



# Intensive Nutrition Counseling and Dietary Intervention Improve Weight Gain of Underweight and Failure to Thrive (FTT) Pediatric Patients in AL-Khor Hospital - State of Qatar

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**Abstract:** Introduction: Nutritional status is an important health indicator for children who are vulnerable to nutritional and health problems. Growth and development occur very rapidly during the first two years of life. Inadequate food consumption and infectious diseases are the primary factors contributing to nutritional problems. Aims: This study aims to determine the effect of nutritional counseling on the weight gain of undernourished children who received additional high-calorie food. Methods: The intervention consisted of providing nutritional counseling and high-calorie food supplements. This cross-sectional study employs an independent t-test with a 5% significance level to assess the improvement in body weight. Results: The results showed statistically significant differences in the average weight gain of patients before and after the intervention. Conclusion: Our findings demonstrate that the family guidance model, combined with nutritional counseling, can enhance the weight gain of children.

**Keywords:** nutritional counseling, malnutrition, weight gain, supplementary foods, CDC, growth charts

## INTRODUCTION

Malnutrition may be present in children with chronic low appetite, which can have multifactorial origins. Many children who exhibit eating difficulties have a recent history of organic problems (developmental delay or chronic illness) [1]. Undetected or neglected subclinical malnutrition may be present in some healthy children of low socioeconomic conditions, as reported by nutritional surveys in both the USA and other developed countries [2]. A lack of essential vitamins and minerals, particularly iron, can lead to problems such as anemia and difficulties with learning, and it may also be associated with slow growth in children with mild protein-energy malnutrition. Eating problems among children, such as poor appetite, inappropriate food choices for their age, and food refusal, are a common concern for parents. The severity of these issues can include failure to thrive, difficulty gaining weight and height, and loss of body weight [3-6]. Modifications in feeding habits and the use of oral nutritional supplements may be indicated for children who are unable to maintain adequate energy and nutrient intake [7]. Nutritional programs and dietary interventions may help achieve the goal of providing safe and healthy nutrition for these children and adolescents [8, 9]. All children with poor nutritional status, thin or very short, require special nutritional support to prevent malnutrition [10]. The growth and development of children may be impaired due to severe or mild malnutrition [11]. Nutritional counseling and proper dietary intervention, accompanied by supplementary and complementary foods, can increase growth and reduce the incidence of stunting [12].

Children with poor nutritional status can achieve weight reduction by receiving ready-to-supplement meals [13]. Maternal behavior and their level of health knowledge significantly influence the nutritional status of infants [14]. When malnourished children receive supplementary food and proper nutrition counseling, their body weight significantly increases [15]. Underweight is described as a child's body weight that is too low compared with a normal weight to be considered healthy. Clinically underweight children can be characterized as having a low BMI for age [10]. Malnutrition may happen because of being underweight (wasting & stunting), which causes many health consequences. The Centers for Disease Control and Prevention (CDC) established the growth chart in 2000 [13]. Clinical definitions define underweight as having a BMI for age below the 5th percentile, and short stature as having a height for age below the 5th percentile in children aged two years or older. For children less than two years, determining underweight has been done by the World Health Organization (WHO) growth chart of 2006 [14], which defines underweight as weight-for-length less than or equal to the 3rd percentile; the WHO chart [14] also defines short stature in that age group as length-for-age percentile less than or equal to the 3rd percentile. Low weight for age is another description of underweight in children, including both wasting and stunting [13-15].

Short stature, low height-for-age, shortness-for-age, or growth retardation are terms used to describe children who have stunted growth. Both undernutrition and infections are causes of stunting in children, which is an indicator of a poor environment, inadequate nutrition, and an extended restriction of a child's growth. Delayed mental development,

Poor academic performance and decreased cognitive capacity are among the consequences of stunting in children [15]. These consequences may persist until adulthood, leading to intellectual disability. As a result, work productivity, the quality of a country's national workforce, and economic development can be negatively impacted by adults with intellectual disabilities, according to the WHO [15]. Infants of short-stature women may tend to be underweight and stunted. According to the WHO, if a child's height-for-age is more than 2 standard deviations below the WHO standard, then the child is said to have stunted growth and may be underweight and/or undernourished [15]. Many other factors cause stunting, including genetics, environment, inadequate protein and calorie intake, chronic caloric deficit, stress, and chronic infections like malaria, parasitic infections, and various diseases [15]. Dietary intervention plays a crucial role in reversing waste by gradual controlled replenishment of nutritious food, supplements, and beverages. Wasting can impair the immune system and increase susceptibility to infections, which in turn lead to longer hospital stays, higher costs, and increased readmission rates [16]. During and after pregnancy, a poor diet caused by chronic hunger and starvation, inadequate food and beverage intake, lack of nutritious food/drinks, and chronic food shortage may cause severe health problems when they occur in pregnant and breastfeeding women or in infants and children [17-20]. Poor nutritional symptoms will start displaying within six months or less, and children who are not well-fed can succumb to underweight and may develop malnutrition, which can lead to appetite loss. Physical and cognitive impairment may develop during the critical period of brain development (from pregnancy and birth to preschool) in chronically underweight children unless there is an early intervention for child nutrition improvement [21-25]. Body weight is influenced by calorie intake and caloric storage; a negative imbalance between energy expenditures, physical activity, and metabolism, and energy intake through food/supplements, and drinks can result in weight

loss, malnutrition, and other health issues. As a result, in extreme cases, underweight can lead to chronic diseases and death [26-29]. Inadequate caloric intake has many consequences and causes, as observed in children, adults, and the elderly [30-34]. Underweight in small children is caused by several factors, including inadequate breast milk feeding; irregular feeding of a child with breast milk or formula; food rationing for a young child; early introduction of solid foods while withholding breast milk and formula; and a lack of nutrient-dense foods [35,36]. Supervised nutritious diets, liquid supplements, as well as vitamin and mineral supplements, proper hydration, and the use of healthy foods and beverages, along with treating underlying disease conditions, can be more easily rectified in underweight individuals [37,38].

Rectifying underweight and malnutrition can be achieved by following several strategies, including offering small, frequent, high-energy-density meals and snacks/supplements, as well as beverages & shakes. Additionally, increasing the organoleptic properties of the food served and incorporating nutrient-dense bars, fortified foods, medical foods, drinks, and healthy snacks & shakes can also be beneficial. In addition, the consumption of food for underweight children can be improved by enhancing the organoleptic properties of the food served, such as flavor, aroma, and texture (including softness, hardness, and mouthfeel). Well-balanced meals in small quantities, at a slow pace to avoid refeeding syndrome, should be given to underweight children, especially patients living with anorexia [39]. Adequate animal protein, plant proteins, healthy fats, and starchy vegetables, as well as less fibrous foods, milk, other dairy products, and beverages, should be given in small portions to ensure tissue rebuilding. Consume monounsaturated fatty acids, such as those found in olive oil, along with oily fish, poultry, and eggs. High-fiber, non-starchy Vegetables, which easily fill up the stomach and prevent the consumption of weight-enhancing caloric macronutrients, should be limited. [40].

To reduce the risk of malnutrition or protein-energy malnutrition, good caloric intake should be achieved. An adequate intake of calories can treat deficiencies in macronutrients, vitamins, and minerals. In addition, an adequate intake of calories can be used to reverse both intentional and unintentional weight loss, combat frailty, and maintain a healthy body weight [41]. Bodily metabolic activities and other physical and mental activities, including sports and exercise, as well as learning ability, are positively correlated with sufficient energy [42, 43]. At the same time, fatigue, weakness, and lack of concentration may occur due to inadequate energy intake [44]. This study builds upon previous research by incorporating nutritional counseling variables for mothers of children under fourteen who have poor nutritional status and are experiencing poor weight gain and failure to thrive, following guidance from a dietitian at the pediatric dietetics clinic in Al Khor Hospital—Hamad Medical Corporation—State of Qatar.

## **MATERIALS AND METHODS**

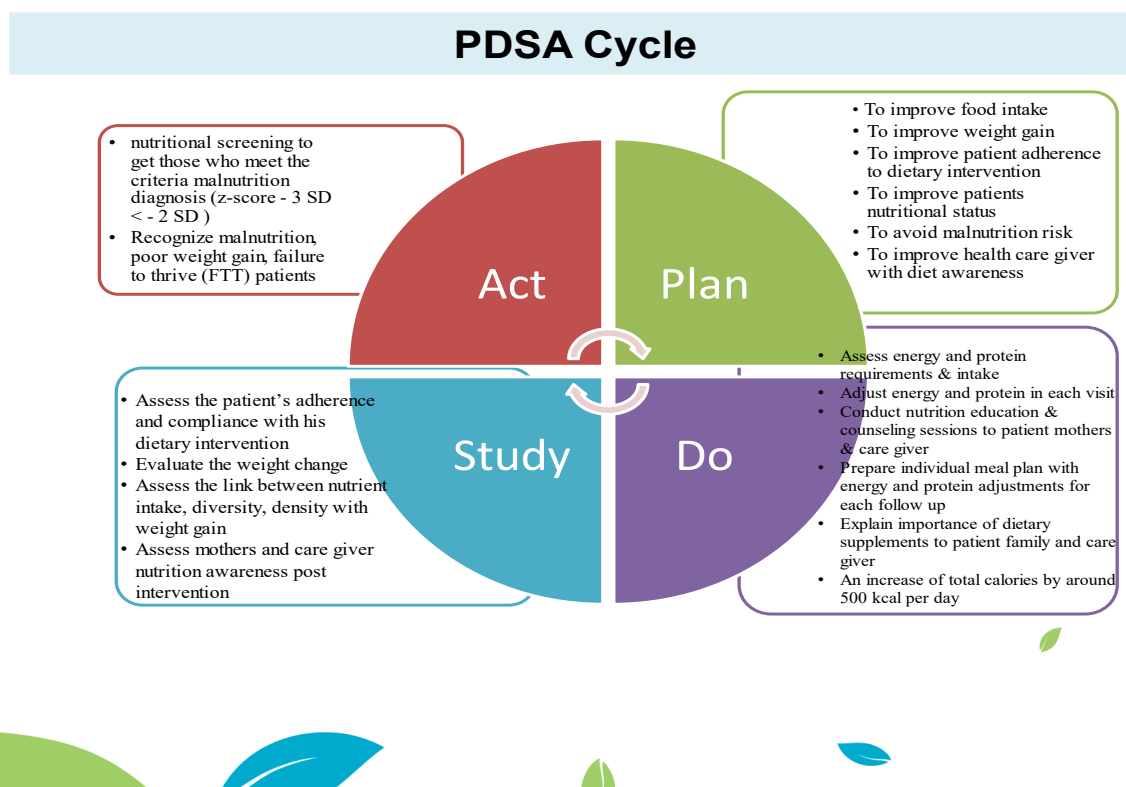
This is a quality improvement study conducted in the pediatric dietetics 'outpatient department in Al-Khor Hospital—Hamad Medical Corporation, State of Qatar. The population in this study was children suffering from malnutrition, poor weight gain, failure to thrive (FTT), and stunting. The sample in this study was part of a population selected according to the established inclusion and exclusion criteria. The determination of respondents begins with a nutritional screening to identify those who meet the requirements set by the

researchers. The inclusion criteria specify that children must have a malnutrition status indicated by a z-score between -3 SD and -2 SD, must not suffer from severe comorbidities such as pulmonary TB or congenital heart disease, and must not currently be receiving tube feeding. The exclusion criteria apply to children who have chronic health disorders. The sample size is 16 children aged 2 months to 9.5 years. The study assesses the pre- and post-intervention body weight, body height, weight gain, acute and chronic malnutrition, the children's compliance with the dietary intervention, and the children's nutrient intake. Digital weight scales with an accuracy of 0.1 kg, a 24-hour recall form used to measure energy and protein intake during the study, and a dietary intervention handout serving as a guide for conducting nutritional counseling. Interventions were provided to the patient's mother in the form of nutritional counseling, which included an individualized dietary intervention with meal plans adjusted for energy and protein levels at each follow-up visit during the study period. To assess the nutritional status of children and the risk of both acute and chronic malnutrition, we will measure body weight, body height, and length for age.

We measured and plotted the weight/age and weight/height percentiles on each child's growth chart at the beginning and end of the study. Pediatric dietitians carry out all measurements of variables. Nutritional counseling for mothers and their children in this study plays a crucial role in achieving the intervention's goals (Table 1). The intervention in this study consisted of nutritional counseling and individualized dietary intervention, including a meal plan. Competent pediatric dietitians conduct follow-up visits every two weeks for a period of six months. To assess the change in average weight before and after the dietary intervention, a four-step method called the PDSA cycle was employed to make improvements and address issues (see Figure 1). A statistical test was performed using the dependent t-test. This research has received approval from the quality department of Al-Khor Hospital. All patients & their mothers agreed to participate in this study.

**Table 1: Dietetic Counseling Provided to Families by Written Recommendations**

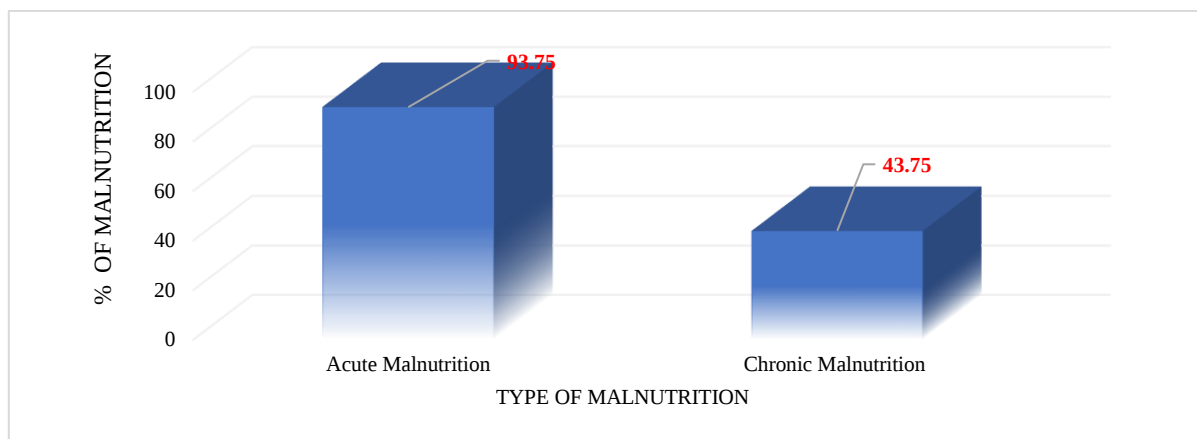
- Introduce food gradually by increasing food quantity to change food habits.
- To avoid feelings of repetition, daily intake should be divided into small meals, plus snacks in the morning, afternoon, and evening.
- Diet should be as varied as possible, and meals should be attractively presented, taking care to prepare the child's preferred dishes.
- Identify the time of day when appetite is best and prepare the highest-calorie meal at that time.
- Provide liquid or soft food (shake, fruit, or vegetable juice, milk pudding, ice cream, yogurt, liquid fruit yogurt, cheese, or fruit dessert).
- Supplement the first course with egg yolk, olive oil, and/or butter, cream, béchamel sauce, and cheese cubes.
- Do not cut out fruit and vegetables.
- Dress vegetables with olive oil
- Add dried or fresh pulses and/or cereals to soups to increase nutritional value.
- Administer dietary supplements or products following medical prescriptions.



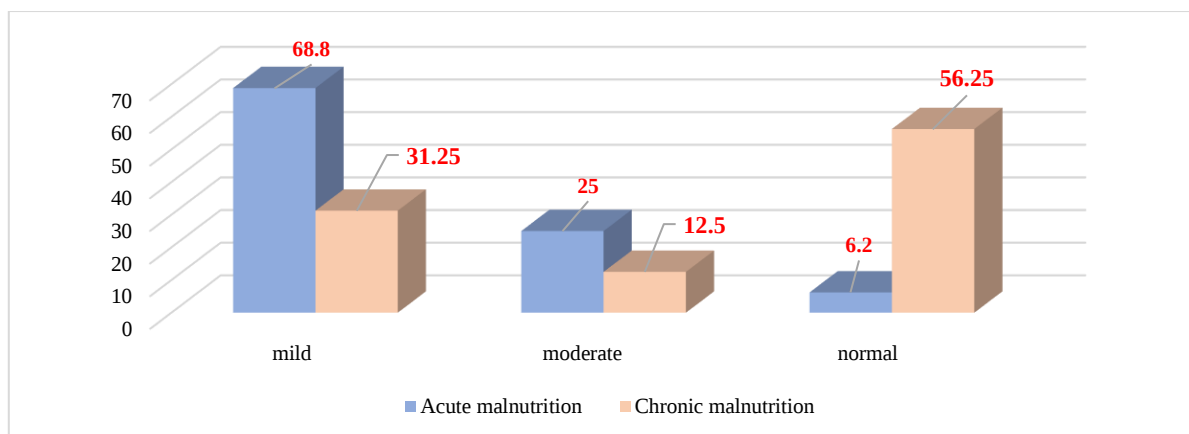
**Figure 1: A Four-Step Cycle to Implement Change, Solve Problems, and Continuously Improve Process**

## RESULTS

Ninety-three patients were seen in the pediatric dietetics clinic during the study period; Figure 2 shows the prevalence of acute (93.75%) and chronic (43.75%) malnutrition. Sixteen patients (17.2%) had met the inclusion criteria and were included in the final analysis. Approximately two-thirds (68.8%) of patients suffered from mild acute malnutrition, and one-fourth (25.0%) had moderate acute malnutrition. Conversely, 43.75% of patients had chronic malnutrition, with mild and moderate cases accounting for 31.25% and 12.5%, respectively (Figure 3).



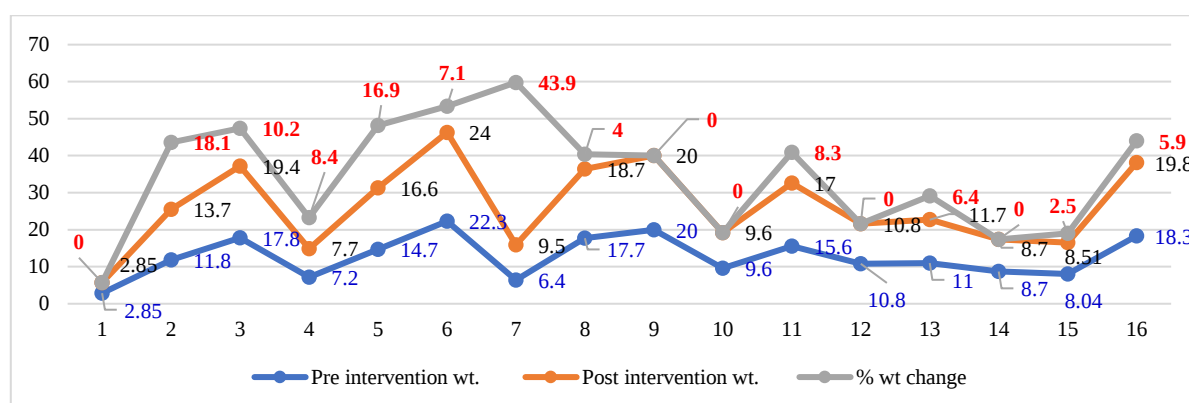
**Figure 2: Prevalence of acute and chronic malnutrition.**



**Figure 3: Severity of acute and chronic malnutrition**

The multi-component intervention process consists of one nutrition counseling session every two weeks for patient mothers, combined with dietary intervention and meal plan adjustments to enhance child appetite, promote weight gain, and improve overall health. [45]. This multi-component intervention resulted in significantly improved diet quality, with improvements in weight gain. It may be adapted for use in many clinical and research areas to enhance health parameters in this population.

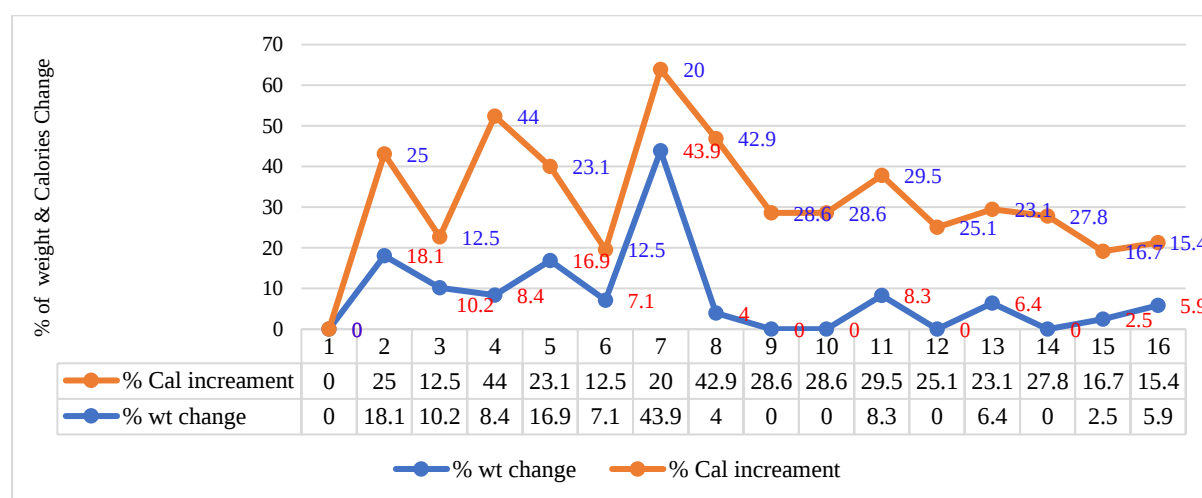
Intake is essential for children under five because it is known that children under 5 years are more susceptible to malnutrition problems [46]. Among other health problems faced by children under five, nearly 34% of child mortality and unknown side effects are mainly caused by malnutrition [47]. Consumption of foods rich in protein, calories, and micronutrients given to malnourished children can overcome the problem of malnutrition [7]. High-calorie and good nutritional supplements and additives may be used to improve weight. The level of energy and nutrient intake of some patients is still relatively lower than the recommended adequacy, where the intake of energy increases range of (0 - 44%). The results show a significant difference ( $p < 0.05$ ) in average body weight before and after dietary intervention, which included calorie adjustment, supplementary food, and frequent nutritional counseling (Figure 4).



**Figure 4: Multi-Component (Pre-Post) Intervention Weight & % of Weight Change**

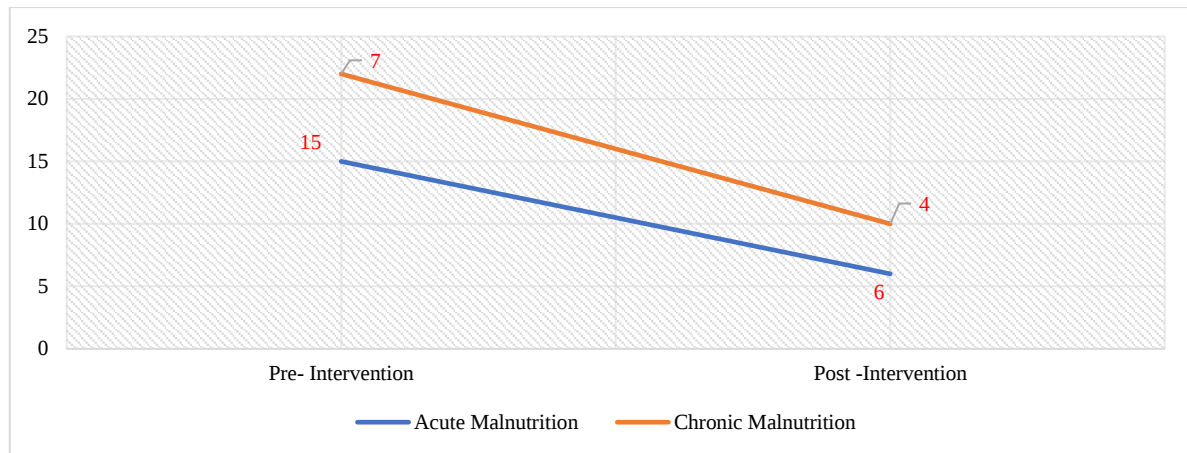
Improved nutrient intake and dietary diversity are associated with higher nutrient density and weight gain [48]. Changes in an individual's food and nutrient intake can impact

their health [49]. Increasing energy-dense foods with high levels of key nutrients may be linked with weight gain [50]. The increase in calorie-dense food may reflect a reduced intake of empty calories, which in turn supports weight gain. An increase in total calories of approximately 500 kcal per day was also observed, further indicating a possible decrease in "empty calorie" intake, which aligns with current recommendations for weight gain [51]. The mean daily intake of the ready-to-feed supplements was 246 kcal. Together with increased caloric intake from other foods, this resulted in adequate energy intake (at least 80% of the Recommended Daily Allowance, or RDA) at the end of the study. Positive weight gain was parallel with calorie increase in 11/16 children (68.75%), as shown in Figure 5, and they found the supplement agreeable to the taste and compliant with the dietitian's intake prescriptions.

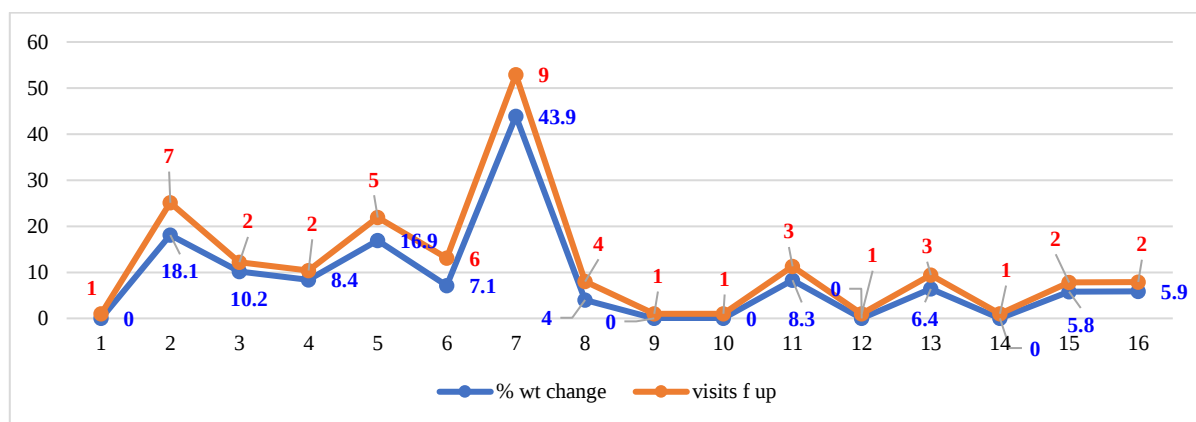


**Figure 5: Relationship between % Weight Gain and Calorie Increase**

Anthropometric measurements showed that at the baseline assessment, 93.8% (15/16) had acute malnutrition (weight-for-height below the 25th percentile); of them, 68.8% and 25.0% were at mild and moderate risk of acute malnutrition, respectively. After 4 months of nutritional intervention, acute malnutrition decreased to 37.5% (6/16), one patient had 6.25% moderate malnutrition, and 31.25% (5/16) were at mild malnutrition. The difference was statistically significant between baseline and the 4-month period of intervention ( $P=0.002$ ). Chronic malnutrition was observed in 43.75% (7/16) at the baseline assessment; of them, 71.4% were at mild chronic malnutrition, and two patients (28.6%) were at moderate chronic malnutrition. We reduced chronic malnutrition to 25% (4/16); one patient had moderate chronic malnutrition, and 75% (3/4) had mild chronic malnutrition. The difference was statistically significant between baseline and the 4-month period of intervention ( $P=0.001$ ), **Figure 6**. Continuing follow-up (visit frequency) has a positive impact on the weight gain of underweight children ( $P < 0.05$ ). It is very important to check weight gain progress, provide support, and adjust the nutritional plan if needed for effective weight gain management. **Figure 7**.



**Figure 6: Malnutrition severity pre- & post-dietary intervention.**



**Figure 7: Correlation between % weight gain and patients' compliance (number of visits)**

## DISCUSSION

Pediatric patients are at risk of malnutrition, and their families have shown excellent compliance with dietary intervention, oral supplements, and nutrition counseling over the 4-month study period. Increased quantity of energy and nutrients consumed over the 4-month treatment period resulted in significant weight gain. However, the role of dietetic counseling provided by the pediatric dietitian during follow-up visits should not be underestimated since these interventions presumably contributed not only to weight gain but also to improving the patients' nutritional habits. Oral supplementation may be easier and more effective than trying to increase regular food intake in children with eating problems. Most patients in this study accepted nutritional supplements with pleasure. Average nutritional intake is essential for underweight children because it is known that they are more susceptible to malnutrition problems. This result was like the finding of Joglekar et al., 2019 [52]. Malnutrition is the primary cause of nearly 34% of child mortality and unknown side effects among underweight children [53]. This study confirms the previous findings of Joglekar et al. (2019) that high-energy, high-protein diets for malnourished children can overcome the problem of malnutrition [52]. Poor maternal nutritional knowledge and feeding practices are found to predispose children to malnutrition [54]. The current study found that frequent nutrition counseling for mothers improves weight gain

significantly. This finding is consistent with Christian P. et al. (2015, who reported that nutrition education and counseling that emphasizes food-management skills is an effective way of overcoming underweight and malnutrition [55]. In addition to nutrition counseling, supplementary feeding provided can improve nutritional status in underweight children [56]. Mothers who do not provide balanced food, do not have good knowledge of breastfeeding, and do not have knowledge about supplementary feeding to children greatly affect the nutritional deficiencies in children; therefore, the role of mothers in preparing balanced and varied nutritious foods derived from food ingredients can overcome malnutrition in children [55]. Counseling provided by trained nutritionists regarding the types of food available locally can encourage growth in children and improve community nutrition education [57, 58]. Mothers who have a good level of nutritional knowledge provide more vegetables, fruit, and nuts and give fewer drinks and fast food [59]. These results are in line with several previous studies, which have shown that children who receive daily complementary foods and are accompanied by nutritional counseling experience linear growth in underweight children [56]. Low-value dietary diversity and age of inappropriate supplementary feeding are significant predictors of stunting [60]. The nutritional status of children may be negatively affected by providing them with inadequate food because of low maternal nutritional knowledge [54]. For this reason, nutritional counseling with an emphasis on a balanced diet is an effective way to improve nutrition knowledge in overcoming underweight and malnutrition [57]. Based on the results of statistical tests (t-independent), the influence of family assistance with nutritional counseling and dietary supplement formulas on weight gain was indicated by the p-value  $< 0.05$ . The increase in body weight of the treatment group was greater and more meaningful when calorie adjustment was accompanied by nutrition counseling. Interventions in the form of nutrition education have a significant influence on the knowledge, attitudes, and practices of maternal nutrition and the nutritional status of children under five [61]. Formulating messages and improving skills require more attention. Therefore, counseling must be appropriate and well-targeted so that respondents can accept the intent of the counseling and apply it in their daily lives [55]. Continuing to follow up to check weight gain progress, provide support, and adjust the nutritional plan if needed is crucial in weight gain management. The follow-up can be done with a clinical dietitian; the frequency of visits (weekly to monthly) depends on the individual situation. We measure the child's weight and height during these visits and plot them on a growth chart to track their trend. The child's progress with eating and nutrition, and any concerns or new questions, were discussed with the clinical dietitian. These frequent visits are usually continued until the child's weight gain is steadily increasing and catches up to the typical range for weight gain. Within three to six months, children usually catch up to their expected weight if they can consume an adequate number of calories and protein. This study found that weight gain significantly correlated with follow-up frequency (number of visits),  $P < 0.05$ . Improvements in weight gain were primarily observed in children who were part of the intensive care group. The congruence of these data suggests that supervision and continuing education of patients and their healthcare providers are necessary for the success of dietary interventions.

## **CONCLUSION**

Underweight has various causes and adverse consequences that impact the health and quality of life of affected children. The primary objective of the current study was to assess

the impact of intensive nutrition counseling and dietary intervention on improving the weight gain of underweight and failure-to-thrive (FTT) pediatric patients at AL-Khor Hospital, State of Qatar. This study showed that there was a high prevalence of acute and chronic malnutrition among the study population. Dietary intervention involves providing foods rich in protein, calories, nutritional supplements, and micronutrients that can help overcome underweight conditions and promote weight gain. An increase of total calories by around 500 kcal per day, together with the ready-to-feed supplements, resulted in adequate energy intake (at least 80% of the RDA) and was also further indicative of a possible drop in empty calorie intake.

Additionally, continuing follow-up (visit frequency) and intensive nutrition counseling have a positive impact on the weight gain of underweight and failure-to-thrive (FTT) children.

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