ORIGINAL ARTICLE

The Effect of Nutrition in The First Year of Life on Development in Preschool Period

Bir Yaş Altı Beslenmenin Okul Öncesi Dönemde Gelişime Etkisi

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ABSTRACT
Objective: *Early detection of nutritional problems and timely interventions in early childhood can prevent developmental issues. This study aimed to investigate the impact of nutrition during the first year of life on developmental outcomes in the preschool period.*
Material and Method: *We conducted a single-center descriptive study with 139 children aged 1-6 years and their mothers, who attended Şişli Hamidiye Etfal Hospital Family Medicine Polyclinics between March and June 2019. Mothers who agreed to participate provided written consent. After completing a structured information form, the Denver II Developmental Screening Test Turkey Standardization (DGTT II) was administered to the children.*
Results: *Of the participants, 35 mothers (25.2%) had only one child, and the DGTT II results for these children were significantly better (p = 0.015). Children who were exclusively breastfed during the first 6 months had a higher rate of normal DGTT II results (p = 0.038). Conversely, children who were not fed formula had significantly higher rates of normal DGTT II results (p = 0.028). Those who were given cow's milk before 1 year of age had a higher rate of abnormal DGTT II results (p = 0.037).*
Conclusion: *The study found a significant association between abnormal DGTT II results and male gender, living in an extended family, not being an only child, not being exclusively breastfed for the first 6 months, and being fed with formula or cow's milk. Regular monitoring of children in large and multi-child families, along with providing mothers with education on infant nutrition during pregnancy and postpartum, may reduce developmental problems.*
Keywords: *child development, nutritional status, preschool, child*

ÖZET
Amaç: *Erken çocukluk döneminde beslenme sorunlarının tespiti ve müdahaleler, gelişimsel sorunları önleyebilir. Çalışmamızda, 1 yaş altı beslenmenin okul öncesi dönemdeki gelişim üzerindeki etkisini araştırmayı amaçladık.*
Gereç ve Yöntem: *Mart ve Haziran 2019 tarihleri arasında Şişli Hamidiye Etfal Hastanesi Aile Hekimliği Polikliniklerine başvuran ve yazılı onam ile çalışmaya katılmayı kabul eden 1-6 yaş arasındaki 139 çocuk ve anneleri ile tek merkezli tanımlayıcı bir çalışma gerçekleştirdik. Anneler hazırlanan bilgi formunu doldurduktan sonra, çocuklara Denver II Gelişimsel Tarama Testi Türkiye Standardizasyonu (DGTT II) uygulandı.*
Bulgular: *Tek çocuğu olan anne sayısı 35 (% 25,2) idi ve tek çocuğu olan annelerin çocuklarının DGTT II sonuçları anlamlı derecede daha yüksekti (p=0,015). İlk 6 ay sadece anne sütü ile beslenenlerin DGTT II sonuçlarının normal çıkma oranı daha yüksek bulundu (p=0,038). Formül mama ile beslenmeyen çocukların DGTT II sonuçlarının normal çıkma oranı anlamlı derecede daha yüksek bulundu (p=0,028). 1 yaşından önce inek sütü verilen çocukların DGTT II sonuçlarının anormal çıkma oranı daha yüksek bulundu (p=0,037).*
Sonuç: *Çalışmada, DGTT II anormal sonuçları ile erkek cinsiyet, geniş bir ailede yaşama, tek çocuk olmama, ilk 6 ay sadece anne sütü ile beslenmeme, formül mama ve inek sütü ile beslenme arasında anlamlı bir ilişki bulundu. Geniş ve çok çocuklu ailelerde yaşayan çocukların sık gözlemlenmesi, annelere hamilelik ve doğum sonrası bebek beslenmesi konusunda eğitim verilmesi, gelişimsel sorunları azaltabilir.*
Anahtar Kelimeler: *beslenme durumu, çocuk, okul öncesi, çocuk gelişimi*

INTRODUCTION

Healthy early childhood development is crucial for public health. Development involves the simultaneous acquisition of tissue structure and function alongside growth, influenced by both genetic inheritance and environmental factors. In addition to physical factors, nutrition, family environment, emotional state, and socio-cultural conditions also play significant roles in shaping a child's psychological and physiological development (1). Brain development begins just days after fertilization and progresses most rapidly during the first few years of life. Providing the necessary nutrients during this critical period is essential for supporting optimal development. Inadequate nutrition and frequent illnesses can lead to developmental problems in children (2). Recent estimates suggest that 250 million children under the age of 5 living in low- and middle-income countries are at risk of not reaching their full developmental potential (3).

Developmental delay is typically defined as a lag in achieving age-appropriate milestones in one or more areas, including speech and language, motor skills, social interaction, emotional regulation, and cognitive abilities (4). Detecting and addressing nutritional problems in early childhood can

Table 1: Denver II relationship with sociodemographic characteristics and first-year nutritional data

Sociodemographic characteristics	Denver II results		P value
	Normal N(%)	Non-normal N(%)	
Gender			
Female	57 (81.4%)	13 (18.6%)	0.020
Male	44 (63.8%)	25 (36.2%)	
Education level of mother			
Illiterate	4 (66.7%)	2 (33.3%)	0.558
Below high school	55 (69.6%)	24 (30.4%)	
High school and above	42 (77.8%)	12 (22.2%)	
Working status of mother			
Home stay	80 (72.7%)	30 (27.3%)	0.648
Blue collar	7 (63.6%)	4 (36.4%)	
White collar	14 (77.8%)	4 (22.2%)	
Income status of mother*			
Low (< 1700 ₺)	81 (71.1%)	33 (28.9%)	0.334
Middle (1700 – 3500 ₺)	13 (72.2%)	5 (27.8%)	
High (> 3500 ₺)	7 (100%)	0 (0%)	
Family structure			
Nucleus	87 (76.3%)	27 (23.7%)	0.039
Extended	14 (56.0%)	11 (44.0%)	
Number of children in the family			
One	31 (88.6%)	4 (11.4%)	0.015
Two or more	70 (67.3%)	34 (32.7%)	
Breast milk			
Only breast milk in the first 6 months	72 (78.3%)	20 (21.7%)	0.038
Breast milk and formula	29 (61.7%)	18 (38.3%)	

₺ Turkish Lira
**The minimum wage at the time of the study was taken as a reference.*

prevent such developmental delays. Therefore, our study aimed to investigate the impact of nutrition during the first year of life on developmental outcomes in the preschool period.

MATERIAL AND METHODS

Study population

The study included 139 children aged 1-6 years and their mothers, who attended the Şişli Hamidiye Etfal Hospital Family Medicine Polyclinics between March and June 2019, with mothers providing written consent to participate. Children with known neurological diseases, developmental deficits, prematurity, iron deficiency, or those taking any medication other than age-appropriate supplements (such as iron or vitamin D) were excluded from the study. The sample size was calculated as 132, based on a total of 200 children aged 1-6 years who attended the outpatient clinics in the previous three months, with a 95% confidence level, aiming to reach this minimum number. Ethics committee approval was obtained from the Health Sciences University Şişli Hamidiye Etfal Training and Research Hospital Clinical Research Ethics Committee on February 5, 2019 (No: 2256).

Data Collection Tools

After the mothers completed the prepared information form, the Denver II Developmental Screening Test Turkey Standardization (DGTT II) was administered to the children. When assessing the children's development using the DGTT II, the results were categorized as normal, suspicious, or abnormal. For the purposes of our study, suspicious and abnormal results were combined and categorized as abnormal.

Denver II Developmental Screening Test Turkey Standardization (DGTT II)

The DGTT II was first published in 1967 to help healthcare professionals detect developmental problems in children. It has since been adapted and standardized in many countries and has been used to screen more than 50 million children worldwide. In Turkey, it was standardized by Kalbiye Yalaz, Banu Anlar, and Birgül Bayoğlu in 2009 and made widely available throughout the country (5). The test form consists of 134 items and assesses a child's development across four general areas: personal–social, fine motor-adaptive, language, and gross motor skills. A test result is considered normal if there are no delayed items or at most one caution item. A result is considered suspicious if there is one delayed item or two or more caution items, or if there is at least one caution item in addition to a delay. An abnormal result is defined as at least two delays, regardless of the presence of caution items. Fifteen children whose test results were found to be suspicious in the first time were called for follow-up and their tests were repeated in the near future. The repeated test results were evaluated as normal in 7 of them and abnormal in 8 of them. In total, the results of 101 (%72.7) children were found to be normal and 38 (%27.3) children were found to be abnormal.

Table 2: Association of first-year nutritional data with DGTT II

		DGTT		P value
		Normal N(%)	Abnormal N(%)	
Time to start complementery feeding	<6 months	17 (70.8%)	7 (29.2%)	0.825
	≥6 months	84 (73.0%)	31 (27.0%)	
Feeding with formula	Yes	28 (60.9%)	18 (39.1%)	0.028
	No	73 (78.5%)	20 (21.5%)	
Cow milk	Yes	20 (58.8%)	14 (41.2%)	0.037
	No	81 (77.1%)	24 (22.9%)	
Honey	Yes	19 (67.9%)	9 (32.1%)	0.523
	No	82 (73.9%)	29 (26.1%)	
Strawberry	Yes	17 (70.8%)	7 (29.2%)	0.825
	No	84 (73%)	31 (27%)	
Market product	Yes	38 (73.1%)	14 (26.9%)	0.932
	No	63(72.4%)	24 (27.6%)	

Statistical Analysis

Statistical analyzes were done with IBM SPSS 21 package program. Normality tests, Q-Q plot and histogram were used to examine the conformity of the data to the normal distribution. Since the data did not show normal distribution, Mann-Whitney U and Kruskall Wallis tests were used in the analysis of the variables. Results are given as the median (25th-75th Quarter). Chi-square and fisher tests were used for categorical data analysis. $p<0.05$ was considered significant.

RESULTS

The mean age of the 139 children participating in the study was 42.43 ± 16.34 months, with 70 (50.4%) being girls and 69 (49.6%) boys. DGTT II results of 101 (%72.7) children were found to be normal and 38 (%27.3) children were found to be abnormal. Table 1 presents the relationship between sociodemographic data and DGTT II results. A significant relationship was found between gender and DGTT II outcomes, with girls showing significantly better results than boys ($p = 0.020$). Of the participants, 114 (82%) were from nuclear families, and children from these families had significantly better DGTT II results compared to those from extended families ($p = 0.039$). Among the 35 (25.2%) mothers with only one child, the DGTT II results were also significantly better ($p = 0.015$).

Table 2 shows the relationship between nutritional data and DGTT II results. Children who were exclusively breastfed for the first 6 months were more likely to have normal DGTT II results ($p = 0.038$). Additionally, children who were not fed formula had significantly higher rates of normal DGTT II results ($p = 0.028$). Conversely, children who were given cow's milk before the age of 1 were more likely to have abnormal DGTT II results ($p = 0.037$).

The distribution of foods that should not be given to children before the age of 1 is illustrated in figure 1. Market products were the most commonly given, with a prevalence of 37.4% (n = 52). The rate of mothers with a high school education or higher who gave egg whites to their children before the age of 1 [n = 11 (22.9%)] was significantly lower than among those with less than a high school education [n = 32 (40.5%)] and illiterate mothers [n = 5 (10.4%)] ($p = 0.002$). Mothers who gave honey to their children before the age of 1 year were significantly younger than those who did not ($p = 0.038$). The rate of illiterate mothers feeding their children cow's milk was 83.3%, significantly higher than that of mothers with high school or higher education, or those with less than a high school education ($p < 0.001$). The rates of giving honey, strawberries, and market products before the age of 1 were significantly lower among mothers with a high school education or higher compared to other groups ($p = 0.012$, $p = 0.028$, $p = 0.011$, respectively). The rate of stay-at-home mothers giving market products to their children was 42.7% (n = 47), compared to 17.2% (n = 5) among working mothers, with the difference being statistically significant ($p = 0.028$). Additionally, as the mother's income level decreased, the rate of giving market products increased ($p = 0.049$).

DISCUSSION

Our study aimed to investigate the impact of nutrition during the first year of life on developmental outcomes in the preschool period. We observed that sociodemographic factors, particularly gender and family structure, have a significant influence on child development. The DGTT II results indicated that girls had normal developmental outcomes at a significantly higher rate than boys. While some studies in the literature report no gender differences (6, 7), others align with our findings, showing similar gender-related disparities (8, 9). The male gender is often considered a risk factor for developmental issues (10, 11), and the socioeconomic and environmental characteristics of the region where our study was conducted may contribute to the observed gender differences. This suggests that boys may benefit from closer developmental monitoring.

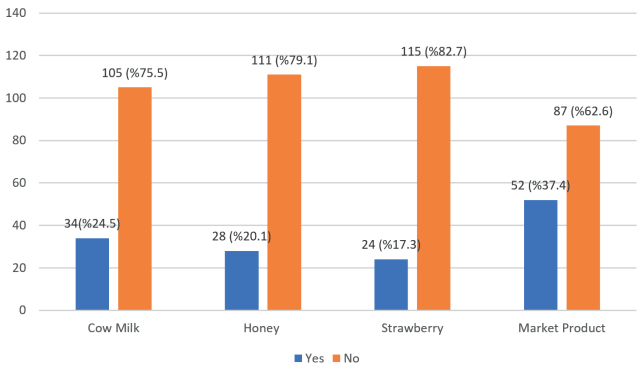

Figure 1: Nutritional distribution with foods that should not be given before the age of one

In a 2012 study involving 179 children, a comparison between households with an average of 3 members and those with 6-7 members found that children with abnormal DGTT II results were more often from larger families (12). This may be due to the reduced attention and time each child receives as the number of family members increases (13). Supporting this, our study found that children of mothers with only one child had significantly better DGTT II results. To address this issue, increasing the availability of institutions such as kindergartens and playgroups, which provide social and psychological support to mothers and enhance their capacity for empathetic parenting, could be beneficial.

In a cohort study conducted in Spain, infants were evaluated using the Bayley scale at 14 months of age, and it was shown that breast milk is associated with better cognitive development (14). Belfort et al. evaluated children at 3 and 7 years of age for cognitive functions and found significant differences between those who were exclusively breastfed for the first 6 months and those who either did not receive any breast milk, were weaned early, or received formula in addition to breast milk (15). Our study also demonstrated that children who were exclusively breastfed for the first 6 months had a higher frequency of normal DGTT II results, whereas those who were fed formula had a lower rate of normal results. These findings support the World Health Organization's recommendation that infants should be exclusively breastfed for the first 6 months (16). One potential reason for the positive effect of breast milk on development may be its fatty acid content. Bjerve et al. found a significant relationship between docosahexaenoic acid (DHA) concentrations in breast milk and psychomotor development (17). Additionally, many studies have identified a significant relationship between maternal education and breastfeeding practices (18, 19). Therefore, it is crucial to provide mothers with education on infant and child nutrition both before and after birth. Increasing the availability of pregnancy schools and expanding access to online platforms for educational content can help reach a broader audience, especially as internet usage continues to rise.

According to the American Academy of Pediatrics, certain feeding practices are defined as inappropriate for age. These include giving babies any solid or liquid food other than breast milk or formula before 4 months of age, offering cow's milk or soy milk instead of breast milk or formula, introducing juice, meat, eggs, cheese, or grocery products before 6 months, giving cow's milk, soy milk, or market products before 9 months, and providing flavored milk or market products before 12 months (20). A study conducted with Hispanic mothers and their infants found that inappropriate feeding practices increased in infants who were not exclusively breastfed for the first 6 months and were introduced to solid foods early (21). In 2014, Bennett Jr. et al. compared the developmental outcomes of children who drank cow's milk before the age of 1 and underwent the Denver II developmental screening test, finding that these children were significantly delayed in reaching developmental milestones (22). Similarly, our study found that children given cow's milk before 1 year of age had abnormal DGTT II results more frequently. This may be attributed to the protein content of cow's milk. A study by Mennella et al. found that children fed cow's milk-based formula scored lower on tests measuring cognitive development compared to those fed formula with highly hydrolyzed proteins (23). Additionally, research by Cartagena et al. demonstrated that families with lower income and education levels were more likely to provide their children with inappropriate nutrition for their age (21).

In our study, we found that the rate of feeding inappropriately for age increased with the decrease in maternal education level and income level. This may be due to traditions, misconceptions and impossibilities due to low income. The fact that the age of the mothers who gave honey to their children before the age of 1 year was significantly younger in our study may be an indicator of that younger mothers might be less aware of the potential health risks associated with feeding honey to infants, such as the risk of infant botulism (24). There are also studies in the literature showing that younger maternal age is a risk factor for poor dietary habits (25, 26).

In the first year follow-up, questioning the nutritional status, explaining the importance of feeding only with breast milk in children younger than 6 months, and giving information about the transition to complementary foods in those older than 6 months and making necessary warnings can reduce this situation. Additionally, to prevent poor dietary habits in infants among younger mothers, it is essential to provide targeted education and support. This includes offering prenatal and postnatal counseling, developing culturally sensitive educational materials, and establishing peer support programs.

CONCLUSION

The study found a significant relationship between abnormal DGTT II results and several factors, including male gender, living in an extended family, not being an only child, and not being exclusively breastfed for the first 6 months, as well as being fed formula and cow's milk. To reduce developmental problems, it is recommended to conduct frequent monitoring of children in large and multi-child families and to provide mothers with education on infant nutrition during pregnancy and after birth.

Conflict of Interest: No conflict of interest was declared by the authors

Ethics: This research is approved by the Şişli Hamidiye Etfal Research and Training Hospital Ethics Committee (Approval date: 05.02.2019; Approval code: 2256).

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