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Abstract

Background: The initial years of life, particularly the first two years, are considered the most important for brain development and timely interventions profoundly affect the health of the child and families.

Aims: This study aimed to determine the effect of maternal health education on motor, social and cognitive development in infants less than two years old, and to identify the factors that could affect normal development.

Methods: Two hundred and ten mothers and their infants (109 interventions, 101 controls) were recruited from maternal and child health (MCH) centers in Assiut Governorate, Egypt, 2017. The maternal training programme has been taught to mothers of infants in intervention groups twice per month and up to five months’ duration; however, routine services are provided to control groups only. Bivariate and multivariable analyses were performed to identify the most important predictors of normal development.

Results: There were significant improvements in early childhood developmental (ECD) domains for the intervention groups after five months comparable to the base line assessment. Percent of normal development among intervention groups in communication subscale increased from 46.8% to 76% to 97.9% compared to 50.5% to 46.8% to 57.4% in the control groups (baseline, after two month and after five months assessment respectively). The intervention was a significant predictor in normal development.
Conclusions: There was an improvement in ECD domains for the intervention groups after applying maternal training programme. Designing educational interventions for routine health care services that reach all children will provide mothers with the opportunity for improvement in ECD.

Keywords: Early childhood development; maternal training; intervention; ASQ-3, Egypt

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Introduction

Child development is defined as those aspects of growth that involve physical, mental, emotional and social changes (1). Developmental delay is a condition in which the child is not developing and/or does not reach skills in accordance with the sequence of predetermined stages (2). Approximately 5–15% of all children in the general population show developmental disorders (3) and are classified into different categories (gross motor, fine motor, social skill, speech and mental skill) (4). A study undertaken in the United States of America reported that nearly one in six children had developmental delays (5). Systematic reviews of the scientific literature demonstrate effectiveness of early childhood development (ECD) programmes in preventing developmental delay (6).
Following the emphasis on home environment and the importance of the role of parents in educating children using toys appropriate to their age, Nagar and Sharma (2009) found that there was a statistically significant relationship between developmental age and psychomotor development concerning home environment (7). In an intervention on the importance of the role of playing in improving developmental skills in infants between 13 and 17 months of age, a significant relationship was revealed in improving mental and motor developmental skills in the intervention group rather than in the control group (8). Increasing detection of developmental disorders at an earlier age through intervention services are cost effective and improve the developmental prognosis, resulting in short and long-term benefits (9). Currently, there is little awareness about the problem of delayed development and there is no strategy to improve development of disadvantaged children or how to provide mothers with relevant skills in ECD. This study assessed the impact of ECD support services on caregivers (mothers) with regard to motor, social and cognitive development of children and to identify those factors that could affect normal child development.

**Methods**

**Study design and setting**

A pre-test / post-test control group study was conducted in Assiut Governorate, Egypt at two urban and two rural maternal and child health (MCH) centres. Data was collected from July 2016 to March 2017.

**Sampling technique**

The sites were chosen based on data and approvals from the Ministry of Health, since these sites have sufficient numbers of patients, availability of well-trained nursing staff, equipped for the conduct of health education classes, proper assessment of growth and development, and practical distance from Assiut University. Mothers and their children were recruited from immunization clinics of urban and rural maternal and child health (MCH) centres (two urban and two rural), randomly assigned into intervention and control groups, and excluding children with congenital and neurological diseases.

**Sample size**

Two hundred and ten participants were interviewed at the baseline survey (109 interventions, 101 controls); 190 (90.5%) successfully completed the study after two months (96 interventions, 94 controls), and 188 (89.5%) successfully completed the study after four months (94 intervention, 94 control). Twenty-two (10.5%) women dropped out during the study period after baseline assessment due to refusal to complete to the end line assessment, especially those in urban settings and those travelling outside their countries. Rural areas had lower dropout rate because rural outreach workers (Raedat Rifiyat) had communication with most mothers and therefore reminded them before each class.
Study design

Data were collected using two questionnaires (one for the mothers and the other for children). For mothers the questionnaire was semi–structured and administered through personal interview. Information collected included:

- Background information of the child and mother (age of the mother, marital status, education, occupation, father’s age, education, occupation, child age, gender and birth weight).
- Evidence of maternal social support (help from husband, as well from immediate family and others).
- Pattern of breast feeding (BF), time of start BF, exclusive BF, and foods given to the baby after six months.
- Child morbidity and exposure to any health problems in the previous two months.

Children were interviewed using the Ages and Stages Questionnaires, 3rd edition ASQ-3. ASQ-3, which is a screening tool that assesses a child's development from 2 to 60 months of age; it evaluates five domains of development:

1. Communication: this refers to a child’s language, listening and comprehension skills.
2. Gross motor: this refers to a child’s use and coordination of arm and legs.
3. Fine motor: this refers to a child’s movements and coordination of hands and fingers.
4. Problem solving: this refers to a child's problem-solving, learning and play skills.
5. Personal–social: this refers to a child’s self-learning skills and interaction skills with others.

Each domain has a set of six items and parents rate the most appropriate answer for each skill: “Yes,” “Sometimes,” “Not yet,” with point values of 10, 5, or 0, respectively. The total score for each skill is obtained by adding the scores of the six items and comparing with the cut-off points, which vary for all skills and ages (3). The ASQ-3 English version was translated into...
Arabic and back translated to ensure accuracy. For each domain results are reported as “normal” or “suspect developmental delay” (SDD), indicating that a particular milestone attainment was not evident and further evaluation is recommended.

Cut-off points for each subscale are provided to indicate whether the score falls within a normal developmental range based on chronological age, or if it represents “at risk” or delayed development. ASQ-3 has established reliability and validity for practical use in a written questionnaire and has widespread use in clinical and research settings (10,11); Cronbach’s alpha for total score was 0.86.

Children in intervention groups were entered into maternal health education programmes; routine services were provided to control groups only.

**Description of intervention**

The period of intervention was five months and was delivered by the researchers and assisted by two trained nurses. Approximately 10–15 mothers and their children were present per class, creating 3 groups in each intervention site. The groups were classified according to child age (2 – <6 months, 6 – <9 months and 9 – <12 months) to allow mothers to receive age-related information and absorb the information received. Every mother in the intervention groups received twice monthly health education classes, resulting in a total of 60 classes for the intervention.

Education classes included PowerPoint presentations and literature prepared by the researchers based on the book "Ages and Stages Learning Activities 0–5 years" (12), which contains pictures illustrating various aspects of development; for example pictures of children in activities that would promote motor development (crawling, pushing, holding, etc.) and cognitive development (naming objects, looking at a book, playing matching games, etc.).

Each session lasted approximately two to three hours. For one hour trainers explained the different aspects of child development for each age group and demonstrated how these could be promoted through play and interaction. Mothers also learned how to use everyday activities (e.g. bathing, dressing the child) and everyday household tasks (e.g. laundry, meal preparation) to promote interaction and development. For the remaining two hours the trainers and mother played with the child in ways that would promote development. All children at the intervention and control sites were assessed by ASQ-3 according to their age after two months and after five months from the baseline assessment.
Statistical analysis

SPSS software version 20 was used for analyses. Bivariate analysis and t-test were used for comparison of the mean; Chi-square test was used for comparison of proportions between intervention and control groups; McNemar test was used for comparisons of proportion within the same group before and after intervention; and multivariable logistic regression analysis was performed to identify the most important predictors of normal childhood development. P value < 0.05 was considered statistically significant.

Ethical approval

Informed and written consent was obtained from the mothers of all the children enrolled in the study. Ethical approval was taken for conducting this study from the Ethics Review Committee, Faculty of Medicine, Assiut University, Egypt. Approval from the Ministry of Health and Population from each study site was also taken. For ethical considerations, the end-line survey was followed by health education for mothers in the control groups. The original copy of the English version of ages and stages questionnaire was purchased.

Results

A total of 210 infants and their mothers were included in the study (109 interventions and 101 controls). There was no statistically significant difference in child's age, gender, residence, mother’s age, education, occupation, father age and education (P ≥ 0.05) between intervention and control groups at the base line assessment. The mean age of children was 5.7 ± 3.4 months in intervention groups and 6.1 ± 3.3 months in control groups; 50.5% and 49.5% were males in intervention and control group respectively; mean age of the mother was 28.8 ± 4.4 years and 25.5 ± 3.7 years in intervention and control group respectively. Mean birth weight was 3018.23 ± 383.96 g and 2975.36 ± 394.132 g among intervention and control groups respectively, and there was no statistical significance.

95.5% of mothers in interventions group had breast fed their infant compared to 96% in the control groups; 33.7% of mothers in the interventions group started breast feeding in the first 30 minutes after birth compared to 33% in the controls; and 69.7% of mothers in the intervention groups were exclusively breast feeding compared to 69.3% in the control groups. The food given to the infant after 6 months from birth were milk products followed by vegetables and bread categories.

Nearly 60% of the intervention groups were exposed to health problems in the previous two months compared to 55.5% in the control groups; there was no statistical significance. The most
common health problems were gastroenteritis, common cold and fever.

There was no statistically significant difference between the intervention and control groups at the baseline assessment regarding communication, gross motor, fine motor, problem solving and personal social skills. After two months and after five months from the baseline line, there were significant differences between interventions and controls regarding the five developmental subscales. In intervention groups, percent of normal child development in communication subscale increased from 46.8% to 76% to 97.9% compared to 50.5% to 46.8% to 57.4% in the control groups (baseline, after two month and after five months assessment respectively) (Table 1).

There was a significant improvement in child development in the intervention groups in all domains after five months comparable to the baseline assessment (P < 0.001). Percent of SDD was 52%, 63.8%, 54.3%, 52% and 50% regarding communication, gross motor, fine motor skills, problem solving personal social skills, respectively, at the baseline in interventions groups, compared to 2.2%, 23.4%, 14.9%, 3.2% and 5.3% after applying the maternal health education program (Table 2).

Logistic regression analysis for ECD domains at the end line assessment (after five months) found that intervention was a significant predictor in normal child development in communication, growth motor, fine motor, problem solving and personal social (OR = 3.42, 3.15, 4.23, 4.21, 4.59 respectively). In addition, maternal social support in child raising (husband, relatives, neighbours and friends) was a significant predictor in communication, personal social domains (Table 3).

**Discussion**

Child development is difficult to measure because of its nature and influence by continuous biomedical and/or sociocultural factors. Most well conducted studies on psychosocial stimulation programmes have resulted in immediate benefits to children’s development and some have shown long-term benefits in social behaviour and school achievement (8).

We believe that our intervention also benefited mothers, since health education brought mothers together and facilitated a sharing of experiences, ideas and general interaction. Mothers gained knowledge of better care for their children and they valued their new skills in dealing with different items of ECD. The intervention effect showed that children in intervention groups had a marked significant increase in the achievement of normal developmental
milestones compared to children in the control groups, which was shown to be highly significant in the multiple regression analysis.

Consistent with our results, a study done in northeast Brazil to improve cognitive and motor development in a community-based intervention (the intervention comprised ten weekly visits and three workshops over a four-month period) was associated with significant improvements in cognitive and motor development (8). Our study found significant percent increases in communication, fine and gross motor, problem solving and personal social skills for the intervention groups compared to control groups two months and five months after the intervention. This was compatible with results of the study by Rezaeian et al. (1), which investigated the effect of implementation of evidence-based care package on the gross motor development on 1–12 months old infants, and the study was also conducted in the Islamic Republic of Iran among 12-month-old infants on motor skills (13). Our study supports the role of playing and learning to improve ECD domains, consistent with a study by Miquelote et al. (14) on the effect of the home environment on motor and cognitive behaviour of infants aged three to 18 months in Brazil. A quasi-experimental study by Sajedi and Barati (15) investigated the effect of perceptual motor training on motor skills of preschool children. After 15 one-hour training sessions over two months, a significant statistical improvement was observed in motor skills.

In our study, the percentage of suspected development delay (SDD) at the baseline in interventions groups was consistent with a study carried out by Kyerematen et al. (16) on the application of the ASQ in child development in a low-income Peruvian shantytown population. Of the 129 children in the study (average age 22 ± 6.8 months), 38.7% had suspect results for at least one of the five scales, namely communication scale (15.5%), gross motor (3.8%), fine motor (10%), problem solving (13.9%) and the personal-social scale (5.4%).

A study in the Islamic Republic of Iran by Sajedi et al. (17) using the ASQ showed Iranian children delayed in the communication, gross motor, fine motor, problem solving and social personal domains (3.87%, 4.04%, 4.31%, 4.15% and 3.69%, respectively). Alptekin (18) reported that the prevalence of developmental delay by using the ASQ–transforming rehabilitation (ASQ-TR) during childhood in Turkey was 6.4% in a community based sample consisting of children aged 3–60 months. Another study, using the Norwegian ASQ cut-off points among infant aged 4-12 months, suggested that between 5.7% and 7.0% of young children had SDD (19).

In addition, a cross sectional study of 510 kindergartens (age group 24–60 months) in the east of Menuofia Governorate, Egypt, found that the prevalence of SDD among the studied children was 2.9%, 0%, 1.7%, 2.2%, and 0.6% regarding communication, gross motor, fine motor,
problem solving, skills, personal social skills, respectively (20). Differences between the above studies may be due to variations in age groups, study design and other factors such as the nutritional status of children.

Moreover, beside the intervention, maternal social support was found to be another predictor for child development in the communication and personal social scale, which was consistent with other results that previously identified maternal social support as a protective factor for child development outcomes (21,22). Primary care, public health, prenatal and parenting programmes could inform parents about the importance of establishing a social support network.

Parents, caregivers and families need to be supported in providing care and protection for young children in order help them achieve their developmental potential. The intervention packages should be applied at developmentally appropriate times during the life course, target multiple risks, and build on existing delivery platforms for feasibility of scale-up (23). If children with developmental delays or disabilities and their families are not provided with timely and appropriate early intervention, support and protection, their difficulties can become more severe, often leading to lifetime consequences, increased poverty and profound exclusion (24).

**Limitations**

Our study has a number of limitations, including missing mothers and their children in the end line survey, and subjective nature of questions in ASQ-3. However, this last problem was mitigated by explanations offered by the researcher.

**Conclusions**

This study’s results revealed the impact of maternal health education in improvement of ECD domains. Designing educational interventions in routine healthcare services that reach all children, and provide policy mechanisms for sustainability of the programme, will provide mothers with the opportunity for improvement of ECD and allow for early diagnosis of child development disorders.

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References


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