Zeynep Kamil Med J 2023;54(2):97–101
DOI: 10.14744/zkmj.2022.88156

ORIGINAL ARTICLE

Effect of gender and parental educational level on Denver Developmental Screening Test-II in healthy children aged 6 months to 6 years

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ABSTRACT

Objective: The present study aimed to evaluate healthy children using the Denver Developmental Screening Test-II (DDST-II) and to investigate the relationship between developmental outcomes, gender, and parents' educational level.

Material and Methods: Children aged between 6 months and 6 years who had no underlying disease were evaluated using the DDST-II. The test results and demographical data were recorded.

Results: Among the 114 enrolled children, 100 cases (46 girls and 54 boys) were evaluated using the DDST-II. According to the results, 86% of the study population had normal development and 14% had abnormal development. When we compared children in terms of gender, there was no significant difference between the DDST-II test results and the success rates in personal-social (PS), fine motor, gross motor, and language development observed (p>0.05). However, a significant relationship was detected between DDST-II success rates and maternal education level (p=0.001). The language development of the children of mothers with a higher education level was also significantly better (p=0.021). The low educational level of the fathers was found to be related to the children's abnormal developmental findings (p=0.005).

Conclusion: The maternal educational level directly determines the success rates of the DDST-II and the language skills of their children. Paternal educational level affects children with abnormal developmental findings. No gender-related differences were found in PS, fine motor, gross motor, and language areas of DDST-II.

Keywords: Children, Denver Developmental Screening Test II, education, gender.

Cite this article as: Doğan NN, Samancı N, Sarı E. Effect of gender and parental educational level on Denver Developmental Screening Test-II in healthy children aged 6 months to 6 years. Zeynep Kamil Med J 2023;54(2):97–101.

Received: September 20, 2022 **Revised:** October 24, 2022 **Accepted:** November 07, 2022 **Online:** June 15, 2023
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Zeynep Kamil Medical Journal published by Kare Publishing. Zeynep Kamil Tıp Dergisi, Kare Yayıncılık tarafından basılmıştır.

INTRODUCTION

Development can be defined as the process of gaining function in areas such as understanding, expression, movement, and daily life skills. Motor and mental development continue from the intrauterine period to adulthood and follow the same sequence in all children. However, the acquisition time of developmental stages shows some differences in normal children within a certain age limit. The degree of importance of structural and environmental factors that play a role in the formation of these differences has been the subject of various studies.[1] Developmental screening tests and intelligence tests provide information about specific functions such as attention, perception, and judgment, as well as general cognitive functions. The Denver Developmental Screening Test-II (DDST) is one such test and was developed by Frankenburg and Dodds in 1967.[2] The widespread use of the test necessitated its revision. The DDST was revised and re-standardized in 1992 to the DDST-II scale. This test has been adapted and standardized in different countries, and Türkiye is one of these.[3–8] DDST-II provides systematic information about a child's general development and helps to detect potential developmental problems at an early stage. This test should be used to compare children with others of their age, but it should not be used to predict future development.[9] DDST is an early diagnosis method, and it is recommended to be applied at least 4 times between the ages of 0–6 years, with the first application being made before the age of 1 year. The test compares the skills of the children in four steps. These are personal-social (PS) skills, language (L), gross (G), and fine motor (FM) skills.[10] If the result of the first evaluation is suspicious or if it is performed in a baby who is at risk, the interview intervals should be increased.[11] The present study aimed to evaluate healthy children using the DDST-II and to investigate the relationship between developmental outcomes, gender of the child, and parental educational level.

MATERIAL AND METHODS

Study Design

This study was conducted in a Training and Research Hospital, Healthy Child Outpatient Clinic, between June 2009 and August 2009, located in Istanbul. The sample in this study consisted of healthy children who were aged between 6 months and 6 years. The DDST-II was used to screen children's development. The relationship between the test results and the child's gender and parental education level was investigated. An informed consent form was obtained from the participants' legal guardians.

The inclusion criteria for this study were as follows: 1. absence of congenital malformation; 2. not being seriously ill during the test; 3. not having an underlying chronic disease; 4. absence of neuromotor disease; 5. term pregnancy (38–42 weeks of gestation) delivery; and 6. No history of hospitalization. Children with prematurity, chronic and neuromotor diseases, including perinatal asphyxia, children who could not complete the test, had an illness at test time and had congenital malformations were excluded from the study. This study was conducted in agreement with the Declaration of Helsinki-Ethical principle for medical research involving human subjects.

Intervention

The 2007 version of the DDST-II was used in this study to evaluate neuromotor development in healthy Turkish children aged 0–6 years. The validity and reliability of the Turkish version of the test used in this study were determined by Anlar and Yalaz.[10] On the evaluation chart, age-specific questions and expected observations were indicated with percentages. It shows us whether the child's developmental level is in the expected normal range for children at the same age. At the evaluation, one child was selected from each family, and the test environment was arranged in a way that would not distract the child's behavior. The DDST-II was administered to each enrolled child by the same trained and certified pediatrician. The recommended materials listed in the DDST-II application guide were used.[12] After the child's age was calculated in days, months, and years, their place on the age scale was determined, and the age line extending from the top of the form to the bottom was drawn with a ruler. Premature-born children younger than 2 years of age were tested after calculating the corrected age. Each section started with the left-most item to the left of the age line and continued to the right. The test results were interpreted as normal (no delay or no more than one caution), abnormal (two or more delays), and suspected development (one delay and one caution, or two or more cautions). Recommendations were presented for delays or cautions for the children with a suspicious test result. The test is repeated 3 months later, and if it is found suspicious again, then the patient is sent for diagnostic evaluation. At the end of the test, details of parents' education levels were collected and recorded. Patients with primary and secondary education levels were defined as "low educated," and those with high school and university education levels were defined as "high educated."

Statistical Analysis

Statistical analyses were performed using the (Statistical Package for the Social Sciences 22.0, Inc., Chicago, IL, USA) package program. Continuous variables are expressed as mean and standard deviation, and categorical variables are expressed as numbers and percentages. Differences between the two groups were tested using the Student t-test or Mann-Whitney U-test. The Mann-Whitney U-test was used to compare differences between two independent groups when the dependent variable is either ordinal or continuous. Chi-square tests were performed for categorical variables. A two-tailed $p<0.05$ was accepted as statistically significant.

RESULTS

Among the 114 children enrolled in the study, fourteen were excluded because of reasons such as prematurity (n=6), chronic disease (n=3), neuromotor disease (n=1), congenital malformation (n=1), illness during the test time (n=1), and inability to complete the DDST-II (n=2). A total of 100 children (46 girls and 54 boys) who met the inclusion criteria were analyzed using the DDST-II (Fig. 1). According to the results of the DDST-II evaluation, 86% of the study population had normal and 14% had abnormal development. When we evaluated children with normal development, 45 percent (n=39) had female gender and 55 percent (n=47) had male gender. Half of the fourteen cases with abnormal development were male (Table 1). There were no differences between genders (p=0.746).

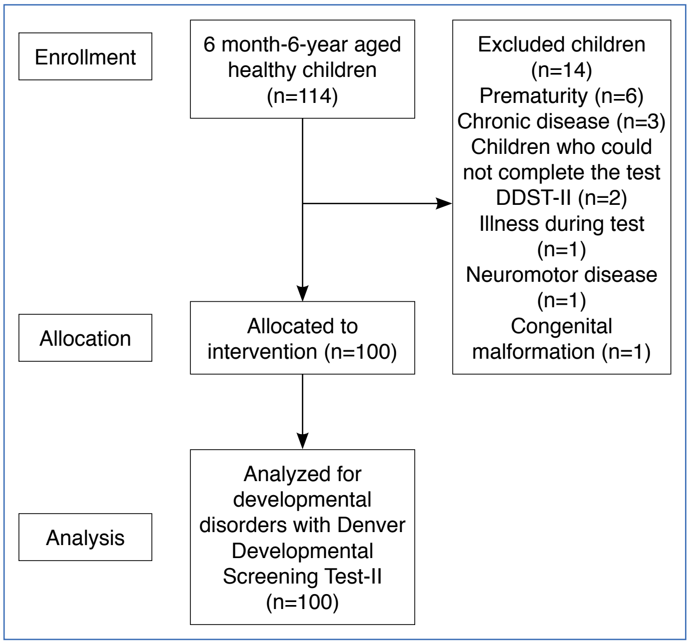

Figure 1: Flow chart for selection of eligible infants in the study.

When the fathers of children with normal development were examined in terms of education, 39 (45%) had a "low" education level, and 47 (55%) had a "high" educational level. There was no significant difference in terms of the father's education level among the children who were found to be normal (p>0.05). Of fourteen children with abnormal test results, twelve fathers had a "low" education level (85%), while the fathers of two had a "high" education level (15%). When fathers were compared in terms of education level in children with abnormal results, the number of fathers with a "low" education level was found to be significantly higher than that of fathers with a "high" education level (p=0.005). A delay in PS development was found in five (9%) children whose fathers had a "low" education level, and in one (2%) child whose father had a "high" education level. The difference was not statistically significant (p=0.205). Language skill development was delayed in seven (13%) children whose fathers had a "low" education level and in one (2%) child whose father had a "high" education level (p=0.06). Among the four cases with delayed DDST-II gross motor development, three fathers had a "low" education level and one child's father had a "high" education level. Of ninety-six children with normal gross motor development, half of the fathers had a "low" educational level, while the other half had a "high" educational level (p=0.618). Of the ninety-five cases with normal DDST-II 'fine motor development, the fathers of forty-six children had a "low" level of education (48%), while those of forty-nine children had a "high" education level (51%). The fathers of the five abnormal cases had a "low" education level. However, the difference was not statistically significant (p=0.057). The comparison of the Denver II test according to paternal education level is shown in Table 2.

When we evaluate children with normal DDST-II test results, 47 (54%) mothers had a "low" level of education, and 39 (45%) had a "high" level of education. The mothers of the fourteen abnormal cases had a "low" education level (100%). The relationship between the DDST-II success rate and maternal education level

Table 1: The comparison of the Denver Test-II results according to gender

Gender	Female (n=46)		Male (n=54)		Total (n=100)	p
	n	%	n	%		
DDST II						0.746
Normal	39	45	47	54	86	
Abnormal	7	50	7	50	14	

DDST-II: Denver Developmental Screening Test-II.

Table 2: The comparison of the Denver Test-II according to paternal educational level

Paternal education (n=100)	Low	High	p
Normal (n=86)	39	47	0.672
Gross motor (n=96)	46	48	0.618
Personal social (n=94)	43	51	0.752
Language (n=92)	44	48	0.713
Fine motor (n=95)	46	49	0.742
Abnormal (n=14)	12	2	**0.005**
Gross motor (n=4)	3	1	0.813
Personal social (n=6)	5	1	0.205
Language (n=8)	7	1	0.060
Fine motor (n=5)	5	0	0.057

was found to be significant (p=0.001). Gross motor development was normal in 96 cases and delayed in 4 cases. Of the 96 cases with normal gross motor development, 57 (59%) had a "low" maternal education level and 39 (41%) had a "high" education level. While there was a delay in 4 (6%) children in the group with a "low" maternal education level, there was no delay in the group with a "high" maternal education level, and the difference was not statistically significant (p=0.154). Of the 94 cases with normal PS development, 55 had a "low" level of maternal education (58%), and 39 (42%) had a "high" level. While the PS development of six children with "low" educated mothers was delayed (9%), there was no delay in the children of mothers with "high" education, and the difference was not statistically significant (p=0.079). Of the 92 cases with normal language development results, 53 (57%) had a "low" and 39 (42%) had a "high" maternal educational level. All eight abnormally developed cases in terms of language were children of "low" educated mothers. The language development of the children of mothers with a "high" education level was significantly better than that of those with a "low" educational level (p=0.021). The comparison of the Denver II test according to maternal educational level is shown in Table 3.

Table 3: The comparison of the Denver Test-II according to maternal educational level

Maternal education (n=100)	Low	High	p
Normal (n=86)	47	39	0.846
Gross motor (n=96)	57	39	0.812
Personal social (n=94)	55	39	0.793
Language (n=92)	53	39	0.781
Fine motor (n=95)	55	40	0.774
Abnormal (n=14)	14	0	**0.001**
Gross motor (n=4)	4	0	0.154
Personal social (n=6)	6	0	0.079
Language (n=8)	8	0	**0.021**
Fine motor (n=5)	9	0	0.123

1. Do gender and parental education level have an effect on the DDST II? 2. When healthy children (6 months-6 years old) were evaluated using the DDST-II, it was found that gender had no effect on this test, but parental education was associated with abnormal test results. 3. The parents of the children with abnormal test results were in the low-education group. In low-education mothers, the abnormality was significant in the language area.

DISCUSSION

The Denver-II is a test that is easy to administer and interpret and was developed to identify children with developmental delays. It's known to be a very accurate and reliable method, according to the literature.[13] The present findings in this study demonstrate that not gender but maternal and paternal educational levels have a notable impact on the development of children. In our study, no statistically significant difference was found in the PS, fine motor, gross motor, and language development subsets of the DDST-II and the success rates of girls and boys living in Istanbul.

There are several reports and findings about the effect of gender on development in literature. In the study conducted by Durmazlar et al.,[14] among 1019 healthy Turkish children, PS development was more advanced in girls, but the authors could not detect any significant difference between girls and boys in language skill development. Similarly, in another study, Epir and Yalaz[15] found that PS development was more advanced in girls. A study investigating the effects of factors such as geographic location, race, parental educational level, and gender on the mental and motor skills of 1409 children aged 1–15 months reported that there was no significant effect of gender on test success rates.[16,17] However, Brito et al.[17] found that male sex is associated with cognitive and neuromotor retardation in the preschool period, while Özkan et al.[18] reported that suspicious or abnormal DDST-II results were found to be higher in boys aged 0–4 years than in girls. In this study, we found that fathers' educational levels have a significant impact on children with abnormal DDST-II findings. Gökçay et al.[19] reported a delay in the fine motor skill subset of the DDST-II in children whose fathers have a primary school education. Isaranurug et al.[20] found that the development of children with a father's education at or below the primary school level was lower in both age groups than that of children with a higher paternal educational level. In the literature, it is stated that fathers with higher levels of education spend much more time and perform different activities with their children. As the educational level of the father increases, he takes on much more parental responsibility as he sees himself as more competent in child development.[21,22]

In general, mothers spend more time providing basic physical care, such as feeding and changing diapers. However, fathers often assume the role of "physical activity" leaders and are generally responsible for engaging children in games and physical activity.[23,24] The obligation of the child to use fine motor movements more in the activities performed with the father and the high motivation during the activities contribute to the acceleration of the child's development.[25] As a result, this interaction affects the normal development of the child. When we evaluated the effect of a mother's educational level on the development of the child, the DDST-II success rates of the children in the group with a "low" maternal educational level were found to be significantly lower than those of children whose mothers had "high" education. This statistically significant difference was particularly evident in the child's language skill development. Similarly, in the study conducted by Yalaz and Epir,[15] the mother's level of education contributed significantly to the child's development in a positive way; the fine motor and language skill development of children whose mothers had a "low" educational level was found to be retarded. Gökçay et al.[19] examined the effect of a mother's education on a child's development; however, no statistically significant difference was observed. This was interpreted as the fact that the study was conducted in children aged 18–24 months and that maternal education did not have any significant effect on the development of children in this age group. It has been reported that the effect of the mother on child development becomes evident at around 32–72 months and increases even more around the age of 5 years.[14] In the study conducted by Durmazlar et al.,[14] children of mothers with a higher educational level had more advanced development; it has been emphasized that this development is particularly noted in the fine motor and language skill subsets. We think that different results in the studies depend on the level of quality and quantity of time-sharing and interaction between mothers and their children. Many previous studies have reported that highly educated mothers spend more time with their children than less educated mothers.[26]

CONCLUSION

In conclusion, the educational level of parents seems to play a direct role in the development of their children. The importance of parental education has become to the fore in enhancing the development of children with slow or limited development. Although we could not examine all factors affecting neuromotor development in this study, the results showed us that the success of families in raising children may be proportional to the level of their education. A better parental educational level, being in a more "meaningful" interactions with the child from infancy, and establishing one-to-one relationships are the important factors that significantly affect child development.

We emphasize that the adoption of parental education at least above the primary school level, especially in developing countries, as a country policy may contribute to raising a generation with more normal neuromotor development. It is seen that the DDST-II can be easily used for the rapid, inexpensive, and reliable evaluation of child development, even in outpatient settings.

Statement

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – NS; Design – NND; Supervision – NND; Resource – NS; Materials – NND; Data Collection and/or Processing – ES; Analysis and/or Interpretation – NND; Literature Search – ES; Writing – NND; Critical Reviews – NND.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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