

# Failure to Thrive Severity Determination by New Design Curves in Standard Growth Charts

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**Abstract-** Failure to thrive (FTT) is a perplexing disorder commonly seen by primary care physicians. Identification of FTT and an assessment of severity of the undernutrition are important to identify children at risk, and to provide appropriate intervention for preventing malnutrition and developing sequela. One of different anthropometric methods for categorizing undernutrition in childhood is Waterlow and Gomez classifications. Unfortunately, these classifications are not an easy task for the practitioners due to its difficult calculations. In this paper, Waterlow and Gomez classifications have been shown on the Standard Growth Charts (WHO 2006). Using these curves, the practitioners can determine severity of FTT by plotting weight, height and age of the patients without any calculations.

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**Keywords:** Failure to thrive (FTT); Anthropometric methods; Standard growth charts

## Introduction

Failure to thrive is a perplexing disorder. The diagnosis is often in the eye of the beholder, laboratory tests are usually unrevealing and the effectiveness of treatment is uncertain (1). While definition of FTT varies widely across studies with criteria ranging from weight < 5th percentile to < 3rd percentile, a fall down 2 percentile lines, less than 80% of normal weight and a low thrive index (2). Until now, five different anthropometric methods for categorizing undernutrition in childhood were applied to children with failure to thrive (3). Between these methods, Waterlow and Gomez classifications have been used to more than others by pediatricians all over the world (4,5). FTT severity determination is very important for primary care physicians because they have different protocols for management and treatment of these children. For example, management of less severe FTT takes place at home but historically, the patients with severe FTT should be hospitalized, until the cause of the FTT is determined (6). In addition, many of primary care physicians have difficulty in using standard growth charts. Key to diagnosing FTT is finding the time in

busy clinical practice to accurately measure and plot a child's weight, height and then assess the trend (7).

In a report from England, 54% of general practitioner didn't diagnose FTT, while a child's weight for age fell below two major percentile lines (8). In addition, a pilot study performed at a family practice residency clinic found that from 29 children diagnosed with FTT, all of them had a growth charts that were incorrectly plotted and diagnosis was delayed in 41% of the patients (9). FTT severity determination may be more difficult because of its hard calculation. In this paper, Waterlow and Gomez classifications have been shown on the WHO standard growth charts 2006.

## Patients and Methods

Comparing Standard Growth Charts (NCHS Revision 2000) to New Growth Charts (WHO 2006); the latter was selected because NCHS growth reference was based on data from several samples of children from a single country and suffers from a number of technical and biological drawbacks that make it inadequate to monitor the rapid and changing rate of early childhood growth (10).

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## Failure to thrive severity curves

Original information regarding weight, height and weight for height/length under 60 months of New Growth Charts (WHO 2006) were selected. Age was monthly considered for this article. 1 year meaning 12 completed months, 2 years meaning 24 completed months, 3 years meaning 36 completed months, 4 years meaning 48 completed months, 5 years meaning 60 completed months, 18 months meaning 1 year and 6 completed months, and 30 months meaning 2 years and 6 completed months.

In Gomez classification, mild, moderate, and severe FTT is equivalent to 75-90%, 60-74% and less than 60% of standard weight, respectively, and in Waterlow classification, for height, the corresponding values are 90-95%, 85-89% and less than 85%, and for the weight for height, the values are 81-90%, 70-80% and less than 70% (5,11,12). Getting the information regarding 50th percentile of weight, height and weight for height of New Growth Charts (WHO 2006) and based on the definition of FTT severity (Gomez and Waterlow classifications) the following calculations were performed: 90%, 75%, and 60% of ideal weight for age (50th percentile or the median weight for age) for both gender, 95%, 90%, and 85% of ideal height for age (50th percentile or the median height for age) for both genders, and 90%, 81%, and 70% of ideal weight for height (50th percentile or the median weight for height) for both genders. Then the curves were drawn.

## Results

The curves for boys and girls age birth to 60 months were generated for length/height for age, weight for age, weight for length (45 to 110 cm) and weight for height (65 to 120 cm). After dividing 50th percentile of weight for age under 60 months for both genders to %90, %75 and %60 results in weight for age (wasting) FTT severity curves (Figures 1 and 2).

After dividing 50th percentile of length for age under 24 months for both genders to 95%, 90%, and 85% results in length for age (stunting) FTT severity curves. After dividing 50th percentile of height for age 24 to 60 months for both genders to 95%, 90% and 85% results in height for age (stunting) FTT severity curves. It was possible to construct both length for age (birth to 2 years) and height for age (2 to 5 years) standards fitting a unique model, yet still reflect the average difference between recumbent length and standing height (Figures 3 and 4).

After dividing 50th percentile of weight for length from 45 to 110 cm for both genders to 90%, 81% and 70% results in weight for length FTT severity curves (Figures 5 and 6).

After dividing 50th percentile of weight for height from 65 to 120 cm for both genders to 90%, 81% and 70% results in weight for height FTT severity curves (Figures 7 and 8).

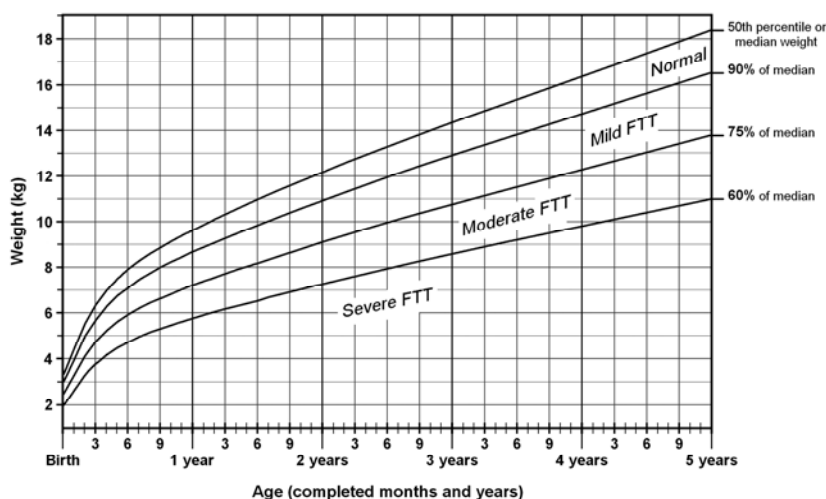


Figure 1. Weight for age (wasting) FTT severity curves for boys age birth to 5 years

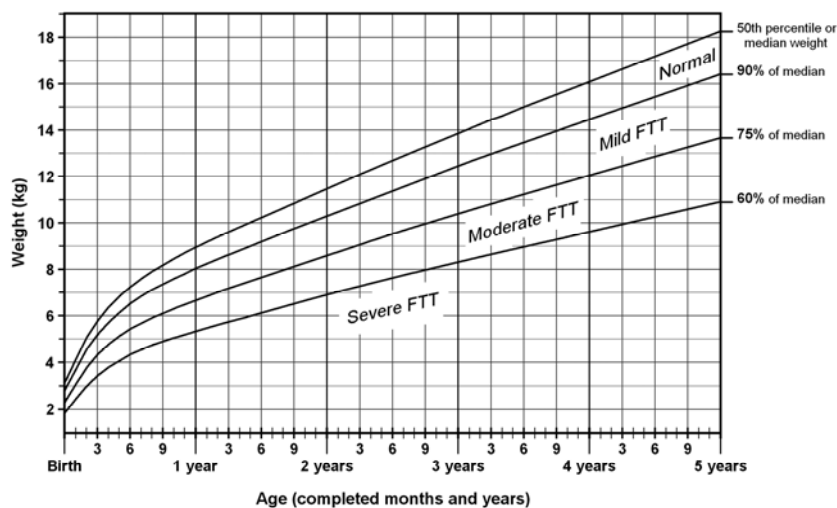


Figure 2. Weight for age (wasting) FTT severity curves for girls age birth to 5 years

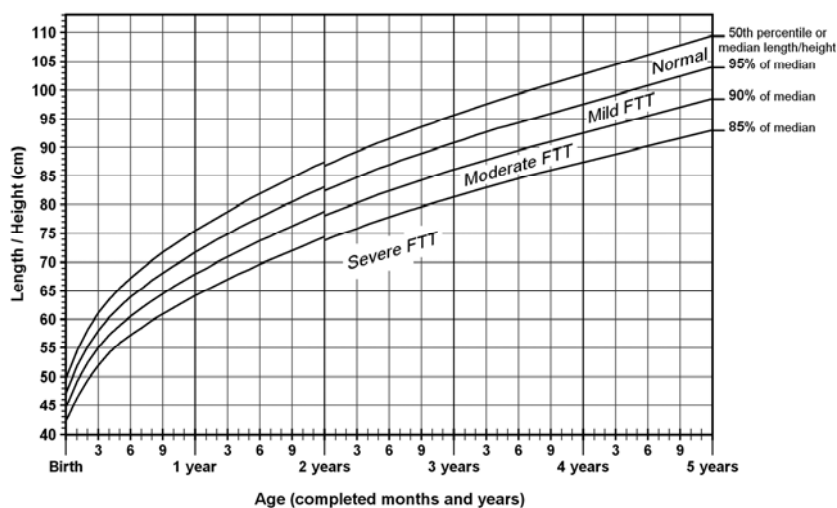


Figure 3. Length/ height for age (stunting) FTT severity curves for boys age birth to 5 years

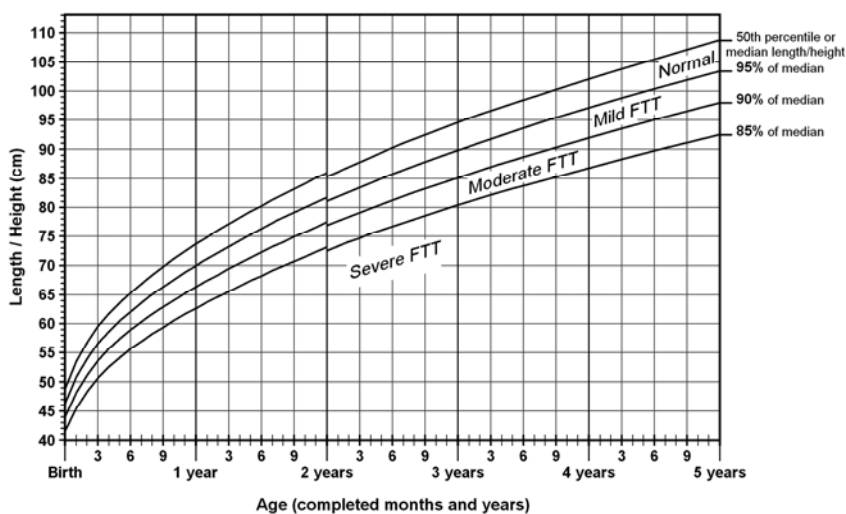


Figure 4. Length/ height for age (stunting) FTT severity curves for girls age birth to 5 years

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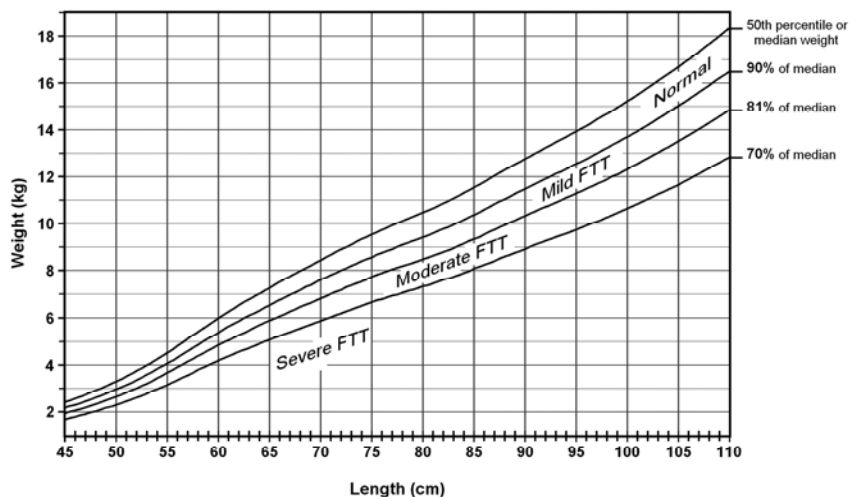


Figure 5. Weight for length FTT severity curves for boys age birth to 2 years

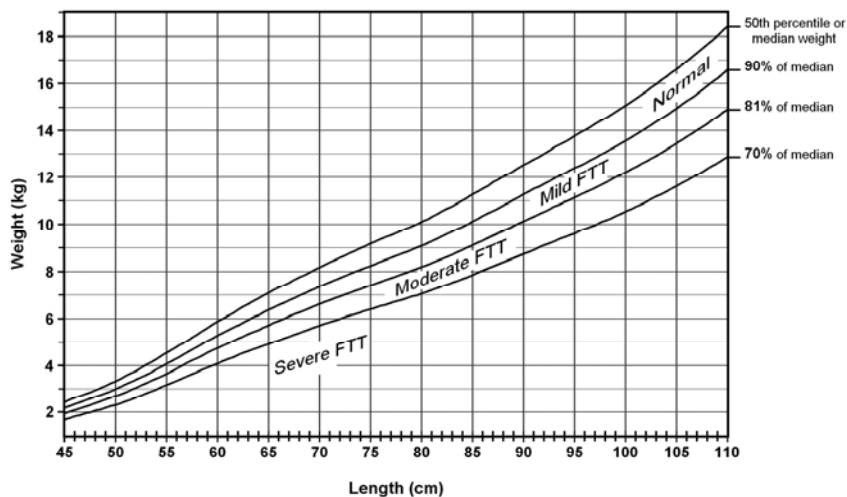


Figure 6. Weight for length FTT severity curves for girls age birth to 2 years

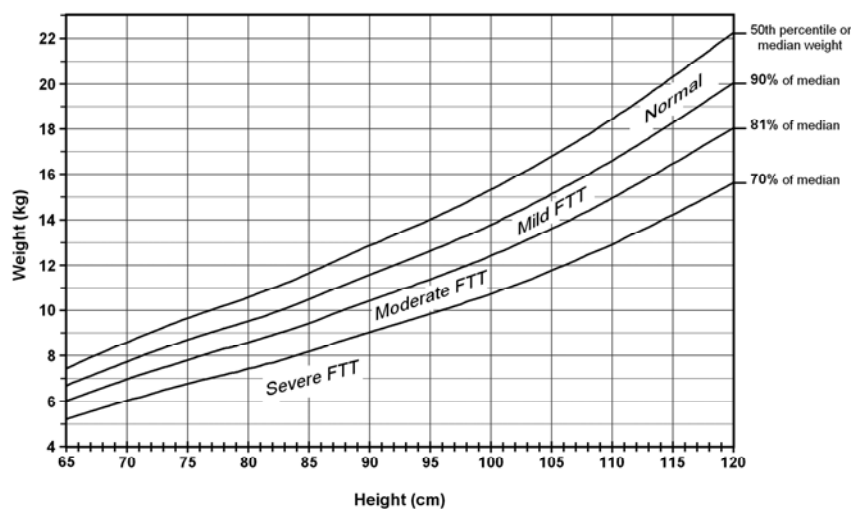
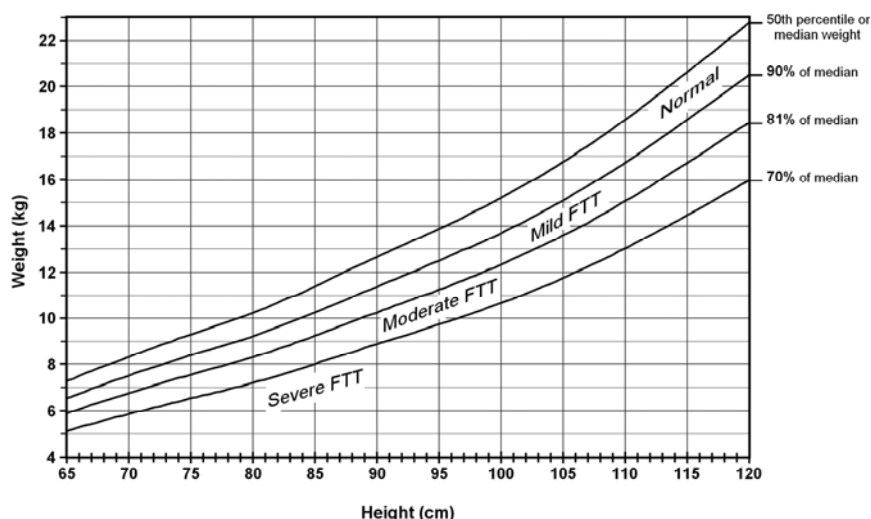


Figure 7. Weight for height FTT severity curves for boys age 2 to 5 years



**Figure 8.** Weight for height FTT severity curves for girls age 2 to 5 years

## Discussion

FTT in the young infant and toddler must be considered a medical emergency if the growth curve documents weight  $< 70\%$  of the predicted weight for length/height (6). Rudolf and Logan concluded that FTT is associated with slight decrement in IQ-3 points and their weight and height is more significantly affected at three years follow up (2). In general, weight gain is used as the measure for identifying babies and young children who are failing to thrive, and it is generally assumed that the more severely underweight the worse the prognosis (3). Growth data were presented in variety of forms including standard deviation scores, mean centile position, percent of normal weight/height, and weight for height (2). Recently it has been argued that clinicians should use the new charts which identify the slowest growing children while correcting for regression to the mean (13). Although the different methods of FTT assessment have been compared in several articles and accordingly each has its own advantages and disadvantages and none is better than the others (3,14,15). But in a single citation by Olsen, they recommended that no single measurement seems adequate on its own for identifying nutritional growth delay (16). Waterlow and Gomez classifications seem to be more practical than other classifications. Unfortunately, FTT severity determination with each other different methods is not an easy task for the practitioners due to its difficult calculations. For using WHO Standard Growth Charts to determine the severity of FTT, a practitioner has to do the following processes:

1- Recording information regarding gender, age, weight and height of a patient.

2- Determine ideal weight (median) and ideal height (median) for age of the patient.

3- Dividing ideal weight, ideal height by percents described by Gomez and Waterlow classifications.

4- Comparing this information with each other and determining the severity of FTT. However, using the curves recommended by the authors of the present article, the practitioners need to perform only 2 processes:

1- Recording patients' information (gender, age, weight and height).

2- Comparing this information with the new curves.

Using these curves, practitioners can determine the severity of FTT by simply plotting weight, height, and age of the patients under 60 months in less time and with no calculating error. In conclusion, FTT severity determination is very essential for the primary general practitioners and the pediatricians. Using these curves is highly recommended specially in developing countries.

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