



# Factors Associated With Failure to Thrive Among Children Aged 3 to 72 Months in Jahrom, Southern Iran

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## Abstract

**Background:** Failure to thrive is one of the most important health problems of children around the world and in developing countries. This study aimed at investigating factors associated with failure to thrive among the children aged 3 to 72 months in Jahrom city of southern Iran.

**Methods:** This case-control study comprised of 250 children aged 3 to 72 months. The case group included children with growth curves below the third percentile in more than one measurement and children above the third percentile with failure to gain weight or with weight loss during at least 1 month. The control group was selected from children with normal growth rate. The case and control groups were matched in terms of age and gender. The chi-square test and logistic regression method were applied for analysis of data using the SPSS 17 software.

**Results:** Failure to thrive in children was significantly associated with factors, such as lower level of mother's education (OR = 4.29, %95 CI = 1.80 - 10.25, P < 0.001), mother's body mass index being less than 18.5 before pregnancy (OR = 22.06, %95CI = 4.83 - 100.73, P < 0.001), parental consanguinity (OR = 2.02, %95CI = 1.081 - 3.79, P = 0.028), and bottle feeding (OR = 2.72, %95CI = 1.34 - 5.34, P = 0.005).

**Conclusion:** Failure to thrive causes serious complications in children later in their lives. With regards to the relatively high prevalence of this problem among children aged under 6 years of age, it is therefore deemed necessary, as an important health problem, to identify factors associated with this disorder, improve pre-pregnancy care, promote women's education level, and train parents to consider appropriate nutrition of children and healthy pregnancy.

**Keywords:** Failure to Thrive, Children, Associated Factors, Iran

## 1. Background

Growth has always been considered as an indicator of health from early infancy to late adolescence (1). Growth monitoring is a basic component of health care, with growth charts considered as the most powerful tools to monitor growth development (2). Generally, height, weight, and head circumference are among parameters used to evaluate the growth of children (3). However, in many studies, weight gain disorder in children is used as a measure of Failure to Thrive (FTT), (4).

Failure to Thrive is a description of a clinical situation for identifying children with inappropriate growth and is widely considered as growth under standard growth curves. Failure to pay attention to this problem, which is generally seen among children under 5 years old, could lead to more serious complications, such as increased mortality and high incidence of related diseases (5). Children afflicted with FTT in their early life in addition to physi-

cal growth problems, have an increased risk of behavioral, cognitive, and emotional disorders over the later years of life (6).

Failure to Thrive is a global problem and according to the World Health Organization (WHO), more than 30% of children under 5 years old show FTT, of which 80% have stunted growth and 20% are underweight (5). Also, according to the report of the WHO in 2016, the average prevalence of stunting in children under 5 years around the world was 23.2% (7).

Results of studies across the world on the prevalence of FTT in developing countries indicate that in most of these countries physical growth of children and adolescents are below international standards (5). In Iran, a nation-wide cross-sectional study conducted on children aged 0 to 27 months in 2004, showed that 4.7% of Iranian children had stunting growth and 5.2% were underweight (8).

Various Studies have indicated that several factors are

associated with malnutrition and FTT in children. These include maternal diseases, early onset of complementary feeding, family socioeconomic status, children's morbidities and diarrheal diseases in particular, maternal age under 20 years, birth rank above 3, number of children, low birth weight, experience of hospital admission in the first year of life, birth interval of less than 24 months, level of parental education, and mother's addiction (3, 6, 9).

Nowadays human resource is considered as a main pillar of sustainable development across the world and paying attention to children's growth is one of the cornerstones of achieving this aim for future generation (10).

Therefore, this study aimed at determining factors associated with FTT among children aged 3 to 72 months in Jahrom city, southern Iran. The results of such studies help implement health planning and policy making as an effective step towards appropriate growth and development of children.

## 2. Methods

This case-control study was carried out in Jahrom city in southern Iran, during year 2016, including 250 children aged 3 to 72 months from 10 urban and 14 rural health centers. In this study, the cluster sampling method was used, in which each health center was considered as a cluster. At first, at each center a sequential number was assigned to all children with FTT. Then, regarding the proportion of participants, cases were selected randomly using the random number table. Next, controls were selected from healthy children referred to centers and matched with cases in terms of age and gender.

Case and control groups were in equal in numbers, considering the inclusion criteria. The case group comprised of children with growth curves below the third percentile in more than one measurement and youngsters above the third percentile with failure to gain weight or with weight loss during at least 1 month. Controls were selected from children with a normal growth trend (4, 9). Children, who had diabetes, genetic disorders, cardiovascular, renal diseases, congenital abnormalities, and hormonal disorders were excluded from the study. Therefore, the investigation was only carried out on children, who were completely healthy at birth.

The data were gathered based on the interest variables, whereby a checklist was prepared and completed using the information of children's document files at health centers. Data were analyzed using the Statistical Package for Social Sciences Version 17.0 (SPSS Inc., Chicago, IL, USA). Chi-square test, Odds Ratio (OR) and corresponding 95% confidence interval (%95 C.I) were used to evaluate the univariate relationship between independent variables and FTT as

the dependent variable. In order to control the effect of possible confounders, the adjusted ORs were estimated using the backward multiple logistic regression method.

This project was approved by the Ethical Committee of Jahrom University of Medical Sciences (under code no. IR.JUMS.REC.1395.0001).

## 3. Results

This study comprised of 250 children, including 126 (50.4%) males and 124 (49.6%) females, with 68 (72.8%) being inhabitants of urban areas. The results obtained did not reveal any significant association between FTT and father's education, father's job, housing status, and the interval between birth deliveries ( $P > 0.05$ ).

Table 1 indicates the univariate and adjusted association of demographic variables with the FTT. The unadjusted results showed a significant association between FTT in children and the level of mother's primary school education (OR: 4.19, 95% CI: 1.89 to 9.29), Body Mass Index (BMI) of the mother being less than 18.5 (OR: 20.38, 95% CI: 4.60 to 90.19) before pregnancy, bottle feeding (OR: 2.18, 95% CI: 1.37 to 4.19), and parental consanguinity (OR: 2.17, 95% CI: 1.15 to 3.51). However, after adjustment, a significant association did not remain in regards to the feeding regimen.

Finally, the results of multiple backward logistic regression showed that children, whose mothers had lower level of education ( $P < 0.001$ ), those with mothers' BMI lower than 18.5 before pregnancy ( $P < 0.001$ ), bottle-fed children ( $P = 0.005$ ), and children with parental consanguinity ( $P = 0.028$ ) were at increased risk of FTT (Table 2).

## 4. Discussion

Malnutrition is currently a major problem around the world, especially in children aged less than 5 years. Lack of food and nutrients is not always the cause of malnutrition. Other important factors associated with malnutrition include insufficient knowledge of the mother, quality of childhood care, cultural and economic factors, childhood diseases, poverty, pollution, and an unhealthy environment (11). Children's poor growth is one of the most important global health problems, especially in developing countries. Paying attention to this problem could result in colossal economic and social benefits and help promote the community's health to a large extent (12).

Findings of this study showed that education level of the mother, mother's BMI before pregnancy, parental consanguinity, and feeding schedule were factors associated with FTT among children aged 3 to 72 months in Jahrom.

**Table 1.** Univariate and Adjusted Associations of Demographic Variables With the Growth Status

Variables		Normal Growth	With FIT <sup>a</sup>	p <sup>b</sup>	OR <sup>c</sup> (%95 C.I)	OR <sup>d</sup> (%95 C.I)
Mother education	University	46 (36.8)	32 (25.6)	< 0.001	1	1
	High school	65 (52)	54 (43.2)		1.19 (0.67-2.12)	1.07 (0.49 - 2.36)
	Primary school	14 (11.2)	39 (31.2)		4.19 (1.89-9.29)	4.46 (1.65 - 12.07)
Mother job	Housekeeping	108 (86.4)	110 (88)	0.705	1	1
	Employed	17 (13.6)	15 (12)		1.15 (0.55-2.42)	1.35 (0.42 - 3.05)
Mother BMI before pregnancy	18.5 - 25	69 (55.2)	44 (35.2)	< 0.001	1	1
	< 18.5	2 (1.6)	26 (20.8)		20.38 (4.60 - 90.19)	23.9 (4.94 - 107.84)
	> 25	54 (43.2)	55 (44)		1.59 (0.93 - 2.72)	1.66 (0.92 - 3.07)
Mother disease	No	120 (96)	117 (93.6)	0.393	1	1
	Yes	59 (4)	8 (6.4)		1.64 (0.52 - 5.16)	1.03 (0.23 - 4.49)
Type of delivery	Normal	58 (46.4)	54 (43.2)	0.611	1	1
	Cesarean	67 (53.6)	71 (56.8)		1.13 (0.69 - 1.87)	1.15 (0.61 - 2.17)
Mother age in pregnancy	18 - 35	107 (85.6)	102 (81.6)	0.694	1	1
	< 18	18 (14.4)	23 (18.4)		1.85 (0.45 - 0.75)	1.14 (0.50 - 2.64)
Gestational age	> 37	117 (93.6)	110 (78)	0.024	1	1
	< 37	8 (6.4)	15 (12)		1.99 (0.82 - 4.88)	2.67 (0.70 - 10.38)
Birth weight	≥ 2500g	112 (89.6)	110 (88)	0.688	1	1
	< 2500g	139 (10.4)	15 (12)		1.75 (0.53 - 2.58)	1.30 (0.38 - 4.45)
Birth height	≥ 50cm	28 (22.4)	27 (21.6)	0.879	1	1
	< 50cm	97 (77.6)	98 (78.4)		1.04 (0.57 - 1.90)	1.02 (0.46 - 2.20)
Head circumference at birth	≥ 35cm	23 (18.4)	22 (17.6)	0.869	1	1
	< 35cm	102 (81.6)	103 (82.4)		1.05 (0.55 - 2.01)	1.05 (0.47 - 2.35)
Birth interval with previous delivery	≥ 3years	51 (40.8)	48 (38.4)	0.852	1	1
	< 3years	8 (6.4)	9 (7.2)		1.32 (0.48 - 3.64)	0.98 (0.24 - 3.98)
Feeding schedule	Breast feeding	88 (70.4)	83 (66.4)	0.002	1	1
	Bottle feeding	17 (13.6)	35 (28)		2.18 (1.37 - 4.19)	2.08 (0.95 - 4.60)
	Both	20 (16)	7 (5.6)		0.37 (0.15 - 0.92)	0.32 (0.10 - 1.00)
Parental consanguinity	No	97 (77.6)	79 (63.2)	0.013	1	1
	Yes	28 (22.4)	46 (36.8)		2.17 (1.15 - 3.51)	1.99 (1.02 - 3.88)
Living location	Rural	30 (24)	27 (21.6)	0.65	1	1
	Urban	95 (76)	98 (79.6)		1.14 (0.63 - 2.07)	1.32 (0.62 - 2.80)

<sup>a</sup> Children with failure to thrive.

<sup>b</sup> Using chi-square test.

<sup>c</sup> Univariate Odds Ratio (OR) and corresponding %95 confidence interval (C.I).

<sup>d</sup> Adjusted Odds Ratio (OR) and corresponding %95 confidence interval (C.I) computed using a multiple logistic regression model.

Results of this study showed that children, whose mothers had elementary education were 4.29 times more likely to experience FTT than those whose mothers had university education. This finding is consistent with the results of studies from Iran (4, 13, 14) and other countries (15), despite studies, which did not reveal any significant

relationship between education level of mother and child growth (6, 16). Lower educational status limits learning and restricts the process of internalizing educational contents (3). An Iranian study suggested that lower level of education in the mother is directly associated with economic and cultural impoverishment of the family. This in turn

**Table 2.** Adjusted Associations of Demographic Variables With the Growth Status Using Multiple Backward Logistic Regression Method

Variables	OR <sup>a</sup> (%95 C.I)	P	
Mother education	University	1	-
	High school	1.07 (0.56 - 2.07)	0.820
	Primary school	4.29 (1.80 - 10.25)	< 0.001
Mother BMI before pregnancy	18.5 - 25	1	-
	< 18.5	22.06 (4.83 - 100.73)	< 0.001
	> 25	1.55 (0.86 - 2.79)	0.138
Feeding schedule	Breast feeding	1	-
	Bottle feeding	2.72 (1.34 - 5.34)	0.005
	Both	0.35 (0.18 - 1.04)	0.059
Parental consanguinity	No	1	-
	Yes	2.02 (1.081 - 3.79)	0.028

<sup>a</sup> Adjusted Odds Ratio (OR) and corresponding %95 confidence interval (C.I) using backward method

has a direct impact on their awareness, learning, and interests toward children’s nutrition, proper care, and protection against different diseases (17).

Findings of this study, similar to other Iranian studies (18), indicated that mothers with pre-pregnancy Body Mass Index (BMI) of less than 18.5 were at 22.06 times greater risk of having children with FTT than those with normal BMI (P < 0.001). Contrary to some previous reports, this study did not show any significant relationship between pre-pregnancy overweightness and FTT among children (4, 19, 20). According to a number of studies, appropriate weight before pregnancy and suitable weight gain during this period are 2 important determinants for prevention of low birth weight. Also, BMI of less than 18.5 or more than 25 during pregnancy are among risk factors affecting children’s growth so that mothers are highly recommended to postpone pregnancy until optimal weight achievement (4, 9).

This study showed that the risk of FTT was 2.02 times higher among children with parental consanguinity. This finding is not compatible with the results of other Iranian Studies (4). It could be assumed that in consanguineous marriage, some genetic factors may impact the growth and development of children, although this assumption remains as an area for more investigations.

The result of this study indicated that bottle-fed children were 2.72 times more at risk of having FTT than breast-fed children. This result is in line with the findings of other Iranian studies (14, 21). Another study from Iran did not find any significant association between feeding schedule and children’ growth (4). Implementing future prospec-

tive studies could be helpful in this regard.

Finally, the current study revealed no significant relationship between FTT and variables, including birth weight, birth height, and head circumference at birth. These results are in agreement with the findings of previous Iranian studies (3, 22). Although this was not consistent with the results of some studies from Iran (4, 13) and other countries (23, 24). These discrepancies could be attributable to differences in the definition of control and case groups in various studies.

In Conclusion, this study showed that FTT in children was significantly associated with factors, including lower education level of the mother, mothers’ BMI of less than 18.5 before pregnancy, parental consanguinity, and bottle feeding. These results indicate the importance of non-nutritional factors in the prevention of malnutrition and FTT. Experiences of some countries have shown that successful planning aimed at controlling malnutrition is to some extent dependent on improved children’s health-care system, increased knowledge and attitude towards nutrition, and improved health behaviors. There are some suggestions to control growth disorders in children, such as promoting pre-pregnancy care, improving the educational level of females, training parents regarding proper nutrition of children, and appropriate pregnancy.

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**Footnote**

**Conflict of Interest:** None declared.

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