed in two test situations: during breast or bottle feeding or drinking from a cup. Fifth: the oral motor control required for solid food stuff such as puree (OMC-2), semisolids (OMC-3) and solids (OMC-4) assessed during spoon feeding whereas crackers (OMC-5) were finger fed by examiner. It was not uncommon for children to refuse to accept biscuits from the examiner in such cases the food was given to the child to self-feed.

The functional areas assessed included the lips, tongue and jaw. The functional units include reactivity, and acceptance, and initiation, food loss, drooling, sequencing and swallowing and bite. Each was given a score of 0 or '1' depending on whether it is normal or abnormal behavior response for the development.

Interpretation: the results obtained were compared as global assessment for each infant if more than 75% of Discrete Oral Motor (DOM) tests are done, then child is normal, from 75%-50% of DOM is done by child, it considered as mild dysfunction, from 50-25% it is considered as moderate dysfunction, if less than 25% it is considered as severe dysfunction[13].

Statistical Analysis: quantitiative data was presented as mean and standard deviation and qualitative data by frequency distribution.

Analytical tests used included unpaired student *t*-test (two sided) for comparing two groups. Analysis of variance (ANOVA) was used for comparing more than two groups. Post hoc test for comparing each two groups. Chi-square test or contingency table analysis for frequency distribution data. Correlation and regression analysis were also performed whenever appropriate. The significance level of 0.05 and 0.01 were used throughout all statistical tests within this study. The statistical package used was that MS Windows 98 and analysis according to Swincow [(14)].

RESULTS

Description of the groups under study is shown in table (1) which shows no statistically significant difference in relation to residence, age and sex of the baby, mother state of literacy and father occupation. There was however statistical significance higher prevalence of males in cases with cerebral palsy.

Overall the prevalence rate of oral motor dysfunction was 39 (55%) with a 100% prevalence among the cases with cerebral palsy, 79.2% prevalence among the malnourished groups and 16.2% in the normal infants.

Using the OMC categorization our results showed the following:

OMC-1: assessing drinking at cup and at breast or bottle showed that oral motor difficulty in the functional areas assessed at breast or bottle was shown in 6% of group I, 17% of group II and 93% of group III.

The difference was statistically significant at P< 0.001. Difficulty with *cup* was shown in 10% of group I, 8% of group II and 20% of group III. The difference was not statistically significant at P> 0.05.

OMC2: 10% of group I compared to 46% of malnourished infants and 93% of cerebral palsy cases (group III) were categorized as abnormal to *puree food*. The difference was statistically significant at P< 0.001.

OMC-3: oral motor difficulty to intake of *semisolids* was found in 6% of group I, compared to 25% of group II and 67% of group III. The difference was statistically significant at P< 0.001.

OMC-4: difficulty with *solids* was shown in 16% of group I, 34% of group II and 8% of group III. The difference was statistically significant at P< 0.001.

OMC-5: difficulty with *crackers* was shown in 16% of group I, 21% of group II and 47% of group III. The difference was statistically significant at P< 0.07.

Breastfeeding patterns:

Early initiation at breast within the first hour of delivery was practiced within groups of study in 58.06% of group I mother infant pairs, 25% of group II and 0% of group III.

Of the 23 cases (32.9%) who initiated breastfeeding in the first hour 8 (26.08%) had a mild or moderate degree of OMD, and none had

severe OMD. This was compared to 47 (67.1 %) who initiated breastfeeding after 12-24 hours of delivery of whom 31 (65.9%) had OMD. Hence delayed initiation or never at breastfed increased the risk of OMD.

Breastfeeding continuity: Two thirds of the babies in group I continued breastfeeding beyond 6 months (67%), compared to two thirds of group II who discontinued breastfeeding before 6 months (66.7%) and 91.7% of group III who were unable to continue breastfeeding beyond initiation or up to six months.

OMD was present in 28 (40%) in cases that discontinued breastfeeding very early in life or before 6 months compared to 15.7% of cases that continued breastfeeding beyond six months. The difference was statistically significant at $P<0.005$.

Exclusive breastfeeding:

In the normal group (group I) bottle was introduced in 66% of cases before 6 weeks and was continued for at least 12 months in 60% of cases and for 18 months in 40% of cases. Pacifiers were offered to 58.1% of this group within the first six months starting as early as before the six weeks in one half of these cases. Herbal drinks were introduced to 100% of these of these cases before 6 months.

In group II 21 (87.5%) of malnourished infants were exposed to bottles in the first six months, and 20 (83.3%) were offered pacifiers

while 100% of these babies were also offered herbal drinks from early on in life and through the first six months of life.

In group III; All 15 cases were offered bottles, pacifiers and herbal drinks throughout the first six months of life and two thirds from as early in life as before the first 2 weeks of age. The difference between the three groups in relation to these practices were statistically significant at P<0.001.

The overall prevalence of exposure to bottles or pacifiers was 55.7% and 47.1% respectively in all the cases under study. OMD in those exposed to bottles and pacifiers in the first six months was 100% and 87.2%. Although two thirds of children with no OMD were exposed to pacifiers however all babies not exposed to pacifiers did not develop OMD in the study.

Also all cases with OMD were offered herbal drinks as well as those with no OMD. However OMD was more common among those infants who were exposed to herbal drinks before 6 weeks 32 (82.04%) and it was less common in those introduced to herbal drinks after 6 weeks of life (50%). These findings were statistically significant at P= 0.004 for bottle and 0.001 for use pf pacifiers and introduction to herbal drinks before six months.

Weaning practices:

Group I introduced foods before 4 months in 9.68%, between 4-7 months in 70.9% and beyond 7 months in 19.4%. Group II introduced

foods before 4 months in 12.5% of cases, at 4-7 months in 25% of cases and later than 7 months in 62.5% of cases (41.7% after 12 months). All cases in group III introduced foods beyond 7 months of age with 10 cases (66.7%) beyond 12 months of age.

OMD was more common with late introduction of foods after seven months as 31 of the 39 cases with OMD (79.5%) compared to 6 of the 31 cases with normal OMD (19.3%) exposed to late weaning. Introduction of food supplements before 4 months was not associated with an increased risk of development of OMD. Most of the cases who had normal motor function were introduced foods between 4-7 months 21 (84%).

Anthropometry and nutritional assessment:

All cases in group I were above the 10^{th} centile for W/A, while all those in groups II and III had W/A below the 10^{th} centile. Two thirds of cases with cerebral palsy and over one half of malnourished babies were stunted with L/A below the third centile. None of the babies in Group I were stunted. Two thirds and 8.3% of groups III and II respectively had a head circumference below the 3^{rd} centile.

A study of oral motor function OMD and its association with underweight (below the third centile0 was shown in 34 (87.2%), compared to only 2 (6.45%) of cases with no OMD above the 3^{rd} centile. Stunted growth (height for age below the 3^{rd} centile) was present in 18 (46.15%) of cases with OMD compared to 9.68% of

cases with no OMD. Moderate wasting (weight for length below 10th centile) was present in 71.8%, while severe wasting was detected in 23.04% of cases with OMD compared to 12.8% and 3.2% in cases with no OMD respectively. Also the head circumference was more severely affected in cases with OMD 23 out of the 39 cases with OMD had a HC below the 10th centile and 8 below the 3rd centile. While only one case with no OMD had a HC below 3rd centile. The difference was statistically significant at P=0.001.

Development: All cases in group I had normal or border line development except 2 in who had speech and language delay. Ten of the malnourished cases had gross motor and fine mother delays (41.7%), 11 had language delay and 7 (30.4%) had social delay. All cases with cerebral palsy had fine motor delay, 80% were socially delayed and 86.7% had language delay, and 60% had gross motor delay. The difference was statistically significant between groups at P=0.001.

The characteristic finding in the relationship between developmental milestones and OMD was that fine motor (hand and eye coordination was the parameter with highest percentage of cases with delay in 25 (64.1%), followed by gross motor in 18 (46.15%), speech and language 13(33.3%) and social development 8 (20.5%). The difference was statistically significant for all four parameters at P=0.001.

The severity of the OMD was assessed between groups and in relation to breastfeeding practices and are shown in the graphic presentations.

DISCUSSION

It was clear from the study that oral motor dysfunction is mostly a feature of cases with cerebral palsy as reported by others [8,15]. However over one half of cases with malnutrition also developed oral motor dysfunction. This finding was a feature of other studies [2,3,4].

We also detected OMD in 16.2% of the normal infants. By assessing breastfeeding practices in all the group under study in relation to the presence or absence of OMD we found that poor or suboptimal breastfeeding practices were a characteristic finding in all cases with OMD irrespective of their underlying pathology [16 17, 18].

In this study we wanted to show that although neurological disease in infants is associated with OMD, yet OMD is also present in infants who are malnourished and normal infants with poor feeding practices, and that poor feeding practices was a common denominator in all groups which has been reported by other workers [2,3,4]. We also wanted to demonstrate that optimum breastfeeding practices were associated with no or insignificant OMD irrespective of the existing pathology and that this could be used as both a preventive and therapeutic approach in the management of children with OMD.

It was clear from the study that oral motor dysfunction was exceedingly common in cases with cerebral palsy as reported by other

workers [8,15]. However over one half of cases with malnutrition also developed oral motor dysfunction. We also detected OMD in 16.2% of the normal infants. The latter was probably related to poor early infant feeding practices as we found poor or suboptimal breastfeeding practices among cases with OMD irrespective of their underlying pathology. While those practices optimum breastfeeding practices had no or insignificant OMD irrespective of the existing pathology [18,19].

Among the most prominently detrimental feeding practices was babies who were fed by bootle or allowed to suckle at a pacifier early in life. This appeared to have the most detrimental effe\ct on the development of OMD. Other workers have shown that early exposure to pacifiers and bottles especially in early life interferes with suckling at the breast and leads to early cessation of breastfeeding [21,22,23]. Nelson et al., (2005) [24] noted that pacifier use was negatively associated with breastfeeding, and a dose-response effect was noted. While other workers noted the morphological changes associated with the use of these tools on the development of jaw malalighnment and facial disfigurement. The significance of the latter on oral function is not clear, but surely deserves investigation as the jaw and gum alighnment clealry play a role in appropriate attachment at the breast and prevention of early detachment and maintining oral pressure in the oral cavity [24].

DiGirolamo et al. (2001) [26] indicated that the strongest risk factor for early breastfeeding termination included late breastfeeding initiation

and early supplements given to the neonate. Several differences, both mechanical and dynamic, have been described between suckling at the breast and suckling on an artificial teat [17, 18]. These imply that using a teat may interfere with an infant learning to suckle and may even increase morbidity[25,26].

Ideally early initiation of breastfeeding should be encouraged and especially neurologically impaired babies should be assisted to attach to the breast and suckle as early as possible to promote oral development. The mechanism of suckling at the breast is closely linked to criteria that match with good oral motor function, including the ability to protrude he tongue and maintain the tongue and mouth open with a wide gape, to move the tongue rhythmically and to swallow while coordinating the suck swallow and breathe pattern [27,28]. Unfortunately these babies are taken moved to feed at a bottle without supporting and guiding the mother to breastfeed the child.

In our study OMD was associated with delayed initiation of breastfeeding after 12-24 hours of delivery of whom one fifth had severe OMD. Exposure to supplements from early life was difficult to assess as all cases were exposed to supplements during the first six months of life especially that exclusive breastfeeding in Egyptcontinued to low[29] and is attributed to deeply rooted cultural and traditional factors [30].

In our study OMD was more common among those infants who were exposed to herbal drinks before 6 weeks 82.04% compared to those introduced to herbal drinks after 6 weeks of life 50%. Also

continuation of breastfeeding beyond six months was a protective factor in the development in OMD.

Another detrimental factor in the feeding practices was that was strongly associated with OMD was delayed introduction of foods especially beyond 7 months and especially beyond 12 months. The latter was characteristic among the cases with cerebral palsy. Late introduction of foods beyond the critical age of learning behaviors such as deglutition, chewing and swallowing bulk foods can accentuate feeding problems and cause refusal to feed and culminate in malnutrition [15].

It is suggested that continued breastfeeding especially when associated with introduction of foods after six months assists the child in learning to accept foods and developing their oral structures in line with behavior of feeding using the cup and spoon. It seems that suckling at the breast is not associated with refusing to feed from a cup or by a spoon, contrary to feeding from a bottle that is associated with refusal to feed from a cup or by a spoon.

There is a strong relationship between breastfeeding and prevention of malnutrition through the immunological properties of breastmilk and its protective effect against recurrent severe infections that lead to malnutrition. Yet, still many of babies who are breastfeeding in developing countries suffer malnutrition especially after the age of 6 months that is unrelated to morbidity but more to incorrect feeding practices. The act of feeding at the breast by suckling appears to play

an important role in the development and functional abilities of the oral structures necessary for later feeding on other foods or various textures and of varying palatability [2,3].

In Egypt the problem of underweight and wasting peaks in the period between 6-18 months despite the high rate of breastfeeding continuity. The Global strategy for infant & Young Child Feeding urges health staff to support optimal breastfeeding practices including the implementation of the Ten Steps, exclusive breastfeeding for the first six months, adequate complementary feeding and protection of breastfeeding through code implementation[31,32]. The later seems to be influenced also by breastfeeding as it has been shown that mother's milk in various cultures contains the flavor and aroma of the foods that mother eats and that this is helpful in increasing the baby's acceptability to these foods. The mechanism is unknown but it could be related to stimulation of taste buds to these foods and thus making it easier for these babies to accept these foods [33,34].

Although this study may have its limitations yet we have shown that breastfeeding practices especially early practices may play a role in the development of OMD and consequently to feeding problems and malnutrition either underweight and obesity. Moreover infants with neurological or behavioral problems may benefit more from optimal breastfeeding practices and improving the development of their oral structures and preventing later feeding disorders that lead to malnutrition among these high risk babies [35,36]. Moreover the use of a

tool that can detect early feeding problems to avoid later development of malnutrition is necessary to prevent the detrimental effects of poor feeding practices on the development of malnutrition and its consequences on morbidity and mortality [37,38,39].

In conclusion The Schedule for Oral Motor Assessment (SOMA) has a high degree of reliability and validity in diagnosing these feeding disorders and could be a useful clinical tool for the assessment of feeding disorders in infants and young children.

References

1. World Health Organization (2003) Global Strategy of Infant and Young Child Feeding. World Health Assembly, May, 2003, WHO, Geneva.
2. Woolston JL (1991) Eating and growth disorders in infants and children. Dev Clin Psychol Psychiatry Ser 24: 1–95, 1991.
3. Lindberg L, Bohlin G, Hagekull B, Thurnstro¨ M (1994) Early food refusal: Infant and family characteristics. Infant Ment Health J 15: 262–277, 1994.
4. Ammaniti M, Ambruzzi AM, Lucarelli L, Cimino S, D'Olimpio F. Malnutrition and dysfunctional mother-child feeding interactions: clinical assessment and research implications. J Am Coll Nutr. 2004 Jun;23(3):259-71.
5. Lucas A (1994) Role of nutritional programming in determining adult morbidity. Arch Dis Child 41: 88–90, 1994.
6. Lucas A. (1991) Programming by early nutrition in man. In Bock GR, Whelan J (eds): "The Childhood Environment and Adult Diseases," Ciba Foundation Symposium 156. Chichester: John Wiley, pp 38–55, 1991.
7. Alcock K. (2006). The development of oral motor control and language. Downs Syndr Res Pract. 11(1):1-8.
8. Reilly S, Skuse D, Poblete X. (1996) Prevalence of feeding problems and oral motor dysfunction in children with cerebral palsy: a community survey. J Pediatr. 1996 Dec;129(6):877-82.
9. Reilly S, Skuse D, Mathisen B, Wolke D. (1995) The objective rating of oral-motor functions during feeding. Dysphagia. 10(3):177-91.

10. Saadeh RJ, Labbock M., Cooney MH., Knoiz Booher KA. (1993) Global breastfeeding prevalence and trends. In Breastfeeding the Technical Basis and recommendation for action. World Health Organization, Geneva, pp 1-190.

11. Frankenburg WK, Goldstien AD., Camp BW., 1971. The revised Denver Developmental Screening Test: Its accuracy as a screening instrument. J. Pediatr. 79:988.

12. Frankenburg WK. The newly abbreviated and revised Denver Developmental Screening Test. J. Pediatr. 99:995.

13. Skuse D, Stevenson J, Reilly S, Mathisen B.(1995) Schedule for oral-motor assessment (SOMA): methods of validation. Dysphagia. 10(3):192-202.

14. Swinscow TD. (1994) Statistics at square one, ninth edition, Latimer Trend and Company, London.

15. Gisel EG, Alphonce E, Ramsay M. (2000) Assessment of ingestive and oral praxis skills: children with cerebral palsy vs. Dysphagia. 15(4):236-44.controls.

16. Mathisen B, Skuse D, Wolke D, Reilly S. Oral-motor dysfunction and failure to thrive among inner-city infants. Dev Med Child Neurol. 1989 Jun;31(3):293-302.

17. Ardran G M, Kemp F H and Lind J (1958a) A cineradiographic study of bottle feeding. British Journal of Radiology 31: 11-22.

18. Drewett R F and Woolridge M W. (1979) Sucking patterns of human babies on the breast. Early Human Development 2: 15-320.

19. Weber F, Woolridge MW, Baum JD. (1986). An ultrasonographic analysis of sucking and swallowing in newborn infants Developmental Medicine and Child Neurology 28: 19-24.

20. Wojdan-Godek E, Mikiel-Kostyra K, Mazur J. Factors associated with exclusive breastfeeding of infants in Poland [in Polish]. Med Wieku Rozwoj 2000;4(3 Suppl 1):15–24.

21. Vogel AM, Hutchison BL and Mitchell EA. (2001) The impact of pacifier use on breastfeeding: a prospective cohort study. Journal of Paediatrics and Child Health Vol 37 (1). pp. 58-63.

22. Benis MM. (2002) Are pacifiers associated with early weaning from breastfeeding? Advances in Neonatal Care. Vol 2 (5). pp. 259-66.

23. **Scott JA., Binns CW., Graham KI., Oddy WI. (2006) Predictors of the early introduction of solid foods in infants: results of a cohort study. *BMC Pediatrics* 2009,** 9**:60.**

24. Nelson EA, Yu LM, Williams S. (2005) International Child Care Practices Study Group Members. Breastfeeding and pacifier use. J Hum Lact. 2005 Aug;21(3):289-95.

25. North K, Fleming P, Golding J and the ALSPAC Study Team. (1999) Pacifier use and morbidity in the first six months of life. Pediatrics Vol 103 (3). Pp.e34. www.pediatrics.org [Accessed March 2005].

26. UNICEF (2008) UNICEF UK Baby Friendly Initiative statement on dummy use. www.babyfriendly.org.uk [pdf file 25 KB; Accessed April 2008].

27. DiGirolamo AM, Grummer-Strawn LM, Fein S. (2001) Maternity care practices: implications for breastfeeding. Birth. 2001 Jun;28(2):94-100.

28. El-Zanaty F. (2009) Way A. Feeding practices and micronutrient supplementation. In: Egypt Demographic and Health Survey 2008. Ministry of Health, El-Zanaty and Associates, and Macro International, Cairo, 2009, pp. 166–175.

29. El-Mougi M, Mostafa S, Osman NH, et al. Social and medical factors affecting duration of breastfeeding in Egypt. J Trop Pediatr 1981;27:5–11.

30. Hammer LD, Bryson S, Agras WS. (1999) **Development of feeding practices during the first 5 years of life.** *Arch Pediatr Adolesc Med* 1999, **153:**189-194.

31. World Health Organization. Complementary Feeding of Young Children in Developing Countries (1998) A Review of Current Scientific Knowledge. WHO/NUT/98.1. World Health Organization Geneva.

32. World Health Organization. (2001) Optimal Duration of Exclusive Breastfeeding: A Systematic Review. WHO/NHD/01.0. World Health Organization, Geneva.

33. Carruth BR, Skinner JD. (2002) Feeding behaviors and other motor development in healthy children (2-24 months). J Am Coll Nutr. 21(2):88-9.

34. Chatoor I. (1996) Feeding and other disorders of infancy or early childhood. In Tasman A, Kay J, Lieberman J (eds): "Psychiatry."Philadelphia: Saunders, pp 638–701, 1996.

35. Hagekull B, Bohlin G, Rydell A: Maternal sensitivity, infant temperament and the development of early feeding problems. Infant Ment Health J 18: 92–106, 1997.

36. Ramsay M, Gisel EG, McCusker J, Bellavance F, Platt R: Infant suckling ability, non-organic failure to thrive, maternal characteristics, and feeding practices: a prospective cohort study. Dev Med Child Neurol 44: 405–414, 2002.

37. Sanders MR, Patel RK, Le Grice B, Shepherd RW: Children with persistent feeding difficulties on observational analysis of the feeding interactions of problem and non-problem eaters. Health Psychol 12: 64–73, 1993.

38. Marchi M, Cohen P: Early childhood eating behaviors and adolescent eating disorders. J Am Acad Child Adolesc Psychiatry 29:112–117, 1990.

39. Woolston JL, Forsyth B: Obesity of infancy and early childhood: A diagnostic schema. In Lahey BB, Kazdin AE (eds): "Advances in Clinical Child Psychology." New York: Plenum Press, pp 179–192, 1989.

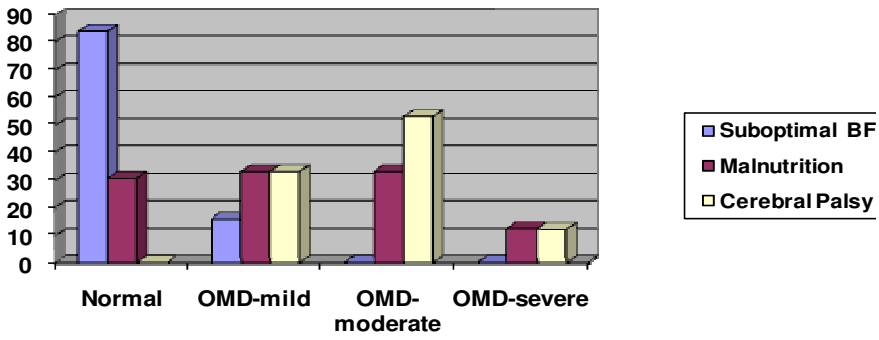

Figure 1- Oral Motor function in infants under study in the different groups and by severity of oral motor dysfunction..

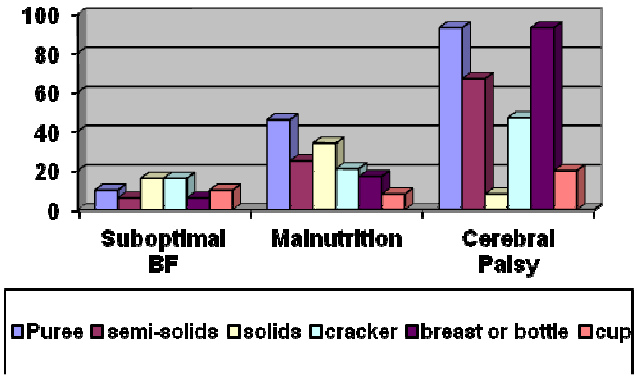

Figure (2) Percent distribution of infants with oral motor dysfunction when tested by SOMA to different textures in the three study groups..

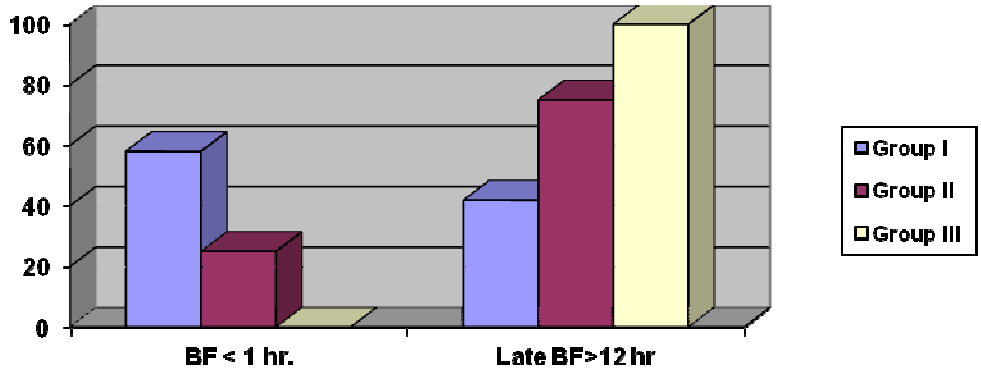

Figure (3) Percent distribution of early breastfeeding initiation versus late breastfeeding initiation in the three groups under study.

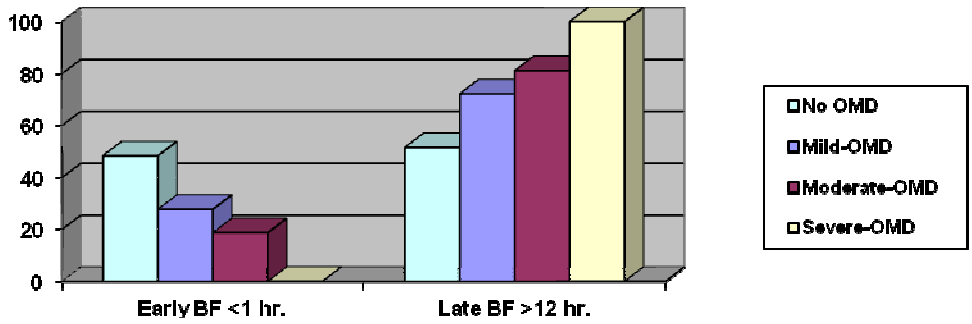

Figure (4) Severity of oral motor dysfunction and breastfeeding initiation.

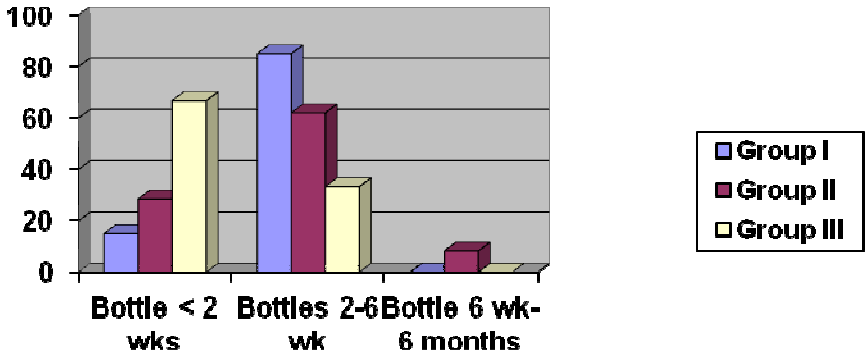

Figure (5) Percent distribution of bottles offered to babies in the three groups under study.

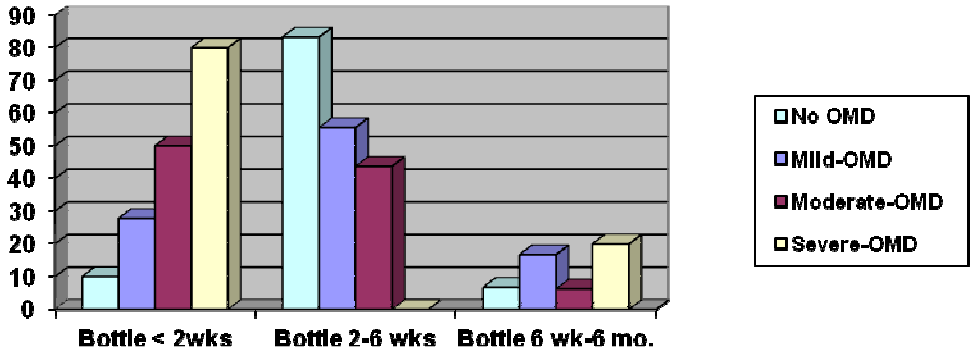

Figure (6) Relationship between the severity of oral motor dysfunction and time of exposure to early feeding by the bottle.

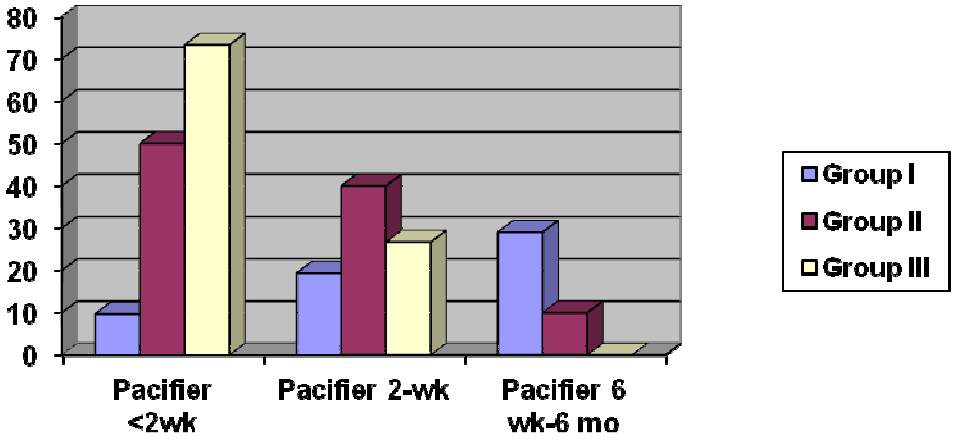

Figure (7) Percent distribution of pacifiers offered to babies in the three groups under study.

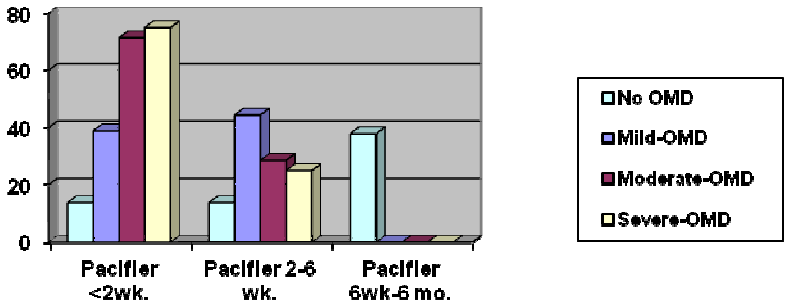

Figure (8) Relationship between the severity of oral motor dysfunction and time of exposure to early feeding by the pacifier.