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Evaluation of 1-year-old children development in Isfahan City and its effective factors using ages and stages questionnaire, in 2014

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Abstract:

BACKGROUND AND AIMS: Attention to the development of children as the future generation that leads to the upbringing of productive human resources is an important subject. Development has dimensions that a child should acquire the skills related to them in proper age. Otherwise, he may be affected by developmental delays. There are different factors influencing children's developmental delays and this study is carried out to evaluate the developmental conditions of 1-year-old children in the Isfahan and its effective factors.

MATERIALS AND METHODS: In a historical cohort, 725 children born in 2013 were selected using multi-stage random sampling from health centers licensed by Isfahan Medical University and followed up to 1-year and their related specifications were extracted from ages and stages questionnaire and their families' files. SPSS 20 software and Pearson and Spearman correlation coefficients, independent *t*-tests, ANOVA, multiple linear regression and analysis of covariance were used for analyzing the data.

RESULTS: The minimum and maximum scores of development were observed in the personal-social domain (52.38 ± 9.1) and fine motor (56.06 ± 5.9), respectively. The results showed that the child spacing has direct relation with development in fine motor domain ($r = 0.2$, $P < 0.001$), personal-social development ($r = 0.197$, $P = 0.001$), and problem solving domain ($r = 0.18$, $P = 0.002$). The score for the development in gross motor skills had a direct correlation with the weight at birth ($r = 0.129$, $P < 0.001$). Breastfeeding also improved personal-social development ($P = 0.024$). Sex ($P = 0.024$) and living place with communication skills also showed significant relations ($P < 0.001$).

CONCLUSION: The factors such as the child's sex, feeding in the first 6 months of age, living in urban or rural areas are effective in delayed development. Considering these factors to prevent adverse effects of the elements and rapid identification of children with delayed development as well as timely therapeutic interventions are essential in the health care system.

Keywords:

1-year-old children, ages and stages questionnaire, children development

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Introduction

The human workforce is considered today as the basis of development. One of the most important basis in achieving that is attention to children as the future generation. Thus, the subject of children development is of great importance.[1,2]

Child development could be defined as a process by which the child's brain and neural system are affected by integrated changes due to structural and functional complexities, following which the child acquires new skills with increasing compatibilities to reach behavioral and functional prominence and maturity. Development has some domains, each of

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which is defined by acquiring special skills, and a child should gradually gain each of the skills in appropriate and natural age. First years of life, especially the 1st year is the most important period in emerging developmental skills in children, since in addition to the high speed of development in the 1st year of age, main functions such as behavior, sentiments, and incitements are evolved in this sensitive period. Moreover, the brain is ready in this period of age to be affected by negative environmental factors. Inattention or bad behavior with children during this sensitive period could also have strong effects on understanding capabilities and behaviors in future. Furthermore, it is in these years that could be benefited from the golden opportunity of primary or secondary preventive measures, and improving developmental delays will be extremely difficult after 3 years of age.[3-9]

It has been said that 12–16% of children are affected somehow by a type of development delays.[10] Developmental delay occurs when children do not reach their developmental milestones at the expected time.[11]

Various assessments have shown that risk factors in developmental delay include mother's age at pregnancy, multiple birth, preterm labor, type of delivery, congenital disorders and low weight at birth, low education of parents and gender (boy).[12-26]

According to American Academy estimations, developmental disorder is among the most prevalent problems in children of that community and the prevalence is about 15–20%.[27]

The prevalence of developmental delay is reported 18.7% in Isfahan, 22.4% in Qazvin and 12.4% in Dezful.[28-30]

New standards for children development by WHO emphasize that all the children in the world have equal factors and opportunities for development. A point is proved that the difference of development of children up to 1-year of age is more affected by feeding during infancy, mother's mental/physical health, child's mental/physical health, environmental factors, and health care quality than racial and genetic effects.[31] Thus, it is necessary to investigate the children conditions in each area and with regards to environmental factors and other effective variables on development. The number of researches about the public population is few, and most of the studies are carried out for high-risk groups. Furthermore, because ages and stages questionnaires (ASQ) screening has been routinely done and access was possible to get the scores for the development of all 1-year-old children in 2014, this study was carried out to determine the development conditions and relative factors in these children taken to Isfahan Health Centers in 2014.

Materials and Methods

Study design and participants

This is a historical cohort study. The statistical population consists of all 1-year-old children taken to health centers under license of Isfahan Medical University, in 2014. Inclusion criteria included the age of 12 months, complete vaccinations, and single birth. The prohibiting conditions to enter the research included being non-Iranian, living with one parent, history of being hospitalized in Neonatal Intensive Care Unit (NICU), history of genetic or metabolic diseases in the child, congenital disorders, adopted child, and imperfect questionnaires. The number of samples was considered 725 children born in 2013, and sampling was done in multiple stages and Isfahan countries (No. 1 and No. 2) were considered as two separate classes in the first stage. In the second stage, some health centers were randomly selected from each count, and in the next stage, the samples were randomly selected systematically, from the office of children's care and followed up to 1-year.

Study instrument and variables assessment

The relevant information of whom were extracted from the family files and ASQ questionnaire. ASQ questionnaire was normalized in Iran in 2002–2007 and has the specificity of 75%, sensitivity of 86% and the validity and reliability of the questionnaire have been established as 0.84 and 0.94, respectively with the ability to determine development disorders of over 96%.[32]

Regarding the importance of considered factors as per previous studies and according to the designed check-list, the scores about child development,[1] sex, birth age, mother's age, mother's education and occupation, type of delivery, birth order, child's weight at birth, family size, consumption of supplement, child nutrition in the first 6 months of age, child spacing, living place (urban or rural), county of living place (No. 1 or No. 2), father's age and occupation and history of mother's abortion were all analyzed.

Statistical analysis

SPSS 20 Software**,** Pearson and Spearman correlation coefficients, independent *t*-tests and ANOVA as well as multiple linear regression and ANCOVA and MANCOVA[2] (to control probable confounding variable) were used to analyze and $P < 0.05$ was considered significant.

Findings

The data for 725 children (49.2% girls and 50.8% boys) were considered in this study. According to

[1] Development indicates gross and fine motor skills, development in problem solving, personal/social behaviors, communication and general development.

[2] Univariate and multivariate analysis of covariance.

Table 1, the mean score for development in children was obtained as 270.30 ± 26.7, and the minimum and maximum scores of development were observed in personal-social domain (52.38 ± 9.1) and fine motor (56.06 ± 5.9), respectively. According to the obtained results from analyzing the data using independent *t*-test and correlation test, as shown in Tables 2-4, the variables of city, living place, sex, child nutrition up to 6 months of age, weight at birth, mother's age, family size, birth order, child spacing and father's age should, at least, have significant relations with one of the developmental domains. The variables of the type of delivery, child's age, consumption of supplements up to 1-year of age, history of mother's abortion, mother's education and mother's and father's occupation have no significant relations with developmental criteria and the general development domain. The analysis showed that mean scores in all the domains in county No. 1, in rural children, girl gender and consumers of breast milk was higher than other levels of variables. Moreover, Pearson and Spearman correlation coefficients showed direct relations between each of the variables of weight, age of mother, family size, birth order, child spacing and father's age, and the related domains with development. By control the effect of confounding variables, the following results were obtained:

The variables of weight at birth ($P < 0.001$) and city ($P = 0.003$) respectively showed significant relations, in development measures in gross motor skills.

Development with regards to fine motor showed a direct correlation with the child spacing ($P < 0.001$).

A better development was observed in communication skills in rural children ($P < 0.001$) and in girl gender ($P = 0.001$).

The personal-social development in consumers of mother's milk was higher ($P = 0.024$) and it had direct correlation with the child spacing ($P = 0.001$).

Development in problem solving was related with the child spacing ($P = 0.002$) and the county ($P = 0.008$).

Finally, general development showed a significant relation with variables of county ($P = 0.02$) and the child spacing ($P = 0.01$).

Discussion

This study is a historical cohort study. It was done with the aim to evaluate the development of 1-year-old children in the city of Isfahan in 2014 and the relevant effective

Table 1: Description of considered variables in the studied population

Quantitative variables	Mean (SD)	Qualitative variables	Variable levels	Number (%)
Score of general development	270.30 (26.7)	Sex	Girl	347 (49.2)
			Boy	368 (50.8)
Score of development in gross motor skills	53.17 (9.15)	County	Number 1	334 (46.1)
			Number 2	391 (53.9)
Score of development in fine motor skills	56.06 (5.97)	Living area	City	621 (87)
			Village	94 (13)
Score of development in solving problems	55.32 (6.96)	Birth age	Term	692 (96.4)
			Preterm	26 (3.6)
Score of development in communication skills	53.37 (7.36)	Mother's occupation	Housekeeper	626 (87.1)
			Occupied	93 (12.9)
Score of personal-social development	52.38 (9.014)	Mother's education	Under diploma	157 (21.8)
			Diploma	336 (46.6)
			Above diploma	228 (31.6)
Weight at birth (g)	3099.81 (4.39)	Type of delivery	Natural	218 (30.3)
			Caesarian	502 (69.7)
Mother's age	28.62 (4.84)	Consuming supplements up to 1-year of age	Perfect	636 (89)
			Partial	79 (11)
Family size	3.5 (0.65)	Child nutrition in the first 6 months	Breast milk	650 (90.2)
			Bottle milk	19 (2.6)
			Both	52 (7.2)
Birth order	1.5 (0.65)	Mother's history of abortion	Yes	101 (15.1)
			No	570 (84.9)
Child spacing (year)	6.63 (3.62)	Father's occupation	Office worker	193 (26.7)
			Laborer	74 (10.2)
Father's age	32.89 (5.21)		Business person	457 (63.1)

SD = Standard deviation

Table 2: Mean score for development according to qualitative variables related to children

Independent variable	Dependent variable Mean (SD)					
	Development for gross motor skills	Development for fine motor skills	Development for problem solving	Development for communication skills	Personal-social development	General development
Sex						
Girl	52.84 (9.4)	55.92 (5.71)	55.36 (6.5)	54.27 (6.8)	53.01 (8.29)	271.4 (25.8)
Boy	53.49 (8.9)	56.20 (6.21)	52.49 (7.25)	52.49 (7.8)	51.77 (9.63)	269.23 (27.6)
P	0.3	0.2	0.9	0.001	0.06	0.2
Age of birth						
Term	53.32 (9.09)	56.08 (5.96)	55.40 (6.76)	53.37 (7.28)	52.47 (8.82)	270.84 (26.72)
Preterm	50 (10.4)	55.19 (6.55)	55.38 (5.81)	52.5 (9.72)	51.92 (10.1)	265 (36.08)
P	0.1	0.5	0.9	0.6	0.7	0.4
Child nutrition up to 6 months of age						
Mother's milk	53.22 (9.27)	56.08 (6.03)	55.51 (6.74)	53.32 (7.34)	52.71 (8.63)	270.84 (26.72)
Bottel milk						
Both	53.16 (8.2)	56.84 (5.32)	54.74 (7.35)	52.16 (7.49)	49.21 (14.55)	267.1 (29.21)
P	52.69 (8.13)	55.77 (5.63)	53.27 (9.17)	54.04 (7.6)	49.81 (10.57)	265.57 (26.76)
	0.9	0.7	0.7	0.7	0.024	0.3
Consuming supplement up to 1 year of age						
Perfect	53.09 (9.3)	56.06 (6.09)	55.35 (6.85)	53.39 (7.74)	52.44 (8.72)	270.33 (26.95)
Partial	53.42 (8.14)	55.89 (5.23)	54.94 (8.14)	53.29 (6.74)	51.65 (11.23)	269.17 (25.97)
P	0.7	0.7	0.9	0.6	0.5	0.7
Living place						
Urban	52.81 (9.43)	55.86 (6.09)	55.15 (6.84)	52.97 (7.36)	52.12 (8.94)	268.89 (26.77)
Rural	55.64 (6.44)	57.45 (4.9)	56.49 (7.5)	56.01 (6.86)	54.15 (9.32)	279.73 (24.78)
P	0.005	0.016	0.1	<0.001	0.05	<0.001
County						
Number 1	54.25 (8.2)	56.27 (6.35)	56.06 (6.62)	53.47 (7.49)	52.62 (9.59)	272.64 (27.94)
Number 2	55.64 (9.8)	55.88 (5.63)	54.69 (7.19)	53.27 (7.26)	52.17 (8.49)	268.27 (25.56)
P	0.003	0.38	0.008	0.77	0.5	0.02

SD = Standard deviation

factors. The minimum and maximum average scores for development were related to personal-social and fine motor skills, respectively. Research findings showed significant relations between sex and development in communication skills or communication domain, such that girls acquires higher scores. Studies by Soleimani,[13,14] Amir Ali Akbari *et al*.,[15] Dorre and Bayat[16] as well as researches by Richter and Janson, Potijk *et al*.,[24,25] Hediger *et al*.[18] and Lin *et al*.[33] can verify this matter. In a study in Norway, the average rate in development conditions of girls in all the development domains, except gross motor skills, was higher than boys.[34] Kerstjens *et al*. stated that development delay in boys is more,[35] but in the studies by Noohjah *et al*.[30] and Sajedi and Alizad,[20] no significant difference was observed between the development of boys and girls. Furthermore, Piek *et al*.[36] consider sex as an ineffective element in development.

According to the results of this study, a direct correlation was observed between weight at birth and development for gross motor skills after controlling confounding variables. It is verified in the studies by Amir Ali Akbari *et al*.,[15] Soleimani *et al*. in 2001[13] and then in 2009, and also studies by Sajedi and Alizad.[20] Furthermore, the research by Abadi *et al*.[37] showed that infants with low weight at birth significantly acquire gross motor skills less than normal infants. Alvik[23] also stated similar results to ours. Yazdan *et al*.[19] reported higher moving disorders in children with low weights at their birth, whereas Glasson *et al*. stated that children with development disorders had no significant differences in their weight at birth in the control group.[38]

In this study, the rural children gained a higher score for development in all the domains apart from problem-solving criteria. However, no significant difference was observed between the scores of urban and rural children after controlling confounding variables, and development had higher rates in personal-social measures in rural children. No difference was also observed in the study by Ghahramani and Tavakolizade[21] between rural and urban areas. The scores in problem-solving and general development (even with

Table 3: Mean score for development according to qualitative variables related to parents

Independent variable	Dependent variable Mean (SD)					
	Development for gross motor skills	Development for fine motor skills	Development for problem solving	Development for communication skills	Personal-social development	General development
Mother's occupation						
Housekeeper	53.31 (9.9)	56.13 (5.95)	55.40 (6.5)	52.38 (9.12)	53.47 (7.28)	270.6 (26.81)
Occupied	52.61 (9.53)	55.19 (6.55)	52.49 (7.25)	52.34 (8.53)	52.77 (7.82)	268.58 (27.05)
P	0.5	0.3	0.9	0.9	0.4	0.5
Type of delivery						
Caesarian natural	53.17 (8.93)	56.14 (6.21)	55.39 (7.27)	52.65 (9.11)	53.52 (7.55)	270.9 (28.35)
P	53.21 (9.25)	55.87 (5.24)	55.07 (6.26)	51.67 (8.75)	53.03 (6.8)	268.8 (22.91)
	0.9	0.5	0.5	0.1	0.3	0.2
Father's occupation						
Office worker	53.78 (8.83)	55.6 (6.45)	55.05 (7.01)	51.71 (8.86)	52.85 (7.1)	268.98 (24.72)
Laborer	54.46 (7.83)	55.61 (5.84)	56.15 (5.76)	52.84 (8.4)	53.31 (8.37)	272.36 (26.69)
Businessperson	52.71 (9.46)	56.35 (5.77)	55.31 (7.12)	52.58 (9.18)	53.62 (7.29)	270.56 (27.61)
P	0.1	0.2	0.5	0.4	0.4	0.6
History of abortion						
Yes	52.8 (9.28)	55.89 (7.75)	54.75 (9.5)	51.24 (11.56)	52.92 (8.9)	267.62 (35.7)
No	53.45 (9.01)	56.18 (5.53)	55.38 (6.52)	52.57 (8.6)	53.52 (7.09)	271.09 (24.94)
P	0.5	0.7	0.5	0.2	0.5	0.3

SD = Standard deviation

Table 4: Pearson/Spearman correlation coefficients between the developmental scores with ordinal quantitative and qualitative variables

Independent variable	Dependent variable					
	Development for gross motor skills	Development for fine motor skills	Development for problem solving	Personal-social development	Development for communication skills	General development
Weight at birth						
r	0.129	0.004	0.06	0.04	0.025	0.091
P	<0.001	0.23	0.1	0.25	0.49	0.014
Mother's age						
r	0.081	0.064	0.04	0.1	0.02	0.09
P	0.03	0.08	0.2	0.004	0.5	0.01
Family size						
r	0.159	−0.015	0.059	0.053	0.052	0.099
P	<0.001	0.6	0.1	0.1	0.1	0.008
Birth order						
r	0.16	0.005	0.06	0.05	0.08	0.11
P	<0.001	0.9	0.07	0.1	0.03	0.003
Child spacing						
r	0.001	0.2	0.18	0.197	0.06	0.093
P	0.98	<0.001	0.002	0.001	0.21	0.013
Father's age						
r	0.1	0.07	0.1	0.083	0.03	0.64
P	0.004	0.04	0.7	0.002	0.4	<0.001
Mother's education						
r	−0.01	0.05	−0.01	−0.06	−0.05	−0.03
P	0.77	0.13	0.75	0.06	0.11	0.29

controlling the problems) were higher in the children belonging to county No. 1, and the score for gross motor was higher in children of county No. 2.

The birth age (term and preterm) had no significant relation with development domains. However, the results of studies by Sajedi and Alizad,[20] Ghahramani and Tavakolizade,[21] Amir Ali Akbari *et al*.,[15] Nouhjah *et al*.,[30] Ozbek *et al*.,[39] Hediger *et al*.,[18] Potijk *et al*.[25] and Richter and Janson[24] are in contradiction with the above results. The reason could be due to no participation children with the history of hospitalization in NICU to this study. Since most of the preterm infants have problems that lead to hospitalization in NICU and in

our study, only 3.6% of the infants were preterm and probably had no difficulties, being similar to the term infants.

The relation of variables such as abortion history, mother's education, type of delivery, consuming supplements, and father's occupation was not significant in any of the development domains, in this study. No correlation also existed between parent's education and development according to Shahi *et al*.[40] However, the results obtained by Hediger *et al*.,[18] Handal *et al*.,[22] Richter and Janson[24] and Potijk *et al*.[25] are not in conformity with the results of this study, reporting a significant relation between the low level of education of mothers and low score for the development. Moreover, Ghahramani's studies showed that the score for the development is higher in children with mothers who are housekeeper.

In the study by Amir Ali Akbari *et al*.,[15] repetitive abortion of mothers had a significant correlation with development delays. Type of delivery was ineffective in developmental delays according to Soleimani's studies in 2001,[13] but it was significant in his later research on the child's development.[14]

The relation of consuming supplements and father's occupation is not investigated in any reports, and only it was in Handal *et al*.[22] that a direct relation was observed between the family income and development for gross motor skills, problem-solving and communication skills. In our study, the children exclusively breastfed in their first 6 months of age had better score in development regarding personal-social aspects. In the study by Ali *et al*.,[26] breastfeeding showed higher score in all development domains. Moreover, many studies confirm the role of breastfeeding in increasing children development.[41,42]

The relation of development and father's age is not investigated in any studies. In this study, the direct relation of father's age and development was observed for gross motor ($r = 0.1$, $P = 0.004$), fine motor ($r = 0.07$, $P = 0.04$), personal-social development ($r = 0.83$, $P = 0.02$) and general development ($r = 0.64$, $P < 0.001$).

Results

Results indicated the direct correlation of family size, gross motor and general development. Furthermore, high birth order was related to better development in gross motor skills, problem-solving, communication skills, and general development, being in conformity with the results of the study by Soleimani and Karimi in 2006,[14] but the results were in contradiction with the results obtained by Hediger *et al*. and Alvik. In these studies, the high grade of birth accompanies developmental delays.[18,23]

According to this study, mother's age had direct relations with development in gross motor, fine motor, personal-social domains, and general development. Low age of mothers was considered a risk in the studies done by Soleimani and Karimi,[14] Potijk *et al*.[25] and Ryan-Krause *et al*.[17] In the Hediger study, higher age of mothers accompanied delay in social and motion skills,[18] but in another study by Soleimani, mother's age was considered as an ineffective factor.

In this study, the child spacing, even after controlling the confounding variables, had direct relations in gross and fine motor skills, personal/social, problem-solving domains and general development, which could be due to better physical conditions of mothers with regards to body strength during pregnancy and more attention of parents to the child, because of mother's fewer problems in paying attention to younger children.

In general, in this study after controlling confounding factors, weight at birth, child spacing was related to development on gross motor, development on fine motor, personal-social aspect, problem-solving, and general development. Being a villager and being a girl were related to development in the domain of communication skills, and county was somehow related to development on gross motor, problem-solving, and general development. Breastfeeding also improved development in the personal-social domain. The difference in the results from different studies could be due to the difference in the studied population and the sample size.

Large number of samples and homogeneity of the measuring instruments and well be random selection of participants are among the advantages of this study. However, due to lack of access to most of the information about prepregnancy and in-pregnancy periods that can be among the effective factors in development, it is hereby recommended for the prospective studies to be done, considering prepregnancy care.

Conclusion

The situation of 1-year-old children development in the city of Isfahan shows that these children are benefited from appropriate health care. However, the factors such as the child's sex, feeding in the first 6 months of age, living in urban or rural areas are effective in delayed development. Considering these factors to prevent adverse effects of the elements and rapid identification of children with delayed development as well as timely therapeutic interventions are essential in the health care system.

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Conflicts of interest
There are no conflicts of interest.

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