JCHR

Journal of Community Health Research 2020; 9(1): 13-20.

Failure to Thrive and its Risk Factors in 0-24 Months Children in Bojnurd City of Iran during 2008-2013

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ARTICLE INFO

Original Article

Received: 21Sep 2019
Accepted: 20Jan 2020

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ABSTRACT

Introduction: Failure to thrive (FTT) is a global problem and one of the most common health problems in childhood that involves many other social, economic, and cultural factors. Considering the adverse effects of FTT in the future of children, we studied FTT and its related factor in children under the age of 2 years in Bojnurd (the capital city of North Khorasan province, Iran).

Methods: This study was a Retrospective cohort study on 1000 health records, born in 2008-2013. Stratified sampling method was applied and the data were collected using a checklist in the health centers. Finally, data were analyzed using Chi-square, Multiple logistic regression, and independent t-test in $SPSS_{19}$ software. Significant level was set at 5%.

Results: Incidence of FTT was calculated as 443 children (44.3%) in the children's first two years of life. A significant relationship was observed between FTT in children and head circumference disorders at birth (p=0.001), maternal age at delivery (p=0.01), mother's education level (OR=0.4 CI95% [0.2-0.8] p=0.012), type of delivery (OR=0.5 CI95% [0.4-0.7] p<0.001), unspecified gestational age (OR=3.6 CI95% [1.3-10.08 p=0.015]), and pregnancy under the age of 18 (OR=2.4 CI95% [1.1-5.3] p=0.02).

Conclusion: Considering the high incidence of FTT in children, increasing awareness about timely feeding, promoting households' health, preventing and controlling infectious diseases should be improved.

Keywords: Failure to Thrive, Risk Factors, Children

How to cite this paper:

Lashkardoost H, Doaei S, Akbari Z, Mashkooti F, Hosseinzadeh E, Hamedi A. Failure to Thrive and its Risk Factors in 0-24 Months Children in Bojnurd City of Iran during 2008-2013. J Community Health Research. 2020; 9(1): 13-20.

[DOR: 20.1001.1.23225688.2020.9.1.5.7]

[DOI: 10.18502/jchr.v9i1.2569]

Introduction

Failure to thrive (FTT) is a global problem and one of the most common health problems in childhood that involves many other social, economic, and cultural factors (1). In fact, FTT is associated with an inadequate physical growth or inability to maintain the desired growth rate over time in children (2). In developing countries, FTT causes disrupt in children's weight gain, mental development, mental health, and defense against infection. According to WHO, more than 30% of children under the age of 5 years suffer from FTT, of which 80% have stunting and 20% are underweight (3, 4).

According to the related studies, the prevalence of FTT in third world countries is higher than other parts of the world. In most of these countries, the physical growth of children is lower than the international standard. In our country 16.3% of girls, 15% of boys, and totally 15.7% of children are underweight and 18.4% of girls, 19.5% of boys, and totally 18.9% of children are stunting (5). In Iran, the most prevalent ages of FTT and stunting are in 6-12 and 12-24 months, respectively. The former is the time of initiating supplementary feeding (6). Low birth weight increases with age, so that at 2 years of age it reaches a peak of 13.8% (3).

One of the most important causes of FTT is deprivation of the baby from breast feeding, early or late start of the supplementary feeding, not giving enough food to the child, child illness, emotional and psychological problems, non-compliance with health issues, and use of unhealthy water(7).

The studies showed that 46% of the FTT were due to non-specific causes (poverty and lack of access to inadequate food, low parenting education) and 26% of the cases were due to organ causes (5). Obviously, identifying risk factors is possible by monitoring the growth of children. Growth monitoring is one of the most important sources of information to diagnose FTT and malnutrition in children.

Moreover, FTT is usually a very slow process, not recognizable by families. Along with the above-mentioned issues, adverse effects of future growth disorder in children, include possible mortality, increased related diseases, reduced learning ability, and reduced mental and physical capacity. Considering few studies on the risk factors of FTT conducted in Iran, we decided to examine FTT in children under 2 years of age and its effective factors in the city of Bojnurd.

Methods

Study design: The present research was a retrospective cohort study on 1000 health records. The target population was children who were born in Bojnurd City and had health records in the years of 2008-2013.

Sampling and sample size

Stratified sampling method (based on the year of birth and urban sanitary facility in Bojnurd) was conducted and the quota of each center was determined. Based on simple random sampling, 1000 health records were selected. Sample size was determined as 1000 people according to the results reported by Naderi (8) considering the expected prevalence of malnutrition at about 5%, 95% confidence level, and accuracy of 0.01.

The inclusion criteria in this research were completeness of the child' health file in terms of the variables under consideration. In the case of incomplete data (due to being illegible, incomplete, confusing, etc.), the following file was used for review.

Instrument and data gathering

The data needed in this study were collected using a checklist derived from maternal and child care records available in health centers. Information collected from this checklist included the physical growth of children (weight, height, head circumference) over two years. These data of children were extracted from their household health records. The FTT was determined in children whose information with regard to these items was not parallel to or had an ascending trend considering the previous growth curve. Furthermore, information such as demographic characteristics and underlying diseases of the

[DOR: 20.1001.1.23225688.2020.9.1.5.7]
[DOI: 10.18502/jchr.v9i1.2569]

mother as well as the previous pregnancy status of mothers were collected. Finally, data were analyzed by Chi-square, Multiple logistic regression, and independent t-test using $SPSS_{19}$ software. Significant level was considered as 0.05.

Results

In this study, 1000 health records of children were studied; 522 of them were boys (52.2%). The mean and standard deviation of the maternal age at delivery was 26.8 ± 5.3 years. We found that 87.5% of mothers were housewives and 44.3% had undergraduate education. Based on the results, incidence of FTT occurred in 443 children (44.3%) in the first two years of life, while 557 children had no FTT (55.7%). About 146 (15%) children were stunting and 368 (37.5%) had weight FTT. The relative frequencies of FTT are shown in Fig 1.

The highest FTT in 18 months of age was 13.2%, the least FTT 3-5 after birth was 0.1%, and no abnormality was observed at birth. The relative frequencies of FTT based on the months are represented in Fig. 2.

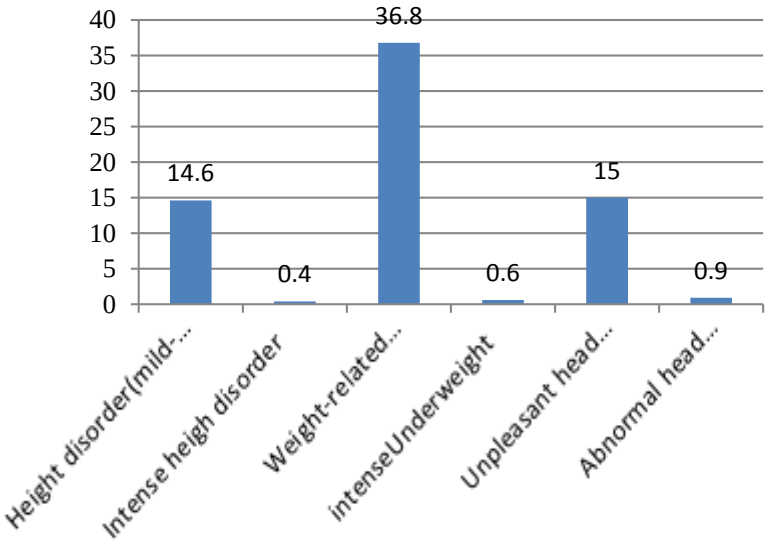

Figure 1. Relative frequency of Failure to thrive.

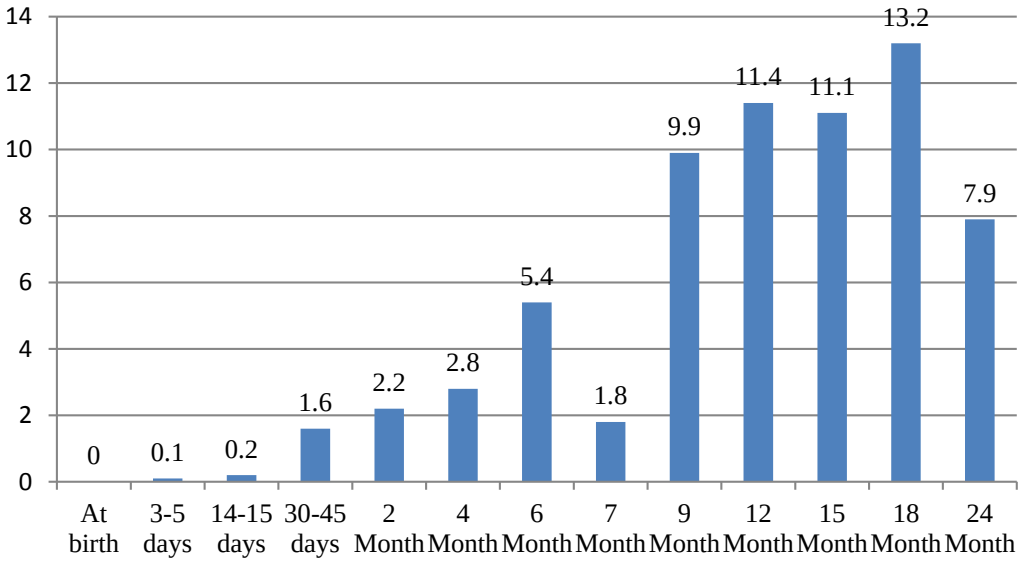

Figure 2. Relative frequency of Failure to thrive based on Months of the Year

[DOR: 20.1001.1.23225688.2020.9.1.5.7]
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The quantitative characteristics of the factors affecting FTT are presented in Table 1.

As show in Table 1, a significant difference was found between maternal age at delivery and head circumference in children with FTT in two groups ($p<0.05$).

Table 1. Characteristics of quantitative variables which affecting Failure to thrive

Variable	of children without FTT (Mean±SD)	of children with FTT (Mean±SD)	P-value
Birth weight	3.4±1.6	3.2±0.4	0.06
Height at birth	50.8±4.1	50.5±3.6	0.35
Head circumference at birth	34.5±1.6	30.01±1.8	0.001*
Maternal age at delivery	27.2±5.3	26.3±5.3	0.01*
Mother BMI	24.8±4.3	25.02±4.6	0.52
Child birth rank	1.8±0.9	1.8±0.8	0.58
Time to start auxiliary feeding	6.2±0.6	6.2±0.6	0.69

*Significant at 0.05% level
**Independent t-test

The FTT was higher in children whose mother's age was under 18 years. Furthermore, FTT was lower in children whose mothers had higher education levels. A significant relationship was observed between type of delivery and unspecified gestational age with FTT in children ($p<0.05$). However, no significant relationship was found between mother's history of previous pregnancy and FTT in children ($p=0.45$) (Table 2).

Table 2. Odds ratios and confidence intervals of qualitative variables which affecting Failure to thrive

Variables		children without FTT	children with FTT	Crude OR and 95% CI **	P-value	Adjusted OR and 95%CI ¶	P-value
Gender	Male	289(51.9)	233(52.5)	1			
	Female	268(48.1)	210(47.5)	0.9(0.7-1.2)	0.84		
Mother's job	housewife	480(86.6)	398(90.2)	1		1	
	Employee	77(13.4)	45(9.8)	0.6(0.4-1.03)	0.07	0.7(0.44-1.2)	0.27
Mother's education level	Illiterate	28(4.8)	31(7.1)	1		1	
	Under diploma	177(31.9)	207(46.6)	0.9(0.5-1.7)	0.96	0.6(0.35-1.1)	0.23
	Academic	352(63.3)	205(46.3)	0.4(0.2-0.8)	0.012*	0.6(0.3-1.3)	0.04
Mother's height less than 150cm	No	538(96.6)	430(97.3)	1			
	Yes	19(3.4)	13(2.7)	0.7(0.3-1.6)	0.52		
Type of delivery	Cesarean	294(52.7)	291(65.8)	1		1	
	Natural	263(47.3)	152(34.2)	0.5(0.4-0.7)	<0.001*	0.7(0.54-1.02)	0.001
Number of children	<=2	414(74.4)	319(72.3)	1			
	2-5	133(23.9)	114(25.7)	1.1(0.8-1.4)	0.5		
	>=5	10(1.6)	10(2)	1.2(0.5-3.2)	0.6		
First pregnancy	No	317(56.9)	265(60)	1			
	Yes	240(43.1)	178(40)	0.8(0.6-1.1)	0.31		
Fifth and above pregnancy	No	537(96.4)	426(96.2)	1			
	Yes	20(3.6)	17(3.8)	1.07(0.5-2.07)	0.83		
Pregnancy under the age of 18	No	410(98.2)	424(95.7)	1		1	
	Yes	147(1.8)	19(4.3)	2.4(1.1-5.3)	0.02*	2.1(0.9-4.6)	0.01
Pregnancy over 35	No	523(93.9)	420(95)	1			

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years old	Yes	34(6.1)	23(5)	0.8(0.4-1.3)	0.43		
Pregnancy interval less than 3 years	No	520(93.4)	410(92.8)	1			
	Yes	37(6.6)	33(7.2)	1.09(0.6-1.7)	0.71		
Multidimensional	No	542(97.6)	433(97.5)	1			
	Yes	15(2.4)	10(2.5)	1.05(0.4-2.3)	0.89		
Baby weight less than 2500 kg	No	546(98)	441(99.5)	1		1	
	Yes	11(2)	2(0.5)	0.2(0.05-1.02)	0.05	0.2(0.04-1.01)	0.23
Baby weight over than 4000 kg	No	552(99.1)	439(99.1)	1			
	Yes	5(0.9)	4(0.9)	1.006(0.2-3.7)	0.99		
Type of infant feeding	Breast feeding	483(86.7)	395(89.2)	1			
	Synthetic milk	14(2.5)	9(2.1)	0.7(0.3-1.8)	0.58		
	Both	60(10.7)	39(8.7)	0.7(0.5-1.2)	0.28		
Mother's desirable weight gain during pregnancy	No	141(26.6)	122(29.4)	1			
	Yes	416(73.4)	321(70.6)	0.8(0.6-1.1)	0.23		
Mother's disease history	No	483(86.7)	365(82.6)	1		1	
	Yes	74(13.3)	78(17.4)	1.3(0.9-1.9)	0.07	1.1(0.6-2.1)	0.33
Risky behavior in mother or spouse	No	543(97.7)	433(97.7)	1			
	Yes	14(12.3)	10(2.3)	0.9(0.4-2.2)	0.93		
The history of high risk pregnancy	No	420(75.4)	343(77.4)	1			
	Yes	137(24.6)	100(22.6)	0.8(0.6-1.2)	0.45		
Unspecified gestational age	No	552(99.1)	429(96.8)	1		1	
	Yes	5(0.9)	14(3.2)	3.6(1.3-10.08)	0.015*	1.4(0.8-2.2)	0.04
unwanted pregnancy	No	496(89)	400(90.3)	1			
	Yes	61(11)	43(9.7)	0.8(0.5-1.3)	0.52		
RH negative	No	526(94.4)	414(93.5)	1			
	Yes	31(5.6)	29(6.5)	1.1(0.7-2.004)	0.51		
History of abortion	No	542(97.3)	426(95.9)	1			
	Yes	15(2.7)	17(4.1)	1.5(0.7-3.07)	0.23		
Still birth	No	549(98.6)	436(98.4)	1			
	Yes	8(1.4)	7(1.6)	1.1(0.3-3.06)	0.85		
Preeclampsia	No	544(97.7)	431(97.3)	1			
	Yes	13(2.3)	12(2.7)	1.1(0.5-2.5)	0.70		
Infertility history	No	546(98)	433(97.7)	1			
	Yes	11(2)	10(2.3)	1.1(0.4-2.7)	0.75		

* Significant at 0.05% level
** Chi-square, Univariate logistic regression ¶ Multiple logistic regression

Discussion

In the present study, the incidence of FTT in children's first two years of life was 44.3 with a confidence interval of 41.1-47.4. Of these children, 37.4% were underweight and 15% were stunting. Similar studies reported that low birth weight among children was about 26.6%(6). In this study, children's FTT started from their first year of life and its highest rate was about 13.2% at 18 months. In addition, a significant relationship was found between head circumference at birth and FTT in children; children with FTT had less mean head circumference. Study conducted by Pronman et al. confirmed these results. They confirmed that children aged 0-11 months were less likely to develop FTT, which may be due to the protective

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role of the breast feeding (4). At 12 months of age, a further FTT appears, which can be attributed to inappropriate complementary nutrition (9).

In the present study, no significant relationship was found between the history of high risk pregnancy in mothers and FTT. Study conducted by Blair and Hvelplund reported different results. So, history of abortion, stillbirth, and cesarean section had a significant relationship with children's FTT(10, 11). A significant relationship was also reported between maternal age during labor and FTT in children. Mothers who were younger than 18 years at the time of delivery were more likely to develop FTT in their children. However, no significant relationship was found in mothers over than 35 years of age. Hien showed that the risk of developing child's FTT increased in mothers under 24 years and over 35 years. This can be attributed to the mothers' lack of readiness for taking care of their children or their boredom (6).

No significant relationship was found between birth ranking, number of children, first pregnancy, fifth pregnancy, and FTT, but research conducted by Hein, Hvelplund, and Mohammadpoorasl showed that children born in families with more than 3 to 5 children were more likely to have FTT. This can be justified by the fact that children were less considered in such families by parents (6, 11, 12). In this study, we observed no significant relationship between the gestational interval less than 3 years and FTT in children, but Nahar and Victora indicated that less than 3 years of interval between pregnancies increased the risk of developing FTT in children, which contradicts with our study (13, 14).

In this study, maternal BMI, height less than 150 cm, and mother's desirable weight gain during pregnancy had no significant relationship with FTT in children. Emond et al.'s results contradicted with our in this regard. They mentioned that maternal weight and height played an important role in the development of FTT (15).

No significant relationship was also found between the type of infant feeding and the onset of supplemental nutrition with FTT in children. However, such studies indicated that long-term breastfeeding, early or later onset of supplemental nutrition, increased the incidence of FTT in children (1, 16). The current nutrition recommendations provided by the Pediatric Academy include exclusive breastfeeding for almost the first six months after birth. The best time to start complementary feeding is after 6 months of age, because at the end of 6 months of age, breast milk alone could not supply the needs of the child. Additionally, the gastrointestinal tract after 6 months of age has an admission for semi-solid foods. If the supplemental nutrition starts earlier than this time, the risk of diarrhea and FTT would increase due to the lack of evolution of gastrointestinal tract.

In addition, FTT had no significant relationship with the child's gender and mother's occupation. However, Radhakrishna et al. reported that boys (17) were more susceptible to FTT than girls (11) and the incidence of FTT was greater in working mothers. These findings contradict with the results of this study (7, 18).

In the present study, a significant relationship was found between mother's education level and FTT in children, so that having higher education had a preventive role in the development of children's FTT. Nahar and Khuwaja confirmed these results, which can be attributed to participants' better management, greater use of health services, and promotion of health care (13, 19). However, such studies did not show a significant relationship between the level of mothers' education and childhood FTT(3). In the present study, a significant relationship was found between the type of delivery and FTT. Natural delivery was a preventative factor in the development of childhood FTT; this result was confirmed by a study (11). In this study, a significant relationship was found between uncertain pregnancy age and the incidence of childhood FTT; this finding was confirmed by a research (20). We found no significant relationship between mother's disease history and FTT, which is contrary to a study (10).

Mother’s high risk behavioral factors had no significant relation with childhood FTT, which can

[DOR: 20.1001.1.23225688.2020.9.1.5.7]
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be attributed to low maternal reporting due to their social shame. However, a study on risk factors for weight faltering in infancy according to age at onset reported significant correlation between mother's high risk behavioral factors and childhood FTT (21).

Limitation

Some data were corrupted due to the filing and could not be accessed. Furthermore, the data were not recorded for research purposes, which restricted our findings.

As we did not evaluate dietary intakes and dietary supplements, future researchers are recommended to evaluate the relationship of dietary intakes and dietary supplements with growth retardation.

Conclusion

The results of this study showed no significant relationship between high risk behavioral factors in mothers and childhood FTT. Regarding the high incidence of FTT in children, increasing parents' awareness, starting the nutritional supplements timely, promoting household health, as well as preventing and controling infectious diseases are recommended to improve the growth of children.

Conflict of Interest

The authors declared that they have no conflict of interest.

Acknowledgements

Ethics Committee of North Khorasan University of Medical Sciences was: IR.NKUMS.REC.1394.839

The authors would like to appreciate the health center staff who helped us in conducting the present study.

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[DOR: 20.1001.1.23225688.2020.9.1.5.7]
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