



FAILURE TO THRIVE AMONG CHILDREN: A RETROSPECTIVE STUDY AT MAKASSED GENERAL HOSPITAL

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ABSTRACT

Background: Failure to thrive (FTT) is a state of under nutrition due to inadequate caloric intake, inadequate caloric absorption, or excessive caloric expenditure. Prompt diagnosis and intervention are important for preventing malnutrition and developmental sequelae. Organic (medical) and nonorganic (social or environmental) often contribute to FTT. **Objectives:** The primary objective of this study was to determine the etiologies of FTT among children admitted to Makassed General Hospital. The secondary objective was to compare the anthropometric criteria between patients with organic and nonorganic causes. **Methods:** A retrospective chart review study was conducted at Makassed General Hospital, Beirut, Lebanon, a tertiary center, on children aged between 1 month and 13 years who were discharged with a diagnosis of FTT in the period between January 2007 and June 2017. We studied the etiologies of FTT and divided them into two groups: organic and nonorganic causes. Then we compared the two groups regarding the demographic data, and the different anthropometric criteria (weight < 5th percentile for age, height < 5th percentile for age, BMI < 5th percentile for age, Weight deceleration across > 2 major percentiles since birth, weight < 75 % of median weight for age). **Results:** A total of 356 children received the diagnosis of FTT, 90 (25.2%) were excluded from the study because they did not complete the workup. Organic causes were found in 57.3% of patients, while 17.4% had non organic causes. Organic causes were primarily related to the gastrointestinal tract 39.7%, followed by endocrine 22.5%, and immunodeficiency 9.3%, and others. The comparison of the anthropometric criteria between patients with organic and nonorganic FTT showed a statistical significance in weight < 5th percentile for age: organic (68.8%) vs nonorganic (53.2%) with P value 0.02, and in height < 5th percentile for age: organic (62%) vs nonorganic (45.2%) with P value 0.02. **Conclusion:** Organic causes of FTT were the most common, with gastrointestinal disorders being the leading cause. Patients with weight and height below the 5th percentile were more common among the organic causes group.

KEYWORDS: Failure to thrive, organic, nonorganic, anthropometric criteria, hospitalization.

INTRODUCTION

Failure to thrive (FTT) is a term used to describe inadequate growth or the inability to maintain growth, usually in early childhood.^[1] It is a state of under nutrition due to inadequate caloric intake, inadequate caloric absorption, or excessive caloric expenditure.^[1]

The term 'failure to thrive' was quoted as early as 1915 by a remarkable American Pediatrician, Dr. Henry Dwight Chapin of New York who was a leader in alerting pediatricians to failure of growth and development associated with poverty and with modern institutional care of infants and young children.^[2]

In routine clinical practice, FTT is commonly defined as either a weight for age that falls below the 5th percentile on multiple occasions or a weight deceleration that crosses two major percentile lines on a growth chart.^[3]

Anthropometric criteria should be considered in combination, rather than one criterion, to more accurately identify children at risk of FTT.^[4]

Reasons to hospitalize a child for further assessment include failure of outpatient management, suspicion of abuse or neglect, or severe psychosocial impairment of the caregiver.^[1]

Routinely, the causes of FTT are divided into organic (medical) and nonorganic (social or environmental). However, in more than 80 percent of cases, a clear hidden medical condition is never identified.^{[1],[5]}

Up to our knowledge there are no recent studies discussing the causes of FTT and there are no studies in Lebanon that compare the different anthropometric

criteria between patients with organic and nonorganic FTT.

Thus; the objectives of our study were to determine the etiologies of FTT among children and to compare the anthropometric criteria between patients with organic and nonorganic causes of FTT.

Methods

Study design

A retrospective chart review conducted at Makassed General Hospital at Beirut, Lebanon, a tertiary referral center. Hospital administrative records were reviewed using the tenth revision (ICD-10) to identify all children with Failure to thrive, aged between 1 month and 13 years from January 1st 2007, to June 30th 2017 and was approved by Institutional Review Board (IRB).

Inclusion/Exclusion criteria

The inclusion criteria included all children between 1 month and 13 years old whose weight for age falls below the 5th percentile on multiple occasions, or with a weight deceleration that crosses two major percentile lines on a growth chart. Patients who did not complete the workup were excluded.

METHODOLOGY

Patients were classified into two groups according to the ICD- 10 final diagnosis: Organic FTT and nonorganic FTT (those who completed a full workup with no cause identified), and we checked the different anthropometric criteria for each patient including:

- Weight for age below 5th percentile
- Height for age below 5th percentile
- Weight < 75% of median weight for age
- Weight deceleration across > 2 major percentiles since birth
- BMI for age < 5th percentile, and we counted how many criteria were met by each patient.

Then we classified these patients according to the severity of FTT;

- **Mild:** in which the patient lies 1 standard deviation (SD) below the mean of weight for age
- **Moderate:** in which the patient lies 2 SD below the mean of weight for age
- **Severe:** in which the patient lies 3 SD below the mean of weight for age

Comparison between the two groups was done regarding demographical data which included:

- Age: Classification of patients into 5 groups: less than 6 months, 7 to 12 months, 13 to 23 months, 2 to 7 years and 8 to 13 years.
- Gender, parents' consanguinity, nationality, origin city or village, child birth order.

All investigations including laboratory data and imaging studies whether invasive or not were recorded.

The chief complaint, of each patient was recorded, along with the organic causes of FTT.

Statistical analysis

The Statistical Package for Social Sciences (SPSS, version 24) program was used for data entry, management, and analysis.

Categorical variables were presented as number and percent. Bivariate analysis was carried out by using the chi square for comparing categorical variables. A P-value of ≤ 0.05 was used to indicate statistical significance.

RESULTS

Around 36000 patients were admitted to the pediatric department floor during the study period, of which 356 (1%) had FTT. 90 (25%) patients were excluded since they didn't complete the workup due to financial issues (no availability of 3rd party coverage). 266 patients were included of which 204 (77%) had organic causes of FTT, and 62 (23%) had non organic causes of FTT.

Regarding the demographic data of these patients, we noticed that 164 (62.5%) patients were below 23 months of age. 69 (26.3%) patients were between 2 years and 7 years, and 29 (11%) patients were between 7 and 13 years. 140 (52.6%) patients were females, 92 (34.5%) patients had consanguineous parents, 260 (97.7%) patients were Lebanese, and 174 (65%) patients were in the 1st or 2nd birth order.

With respect to the origin city or village of our patients, we found that 29% of the patients were from Bekaa, 25% were from the north of Lebanon, 22% of patients originated from Beirut, 16% were from Mount Lebanon and 8% were from the south.

The organic causes of FTT included: Growth hormone deficiency (partial and total) 23%, followed by food allergies 22%, Immunodeficiency 9%. These were followed by celiac disease 6%, congenital heart disease 5%, cystic fibrosis 4%, inflammatory bowel disease 4%, and renal disease (Chronic kidney disease, recurrent UTI or Renal Tubular acidosis) 4%. Other causes included Gastro-esophageal reflux disease (GERD), Helicobacter pylori gastritis, cerebral palsy, liver disease, gastrointestinal anatomical abnormalities (ileal stenosis, esophageal atresia, Jujenal atresia), other anatomical abnormalities (cleft lip and palate, laryngomalacia), mitochondrial myopathy and storage diseases.

Other causes including lipodystrophy, AB-lipoproteinemia, homocystinuria, oculo-cerebro-renal syndrome, Rosai Dorfman syndrome, behchet disease, Pierre Robin syndrome, Osler Weber Rendea syndrome, congenital glycosylation disorders, and lactase deficiency constituted 4.4% of all patients.

Fifty (24.9%) patients with organic causes were below six months of age as opposed to 8 (13.1%) patients in the nonorganic causes group. 26 (12.9%) patients were between 7 and 12 months in the 1st group vs 14 (23%) in the 2nd group. 43 (21.4%) patients were between 13 and 24 months in the 1st group vs 23 (37.7%) in the 2nd group. 55 (27.4%) patient were between 25 months and 7 years vs 14 (23%) in the 2nd group. 27 (13.4%) patients were between 7 and 13 years vs 2 (3.3%) in the 2nd group, with a statistically significant p value of 0.04.

98 (48%) patients were females in the organic causes group, however 42 (67.7%) patients were females in the nonorganic causes group with a p value of 0.07. Consanguinity was more among patients with organic FTT: 78 (38.2%) patients, as opposed to 14 (22.6%) patients in those with nonorganic causes.

Regarding the chief complaints of patients with FTT: we noticed that patients with organic and nonorganic causes had similar complaints. Poor weight gain was the most common with 70 (34.7%) and 26 (42.6%) patients respectively. This was followed by gastrointestinal symptoms including vomiting or diarrhea or both: (acute or chronic) 55 (27.3%) and 19 (31.1%) patients respectively. Fever was a leading complaint in 36 (17.8%) patients with organic causes versus 13 (21.3%) patients with nonorganic causes. Poor feeding was a presenting symptom in 6 (3%) patients with organic causes and in 2 (3.3%) patients with nonorganic causes. However, short stature was a complaint only in those with organic causes 19 (9.4%) patients, with a significant p value of 0.02.

Concerning the severity of FTT among the studied patients, there was no statistical significance between the

two groups. 70 (34.8%) patients with organic FTT had mild FTT, 57 (28.4%) patients had moderate FTT, and 74 (36.8%) patients had severe FTT. On the other hand, 22 (36.1%) patients with nonorganic FTT had mild FTT, 20 (32.8%) patients had moderate FTT, and 19 (31.1%) patients had severe FTT.

We studied the anthropometric criteria met by each patient at presentation: In the organic causes group 137 (68.8%) patients had a weight for age below 5th percentile, 199 (100%) patients had weight below 75th percentile of median weight for age, 65 (47.8%) patients with weight deceleration across more than two major percentiles since birth, 119 (62%) patients had height for age below the 5th percentile, and 31 (38.3%) patients had BMI less than 5th percentile for age. On the other hand patients with nonorganic causes of FTT had 33 (53.2%) patients with weight for age below 5th percentile, 59 (95.2%) patients with weight below 75th percentile of median weight for age, 22 (50%) patients with weight deceleration across more than two major percentiles since birth, 28 (45.2%) patients with height for age below the 5th percentile, and 12 (20%) patients with BMI less than 5th percentile for age. This showed a statistical significance between the two groups in regards to weight and height below 5th percentile for age with p value 0.02.

There was no significance regarding the number of criteria met by each group. 28 (14%) of patients with organic FTT met 1 criteria, 46 (23%) patients met 2 criteria, 80 (40%) patients met 3 criteria, 39 (19.5%) patients met 4 criteria, and 7 (3.5%) patients met 5 criteria. However, 16 (26.7%) patients with nonorganic FTT met 1 criteria, 12 (20%) patients met 2 criteria, 25 (41.7%) patients met 3 criteria, 5 (8.3%) patients met 4 criteria, and 2 (3.3%) patients met 5 criteria.

Tables and Graphs

	Organic n (%)	Non Organic n (%)	P value
Age			
≤6 months	52 (24.6%)	6 (11.8%)	0.03
7-12 months	28 (13.3%)	12 (23.5%)	
13-24 months	49 (23.2%)	17 (33.3%)	
25 months-7 years	55 (26.1%)	14 (27.5%)	
7 years – 13 years	27 (12.8%)	2 (3.9%)	
Gender			
Female	105 (49.1%)	35 (67.3%)	0.07
Male	109 (50.9%)	17 (32.7%)	
Parents consanguinity	81 (37.9%)	11 (21.2%)	0.02
Nationality			
Lebanese	210 (98.1%)	50 (96.2%)	0.33
Non Lebanese	4 (1.9%)	2 (3.8%)	
Origin			
Beirut	74 (36.5%)	18 (35.7%)	0.73
South	13 (6.4%)	2 (4.2%)	
North	45 (22.2%)	8 (16.7%)	
Mountain	26 (12.8%)	6 (12.5%)	
Bekaa	42 (20.7%)	12 (25.0%)	
Other	3 (1.5%)	2 (4.2%)	
Child Order (Median (IQR))			
≤2	2.00 (2.00)	2.00 (3.00)	0.51
>2	142 (66.4%)	32 (61.5%)	
	72 (33.6%)	20 (38.5%)	

	Diagnosed n (%)	Non Organic n (%)	P value
History of chief complaint			
Poor weight gain	74 (34.9%)	22 (43.1%)	0.05
Short stature	19 (9.0%)	0 (0.0%)	
Diarrhea	22 (10.4%)	10 (19.6%)	
Abdominal pain	7 (3.3%)	0 (0.0%)	
Abnormal movements	1 (0.5%)	1 (2.0%)	
Vomiting	16 (7.5%)	1 (2.0%)	
Constipation	3 (1.4%)	1 (2.0%)	
Difficulty breathing	11 (5.2%)	0 (0.0%)	
Fever	38 (17.9%)	11 (21.6%)	
Poor feeding	7 (3.3%)	1 (2.0%)	
Vomiting & diarrhea	10 (4.7%)	4 (7.8%)	
Skin lesions or rash	4 (1.9%)	0 (0.0%)	
FTT Severity (variable is demo FTT severity)			
Mild	71 (33.6%)	21 (41.2%)	0.39
Moderate	61 (28.9%)	16 (31.4%)	
Severe	79 (37.4%)	14 (27.5%)	

	Organic n (%)	Nonorganic n (%)	P value
Weight for age < 5th percentile			
No	65 (31.1%)	26 (50.0%)	0.01
Yes	144 (68.9%)	26 (50.0%)	
Weight < 75 % of median weight for age			
No	1 (0.5%)	2 (3.8%)	0.10
Yes	208 (99.5%)	50 (96.2%)	
Weight deceleration across > 2 major percentiles since birth			
No	73 (51.0%)	20 (54.1%)	0.74
Yes	70 (49.0%)	17 (45.9%)	
Height for age < 5th percentile			
No	77 (38.1%)	30 (57.7%)	0.01
Yes	125 (61.9%)	22 (42.3%)	
BMI for age < 5th percentile			
No	50 (61.7%)	12 (80.0%)	0.17
Yes	31 (38.3%)	3 (20.0%)	
No. of criteria met			
1	29 (13.8%)	15 (30.0%)	0.02
2	49 (23.3%)	9 (18.0%)	
3	84 (40.0%)	21 (42.0%)	
4	41 (19.5%)	3 (6.0%)	
5	7 (3.3%)	2 (4.0%)	

Table 4: Causes of failure to thrive.

Causes	Number	Percentage
Cow milk protein or food allergy	44	21.5%
H pylori gastritis	8	4.0%
Immunodeficiency	19	9.3%
Celiac disease	12	6%
IBD	9	4.4%
Cystic fibrosis	9	4.4%
Total GH deficiency	26	12.7%
Partial GH deficiency	20	10%
Congenital heart disease	10	5%
Renal disease	9	4.4%
Liver disease	3	1.4%
GERD	8	4.0%
Cerebral Palsy	6	3%
Anatomic abnormalities (cleft palate, laryngomalacia)	3	1.4%
GI anatomical abnormalities(ileal stenosis, esophageal atresia, Jujenal atresia)	3	1.4%
Storage diseases	3	1.4%
Mitochondrial myopathy	3	1.4%
Others	9	4.4%

DISCUSSION

The prevalence of failure to thrive in the general population is not exactly known and depends upon the population sampled.^[6] Failure to Thrive is a universal problem and according to the World Health Organization (WHO), more than 30% of children under 5 years old show FTT.^[7] Western literature reports a prevalence of 8% in pediatric population.^[8] Mitchell et al reported that 3–5% infants less than 1 year admitted to hospital have failure to thrive.^[9] Berwick has attributed failure to thrive for 3–5% of admissions to pediatric hospitals.^[10] In a local 2012 survey, about 50% of parents or guardians reported ‘picky eating all the time’ in their children who were aged 1–10 years.^[11] The prevalence of ‘feeding difficulties’ was about 15%. However, growth failure is more common in out-patient settings.^[12] Our study showed that 1% of children admitted to Makassed general hospital had FTT.

Previous studies suggest, that the most of children with FTT come the population of ‘average’ income backgrounds.^[13] In particular, it has been noted that children with a weight less than the third centile who are from a low socio-economic class are more likely to be labelled as FTT (and hence referred). However, similar children from a higher socio-economic class are more likely to be described as ‘constitutional short stature’.^[13]

The growth rate of children is significant during the first two years of life and during the early teens, and failure to thrive is more common during these periods.^[14] Hannaway et al,^[15] showed that 81% of children presented with FTT were below 1 year of age. Daniel et al^[16], showed that 60% of children were below 18 month of age. Our study showed that 62% of children were below 2 years of age. This may be explained by the rapid transition from breastfeeding to complementary feeding

during this age group. Also, mothers’ breast feed for a longer period of time in our societies.

Failure to thrive has traditionally been classified into two categories: Organic and Non-organic failure to thrive (NOFIT). Non-organic failure to thrive or psychosocial failure to thrive refers to failure to thrive in a child who has no known medical condition that causes poor growth.^[6] It is caused by emotional deprivation, child abuse, neglect or due to accident.^[6]

The American Academy of Pediatrics recommends that physicians consider child neglect as a cause of FTT, especially in cases that do not resolve with adequate medical care.^[17]

Once the pediatrician classifies a patient to have failure to thrive, a careful history and physical examination is needed, in addition to specific laboratory data.^[18]

The incidence of non-organic failure to thrive amongst children with failure to thrive has been variously reported in Western literature as 32%,^[19] 41%^[20] and 50% (in hospital patients).^[11] Our study showed that 57.3% of patients had organic causes and 17.4% of patients had nonorganic causes of FTT. The source of study population however must be considered, since in a referral center, it is more likely that organic causes of failure to thrive will constitute a large percentage while in a primary care setting the great majority will have non-organic failure to thrive. However, it may be reasonable to assume that organic causes of failure to thrive may be more common in our country, as compared to developed countries.^[6] Also, 25% of our patients were excluded because they did not complete the workup due to absence of third party coverage. In addition, it is assumed that western societies have more single and

working mothers which predispose to more social problems increasing the risk of nonorganic FTT.

Common causes for malnutrition (non-organic causes of FTT) include inadequate breastfeeding, wrong formula preparation, inappropriate diet and 'picky eating'.^[11]

Kanawati et al^[21] studies the health data of children with FTT and showed that respiratory infections, measles, gastroenteritis and pertussis were very common among these patients. Vaccination history was similar to the control group, however patients were late in the vaccination schedule.

Early identification of these children is very important to prevent early and late complications.^[22,23] Undiagnosed and untreated FTT may cause serious morbidity and mortality.^[24,25] Drewett R et al^[26] conducted a study of 107 children with FTT and found a small non-significant difference in IQ seen at the later age of 8–9 years.^[20] This result was also stated in Rudolf et al systemic review.^[25]

Habib Zadeh et al^[27], and Daniel et al^[16], and our study also showed that infants who were in the first and second order of birth experienced more growth failure compared to children of the third order and so on. This might indicate that children of untrained mothers are more likely to develop nutritional FTT.

Hannaway et al^[12] showed that there is no difference between genders. On the other hand, Henry Wamani et al^[28] showed that boys were more stunted than girls. However Habib Zadeh et al^[16], and our study showed that female gender was more prominent among patients with nonorganic FTT. Such a difference may arise from the social and cultural discrimination between genders. Some families pay more attention to nutrition of male children as to that of the females, which in turn may lead to growth failure and other health problems in female infants.^[16]

A study done by Rahmanian et al showed that the risk of FTT was 2.02 times higher among children with parental consanguinity.^[7] This finding is compatible with our study however not compatible with the results of other Iranian Studies.^[29] It could be assumed that in consanguineous marriage, some genetic factors may impact the growth and development of children, although this theory remains as an area for more investigations.^[7]

Larson et al^[30] as well as our study showed that gastrointestinal causes were the leading organic causes of FTT. As 39% of patients had gastrointestinal causes and 23% had endocrine causes. However Larson et al^[17] showed a 32% and 60% respectively.

CONCLUSION

FTT was mostly due to organic causes, with gastrointestinal disorders being the most common.

Patients with weight and height below the 5th percentile were more common among patients with organic causes.

We recommend to perform a prospective multi-center study to be able to follow up patients after receiving the specific treatment to check if they are adherent to it, and follow up their weight and heights by plotting them on growth charts on different occasions. This will also facilitate the ability to counsel parents of patients with nonorganic causes of FTT. We also recommend health insurance organizations to recognize and include "failure to thrive" patients among their beneficiaries.

REFERENCES

1. Sarah Z. Cole, American Family Physician, 2011; 83: 7.
2. Goldbloom RB. Failure to thrive. Paed Clin North Amer., 1982; 29: 151–166.
3. Failure to thrive. Criteria for determining disability in infants and children summary. Evidence report/technology assessment: number 72. AHRQ publication no. 03-E019. Rockville, Md.: Agency for Healthcare Research and Quality; March 2003.
4. Olsen EM, Petersen J, Skovgaard AM, Weile B, Jørgensen T, Wright CM. Failure to thrive: the prevalence and concurrence of anthropometric criteria in a general infant population. *Arch Dis Child.*, 2007; 92(2): 109–114.
5. Stephens MB, Gentry BC, Michener MD, Kendall SK, Gauer R. Clinical inquiries. What is the clinical workup for failure to thrive? *J Fam Pract.*, 2008; 57(4): 264–266.
6. V VENKATESHWAR et al, Med J Armed Forces India, 2000 Jul; 56(3): 219–224.
7. Vahid Rahmanian et al, Shiraz E-Medical Journal 2018.
8. Headley RM, Lustig JV. Growth deficiency (failure to thrive) Current Paediatric diagnosis and treatment, 1997: 232–242.
9. Mitchell W. Failure to thrive-Study in primary care setting. *Paediatrics*, 1980; 65(9): 61–77.
10. DM Berwick Non-organic failure to thrive. *Paediatric Rev.*, 1980; 1: 265-70.
11. Lay Hoon Goh et al, Singapore Med J., 2016; 57(6): 287-291.
12. Frank DA, Zeisil SH. Failure to thrive. Paed Clin North Amer., 1988; 35: 1187–1206.
13. Peter B Sullivan et al, International Journal of Epidemiology, 2004; 33: 847–848.
14. Bisset WM. Failure to thrive. Forfar & Arneil's Textbook of paediatrics, 1998: 465–469.
15. Paul J. Hannaway, clinical pediatrics, 1980; 9: 2.
16. Daniel et al Clinical Pediatrics, 2008; 47: 8.
17. Mark B. Stephens, MD, VOL 57, NO 4 / APRIL 2008 The Journal of Family Practice.
18. Tolia V. Very early onset nonorganic failure to thrive in infants. *J Pediatr Gastroenterol Nutr.*, 1995; 20: 73-80.

19. Berwick DM, Levy JC, Kleinerman R. Failure to thrive: diagnostic yield of hospitalisation. *Arch Dis Child.*, 1982; 57: 347–351.
20. Homer C. Categorisation of etiology of failure to thrive. *Am J Dis Child.*, 1981; 135: 848–851.
21. Abdalla A. Kanawati et al, *Acta Padiatr Scand*, 1974; 63: 849-854.
22. Bergman P, Graham J. An approach to failure to thrive. *Aust Fam Physician*, 2005; 34: 725-729.
23. Powell GF. Nonorganic failure to thrive in infancy: an update on nutrition, behavior, and growth. *J Am Coll Nutr.*, 1988; 7: 345-353.
24. Bergman P, Graham J. An approach to failure to thrive. *Aust Fam Physician*, 2005; 34: 725-729.
25. Raynor P, Rudolf MCJ, Marchant P, Cottrell D. A randomized controlled trial of specialist health visitor intention for failure to thrive. *Arch Dis Child.*, 1999; 80: 500-506.
26. Robert F. Drewett et al, Feeding behaviour in young children who fail to thrive, *Appetite*, 2002; 40: 55–60.
27. Habib Zadeh et al Determinants of Failure to Thrive among infants, 2015.
28. Henry Wamani et al, *BMC pediatrics*, 2007.
29. Sarbishehgi Moghadam M, Khanjani N, Doostan F. Environmental Factors Associated with Growth Delay among 3-72 Month Old Children in Sarbisheh, South Khorasan Province, 2013. *J Neyshabur Univ Med Sci.*, 2016; 4(1): 30–40.
30. Larson Nath, *J pediater gastroenterol Nutr*, 2016.