The European Research Journal
http://www.eurj.org
Original Article
e-ISSN: 2149-3189
DOI: 10.18621/eurj.304447

Developmental screening of healthy children between 6-24 months

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ABSTRACT

Objectives. Developmental screening of healthy children from early childhood provides to identify high-risk children, early diagnose of developmental delay, better prognosis, correspond direction of family and treatment efficacy. The aim of this study was to evaluate the developmental stages for healthy children referring to the pediatric clinic for early childhood check-ups. Methods. The development of 328 children was evaluated. It is found that; awareness skills of infants with siblings were better than those without siblings. The infants attended to by caregivers had limited word usage compared with those cared for by mothers and relatives. The developmental stages were evaluated by using Social-Communication Area Screening Test for Infants (SCASI). Results. The developmental stages of infants whose mothers were graduated from university were better than the other infants in terms of awareness skills. In addition, social content skills in terms of communication levels and total points were better in infants cared for by mothers and relatives than the others, and it appears that those cared for by relatives were better compared to those only looked after by mothers. Our study indicated that according to SCASI scores, 6.1% of infants were in the risk group. Conclusions. During the first years, regular check-ups and recording of the development are very important in terms of ensuring that there is early intervention in the case of any delay in development stages. Screening tests that can be used easily, regularly repeatable, including observation of parents and having short evaluation process should be extended.

Eur Res J 2017;3(3):250-258

Keywords: Infant development, developmental screening, developmental delay

Introduction

The developmental process and, more specifically, the issue of developmental regression in the infant and early childhood period is an area of intense interest for researchers [1] The first years of life after leaving the mother's womb are very important in terms of mental and physical development, and brain development in this period is known to be rapid [2, 3]. Currently, it is thought that the sources of many neurological and psychiatric problems are in some way related to this particular period [4, 5].

Developmental regression observed at rates of 5-30% in the infant and early childhood period may cause delays in one or more areas of growth [6-8]. Though parents may become aware of developmental

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Received: April 7, 2016; Accepted: May 5, 2017; Published Online: June 2, 2017

problems in this period, both initial reporting and diagnosis take time [9, 10, 11]. Early diagnosis and the beginning of rehabilitation for developmental regression is very important for prognosis and treatment efficacy, as well as for offsetting increasing costs [12-14].

Families commonly share some of the problematic experiences in the early period with pediatric clinicians who they meet regularly. Because of that, pediatric clinicians should be competent in child development and aware of developmental problems that can arise. Currently, it is recommended that screening scales must be used during routine health checks for research into developmental delays [15-17]. Especially screening scales that are in accord with the norms of society that the children grow up in and that can be easily administered by pediatric clinicians are needed [18-20].

Screening tests generally consist of a short evaluation process used to identify high-risk children who are in need of more detailed examination [21, 22]. The screening test to be administered by clinicians working with children should be practical and capable of being implemented within a short period of time; it should also be appropriate for that population, and should be regularly repeatable.

This study evaluated a current screening test assessing the developmental levels for healthy babies referring to the pediatric clinic for early childhood check-ups with the objective of identifying high-risk children in terms of developmental delay.

Methods

Three hundred and twenty-eight healthy children brought into the pediatric outpatient clinic between August 2016 and October 2016 for routine vaccination were included after the written and verbal informed consent of their parents was obtained. Local ethics committee approval was obtained for the study. Age, gender, number of siblings, education levels of the mothers and information about the caregivers were all noted. The Social-Communication Area Screening Test for Infants (SCASI) was conducted with the information given by the parents. The relationship between the SCASI subscores and total scores and gender, number of siblings, caregiver information and education levels of mothers were analysed.

SCASI is a test applied to the children at 6th, 9th, 12th, 15th, 18th and 24th months after birth. For this reason only the children at these months were included. In order to compare the results of children at different age groups, we used SCASI score percentages instead of SCASI score points.

A detailed medical history of the children was obtained. Physical and neurological examinations were conducted. Infants with the existence of risk factors such as prematurity, asphyxia, new-born convulsions, hyperbilirubinemia, low birth weight, congenital hypothyroidism and epilepsy were excluded.

The parents were informed about the developmental state of their infants. The children at-risk were first identified and then referred to playgroups or kindergartens by the researchers. Increasing the levels of interaction with the children was recommended to their parents.

Social-Communication Area Screening Test for Infants (SCASI)

SCASI is a developmental screening test focused on the social communication area for infants between 6 and 24 months of age. It is created to assess the development of healthy children at 6th, 9th, 12th, 15th, 18th and 24th months after birth and to determine the children at-risk.It is parent-reported, and may be filled out by either the mother or the father. It can also be completed by the clinician with responses in line with the answers of parents. Taking about 10 minutes to complete and score, it was first developed by Sertgil and colleagues [23]. They studied norm determination and the validity of the criteria [23].

The item "Not yet" was scored as one point, "Sometimes" was scored as two points, and "Often" was scored as three points. The other four questions had options from 1 to 5, and the first option scored as one point and the fifth as five points for each question. SCASI is a test with 43 items and a two-factor structure. The first factor consists of communication-oriented social skills, and the second consists of skills including awareness. Five different scores are derived, including the following subparts: communication-oriented social skills (F1), preverbal skills (F1a), vocabulary (F1b) and skills including awareness (F2). The test has strong internal consistency: α is 0.962, and 0.961 and 0.811 for factors I and II, respectively. The children are identified to be normal or at-risk (at the 20–30% percentile) according to the cut-off score determined for each part.

Socio-Demographic Data Form

Table 1. Distribution of sociodemographic features of children

Age Group (n=328)	**n (%)**
6 month	201 (61.3)
9 month	42 (12.8)
12 month	36 (11.0)
15 month	16 (4.9)
18 month	17 (5.2)
24 month	16 (4.9)
Gender	
Boy	182 (55.5)
Girl	146 (44.5)
Existing of a Sibling	
No	240 (73.2)
Yes	88 (26.8)
Child Care Providers	
Mother	262 (79.9)
Relatives	36 (11.0)
Caregiver	27 (8.2)
Kindergarten	3 (0.9)
Education Levels of Mothers	
Primary School	8 (2.4)
High School	56 (17.1)
University	264 (80.5)

Data are given as number (percent).

This data form was prepared according to the purpose of the study to collect specific information such as gender, age, childcare and education levels of mothers. The physician completed the form based on the parents' statements during the interviews.

Statistical Analysis

The analysis of the data was conducted using SPSS for Windows 22.0 (SPSS Inc., Chicago, IL). The identifying analysis was initiated as means ± standard deviations, frequency distributions, and percentages. Pearson's chi-squared test and Fisher's exact test were used to analyse the categorical variables. The fitness with normal distribution of the variables was assessed by using the Kolmogorov-Smirnov/Shapiro-Wilk test, and visually through a histogram and graphics. In the intergroup comparisons, participants were evaluated using the Mann-Whitney U test when the number of independent groups was two, and with the Kruskal-Wallis test when there were more than two. The Bonferroni correction was used to find the source of the difference when a level of significance was found in three independent samples. The significance level was statistically determined as $p<0.05$.

Results

The development of 328 children was evaluated in this study. Sociodemographic features (distribution by age group, gender, number of siblings, child care providers, and education levels of mothers) are shown in Table 1.

Table 2. SCASI score percentages of children

SCASI (%) (n=328)	**Data**
F1a	67.21±23.50
F1b	73.29±15.45
F1	66.23±23.79
F2	62.71±28.25
Total	67.27±22.97

Data are given as mean ± standard deviation. SCASI=Social-Communication Area Screening Test for Infants, F1a=preverbal skills, F1b=vocabulary, F1=communication-oriented social skills, F2=skills including awareness

The SCASI total and subpart scores of participants were analysed. As shown in Table 2, the mean of the F1a subpart (preverbal skills) scores was 67.21±23.50,

for F1b (vocabulary) scores was 73.29±15.45, for F1 (communication-oriented social skills) scores was 66.23±23.79, for F2 (skills including awareness) scores was 62.71±28.25 and for total scores was 67.27±22.97 in terms of percentages.

Table 3. The Distribution of risk statement of children according to SCASI scores

SCASI (%) (n=328)		n (%)
F1a	Normal	296 (90.2)
	Risky	32 (9.8)
F1b	Normal	323 (98.5)
	Risky	5 (1.5)
F1	Normal	296 (90.2)
	Risky	32 (9.8)
F2	Normal	315 (96.0)
	Risky	13 (4.0)
Total	Normal	308 (93.9)
	Risky	20 (6.1)

Data are given as number (percent). SCASI=Social-Communication Area Screening Test for Infants, F1a=preverbal skills, F1b=vocabulary, F1=communication-oriented social skills, F2=skills including awareness

According to the SCASI score percentages, the number of children-at-risk was determined (Table 3). Thirty-two (9.8%) of the 328 children with respect to F1a, five (1.5%) children with respect to F1b, 13 (4.0%) with respect to F2 and 20 (6.1%) with respect to the SCASI total scores were determined to be in the at-risk group.

The correlation analyses of the SCASI score percentages and gender, the existence of a sibling, child care providers and education levels of the mothers was also evaluated (Table 4). There was no significant difference found between the SCASI total and subpart scores and gender (p>0.05). The SCASI F1a, F1b, F1 and total score percentages of the children with or without siblings were similar (p>0.05). However, the SCASI F2 score percentages were significantly higher among children with siblings (p<0.05). Evaluating child care providers, we divided the sample into three groups according to children looked after by their mothers, those looked after by relatives, and those with other caregivers. It is shown that the SCASI F1a, F1b, F2 and total score percentages were not significantly different between the groups (p>0.05). On the other hand, the SCASI F1 score percentage was different between the groups. The post-hoc tests showed that the significance was derived from the two groups looked after by mothers and relatives (p<0.05). The SCASI F1 scores were

Tablo 4. Distribution of SCASI score percentages according to gender, existing of a sibling, child care providers and education levels of mothers

(n=328)	n	SCASI (%) F1a	F1b	F1	F2	Total
Gender						
Boy	182	66,35±23,86	72,66±16,12	65,06±24,42	62,16±28,60	67,00±23,27
Girl	146	67,96±23,09	74,08±14,59	67,69±22,99	63,40±27,89	67,62±22,67
	p	0.555	0.545	0.386	0.672	0.873
Existing of Sibling(s)						
No	240	66.04±24.26	72.48±16.14	65.22±24.46	60.05±28.15	66.47±23.64
Yes	88	69.86±21.17	75.51±13.22	68.98±21.76	69.97±27.38	69.37±21.11
	p	0.289	0.156	0.343	**0.003**	0.458
Child Care Providers*						
Mother	262	65.93±23.51	73.72±13.46	64.50±23.82	62.58±27.96	65.97±22.93
Relatives	36	72.22±22.66	73.06±20.68	73.40±22.54	63.06±30.43	73.45±20.75
Caregiver	27	70.74±24.64	68.70±23.92	72.78±23.63	63.24±29.82	72.62±25.91
	p	0.158	0.596	**0.017**[a]	0.930	0.063[a]
Education Levels of Mothers						
Primary or high school	64	63.16±26.24	74.14±15.57	63.71±25.01	54.23±30.30	61.04±24.66
University	264	68.01±22.74	73.09±15.44	66.84±23.50	64.76±27.40	68.76±22.35
	p	0.265	0.528	0.385	**0.013**[b]	**0.035**[b]

Data are given as mean ± standard deviation. SCASI=Social-Communication Area Screening Test for Infants, F1a=preverbal skills, F1b=vocabulary, F1=communication-oriented social skills, F2=skills including awareness, a=According to post-hoc tests, the difference is found to be between the children looked after by mothers and by relatives, b=According to post-hoc tests, the difference is found to be between the mothers graduated from university and the mothers graduated from high school

Table 5. Distribution of SCASI risk Statement according to gender, child care providers and education levels of mothers

(n=328)	SCASI Risk Statement									
	F1a		F1b		F1		F2		Total	
	Normal n (%*)	Risky n (%*)	Normal n (%*)	Risky n (%*)	Normal n (%*)	Risky n (%*)	Normal n (%*)	Risky n (%*)	Normal n (%*)	Risky n (%*)
Gender										
Boy	163 (89.6)	19 (10.4)	179 (98.4)	3 (1.6)	161 (88.5)	21 (11.5)	173 (95.1)	9 (4.9)	168 (92.3)	14 (7.7)
Girl	133 (91.1)	13 (8.9)	144 (98.6)	2 (1.4)	135 (92.5)	11 (7.5)	142 (97.3)	4 (2.7)	140 (95.9)	6 (4.1)
p	0.641		1.000		0.225		0.309		0.178	
Existing of Sibling(s)										
No	216 (90.0)	24 (10.0)	236 (98.3)	4 (1.7)	217 (90.4)	23 (9.6)	228 (95.0)	12 (5.0)	223 (92.9)	17 (7.1)
Yes	80 (90.9)	8 (9.1)	87 (98.9)	1 (1.1)	79 (89.8)	9 (10.2)	87 (98.9)	1 (1.1)	85 (96.6)	3 (15.8)
p	0.806		1.000		0.862		0.198		0.218	
Child Care Provider**										
Mother	233 (88.9)	29 (11.1)	260 (99.2)	2 (0.8)	234 (89.3)	28 (10.7)	254 (96.9)	8 (3.1)	246 (93.9)	16 (6.1)
Relatives	35 (97.2)	1 (2.8)	35 (97.2)	1 (2.8)	34 (94.4)	2 (5.6)	32 (88.9)	4 (11.1)	34 (94.4)	2 (5.6)
Caregiver	25 (92.6)	2 (7.4)	25 (92.6)	2 (7.4)	25 (92.6)	2 (7.4)	26 (96.3)	1 (3.7)	25 (92.6)	2 (7.4)
p	0.265		**0.023**		0.567		0.069		0.953	
Education Levels of Mothers#										
Primary or high school	54 (84.4)	10 (15.6)	63 (98.4)	1 (1.6)	56 (87.5)	8 (12.5)	58 (90.6)	6 (9.4)	58 (90.6)	6 (9.4)
University	242 (91.7)	22 (8.3)	260 (98.5)	4 (1.5)	240 (90.9)	24 (9.1)	257 (97.3)	6 (2.7)	250 (94.7)	14 (5.3)
p	0.078		1.000		0.410		**0.024**		0.244	

Data are given as number (percent). SCASI=Social-Communication Area Screening Test for Infants, F1a=preverbal skills, F1b=vocabulary, F1=communication-oriented social skills, F2=skills including awareness, *=Line percentage; **=The 3 children attending kindergarten were excluded, #=The mothers graduated from primary or high schools were combined in a group

higher in the group looked after by relatives in comparison to the scores for the group looked after by mothers. As the mothers who had graduated from primary or high school only were few in number, we divided the mothers into two groups: those graduating from university, and those graduating from primary or high school. Evaluating the education of mothers in these two groups, we found a significant relationship between education levels and the SCASI F2 and total score percentages ($p<0.05$). The SCASI F2 and total score percentages of children whose mothers graduated from university were higher than those of the others. In contrast, there was no significant difference between the groups in terms of the SCASI F1a, F1b and F1 scores ($p>0.05$).

The distribution of the risk statement related to gender, child care providers and education levels of the mothers is shown in Table 5. The ratio of being at-risk in reference to the SCASI F1b was significantly higher in the children looked after by caregivers than the children looked after by their mothers and relatives ($p<0.05$). There was not found to be a difference in the F1a, F1 and F2 scores arising from the child care providers ($p>0.05$).

Evaluating the SCASI risk statement and education levels of mothers, a difference was found in terms of the SCASI F2 scores between the groups. The ratio of children-at-risk was significantly higher in the group of mothers who had only graduated from primary or high school than the mothers who had graduated from university ($p<0.05$). There was not found to be a difference in the F1a, F1 and F2 scores as a result of the education levels of the mothers ($p>0.05$).

On the other hand, there was not found to be any difference between the groups' respective SCASI subpart and total scores as a result of gender and the existence of siblings ($p>0.05$) (Table 5).

Discussion

During the critical developmental period of the first two years, regular check-ups and recording of the infant's development are very important in terms of ensuring that there is early intervention in the case of any delay in development stages. For assessment of development, the available tools include clinical observation or parental reporting. It is thought that the participation of parents in developmental tests is especial helpful for increasing awareness, improving the observation of children and solidifying cooperation with the individual conducting the test [8, 16].

In addition to the methods of only observing a child, there are now alternative methods including

family observations. The Parents' Evaluation of Developmental Status (PEDS) [24] and Ages and Stages Questionnaire (ASQ) [25] are based on the knowledge and concerns of parents in monitoring developmental levels, and are recommended for use by pediatricians [15]. Still, it is not possible to fully observe the developmental skills of the child in the health system. As observational evaluations cannot be used to evaluate all skills, there are many other items in this method, and a significant portion of the test is spent on explanations. During observation of the child's skills, there are many difficulties frequently encountered due to limited time, an inappropriate environment or shyness of the child. Especially in clinics with high numbers of patients, using these tools becomes even more difficult [26]. Additionally, due to parental report-based methods, it is thought that awareness of whether the children gain the appropriate skills for their respective age periods will increase in families.

In our study, the SCASI based on parental reporting was used to assess the developmental stages in infants. As it does not require special education before administration, takes a short time and is easily applied, it is an appropriate screening test for regular use by health workers during routine examinations. The short duration allows for certain key points to be used to inform the parents.

According to the results of the study, there was no significant difference observed in the development of male and female infants. This finding is in accordance with the results of studies which emphasized that there is no significant difference in development levels between the sexes [27-30].

Furthermore, the correlation of siblings with skills involving awareness was assessed, and it appeared that the awareness skills of infants with siblings were better than those without siblings. This result is in accordance with previous studies [31] which show that the presence of siblings ensures a stimulating environment, and as a result, the development of siblings is positively affected in terms of cognition [32, 33].

In situations where working mothers return to work early after child birth, the care of children is commonly undertaken by grandparents, other relatives or caregivers [34]. There are many studies which conclude that mothers returning early to work causes negative results in terms of the development of cognitive, social, emotional and behavioural skills at advancing ages [35-38]. It is thought that the mothers returning to work early negatively affects the bonding process experienced by the infant, and this affects the child's cognitive and behavioural development [39]. A study showed that children of mothers who begin working 4 years after birth have lower levels of hyperactivity, aggressive behaviour and anxiety levels than the children whose mothers begin working earlier [20].

Of the children included in this study, 79.9% were cared for only by the mother, 11.0% by relatives, 8.2% by a caregiver and 0.9% attended crèche. According to our study, when social content skills in terms of communication levels and total points were compared in infants cared for by mothers and relatives, it appears that those cared for by relatives had higher points compared to those only looked after by mothers. This situation may be explained by the fact that children looked after only by mothers may receive less social stimulation and verbal communication during the day. Relatives who take responsibility for caring for children ensure more intense social interaction, together with the mother and father, which may contribute to the development of skills related to communication.

In our study, when infants were attended to by caregivers as compared with those cared for by mothers and relatives, the former appeared to be at more risk in terms of limited word usage. There are insufficient studies on this topic to reach a decisive conclusion; however, one of the most important factors in a child's language development appears to be the environment, with a verbally rich and stimulating environment created by adults supporting more effective language development [40, 41]. This result could be explained by mothers and relatives supporting better language development by presenting more stimulation as compared to caregivers.

Studies have shown a strong correlation between maternal educational levels and a child's cognitive development [42], with this correlation being clearer after the first nine months [43]. In our study, it was concluded that mothers who did not graduate from university were in the lower section in terms of their capacity to ensure that awareness skills of infants were cultivated, forming a higher risk group than infants of mothers who graduated from university. As educational levels increase, mothers have more active verbal communication with infants, using more educational strategies such as frequent talking, making up stories, asking questions and providing positive feedback [44]. Additionally, the effort and expectation

that educated mothers have for their children's education is correlated with children's improved cognitive development and academic success in the future [45].

Our study indicated that according to total SCASI scores, 6.1% of infants were in the risk group. As developmental problems in the early childhood period are common in both Turkey and globally, this rate does not comply with the results showing that developmental issues may occur among nearly one out of every four children [46, 47]. This may be due to our study not including infants at risk in terms of development. The risk percentage for word use skills was 9.8, with the risk percentage of 4.0 for awareness skills. In the general population, awareness skills reflect a structural trait and are gained in the early developmental period. As a result, delays observed in this area are generally considered to be more distinctive as compared to those of the word use area. When the initial health situation of the infants forming our sample group is considered, an attempt was made to exclude situations that may have caused developmental delay. The study included infants applying for healthy child check-ups with no known medical condition. As the child's general health status [48], nutrition [49], iron deficiency [50] and family socio-economic situation [51] may affect assessment of development, the sample for the research was taken from healthy children after considering these conditions.

While the rate of women with education of high school and above is 10.7% for the country in general [52], in our study, 80.5% of mothers had graduated from university, 17.1% were high school graduates and 2.4% were primary school graduates. This data shows that the sample group contained families in the upper education level in the country.

The Limitations of the Study

Our sample was comprised of a relatively small group in terms of maternal educational levels and children at risk of developmental regression. This situation means that the results cannot be generalized to society, and this is one of the important limitations of the study. Taking account of the norms in Turkey, the strong points of the study are the use of an advanced current screening test and assessment of child development by the same individual.

Conclusions

Currently, problems have been experienced in terms of appropriately informing and supporting infants and their families without any diagnosis within the health system. The results of identifying infants at risk in terms of development shows that there is need of more support for the infant in terms of their development and the corresponding direction of the family. The more widespread use of a regular applicable survey for developmental screening, especially during routine check-ups, is of great importance for the various stages of diagnosis and for establishing direction of treatment. Consequently, there is a need for more comprehensive studies in this area.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

Financing

The authors disclosed that they did not receive any grant during conduction or writing of this study.

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