Effectiveness of *Moringa oleifera* in combating mild and moderate malnutrition in pediatric age group

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Abstract: Malnutrition is brought on by a multitude of causes, Food insecurity, lack of education, poverty, parasitic infestation and impure drinking water these are some of them. Considerable investments have been made by governments and aid agencies in programs designed to prevent malnutrition. Two sets of requirements are suggested for malnutrition management. First are the requirements for rehabilitation with the use of a variety of appropriately processed locally available food or rehabilitation foods are being formulated to treat moderately malnourished children. *Moringa oleifera* have demonstrated a multitude of attributes. It has an impressive range of medicinal uses with high nutritional value, successful treatment of malnourished children with Moringa has been well-documented in Moringa project in south-western Senegal. There is no rigorous clinical trial has tested its efficacy for treating malnutrition. **Objective** of the study is to investigate the effect of *Moringa olifera* powder for treating mild and moderate malnutrition among sample of children in pediatric age group. **Subjects:** This an experimental clinical trial carried out on 6o child in nutritional center as an out patients. Inclusion criteria include pediatric age group(4-12) both sexes are involved patients was malnourished based on diagnostic criteria(WHO Z score).Children were categorized according to height Z score to normal (+2 to -2 SD), and stunted (< -2SD) moderate(< -2SD- > 3SD) severe (< -3SD) and according to weight Z score to normal (+2 to -2 SD, wasted (< -2SD) moderate(< -2SD- > 3SD) severe (< -3SD). Exclusion criteria include children with severe malnutrition, patients suffering any serious hepatic, renal or cardiac disease and not having diabetes mellitus or serious infections or short stature due to endocrine or other chronic systemic disease or hereditary bone dysplasia**. Methods**: Ready prepared *Moringa olifera* powder was used as directed by pharmaceutical company instruction 10mg added to 1cup of fruit juice taken twice daily between meals was prescribed to our patients for 40d. Growth was monitored and recorded before and after intake of *Moringa olifera* powder. **Results**: After intervention, cases gained more weight than controls yet, it was not statistically significant (*P* 0.07). Also, there was no statistical difference between cases and controls regarding weight after intervention and BMI after intervention (*P* 0.89 and 0.93) respectively. There was dietary inadequacy regarding total caloric intake with high intake of protein, COH and adequate intake of fat. Regarding micro nutrients there was inadequate intake of vitamin A, vitamin D, vitamin C, calcium and zinc with adequate intake of Iron. **Conclusion**: Usage *Moringa olifera* powder adding no significant clinical advantage over the traditional ways of management moderate malnutrition in limited clinical trail among a sample of children.

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Key Words: *Moringa olifera*-malnutriton- local food-moderate –children.

1.Introduction:

Childhood malnutrition is prevalent in developing countries and contributes to one-third of all deaths in these countries.The economic costs of under nutrition include direct costs such as the increased burden on the health care system, and indirect costs of lost productivity (1). Adequate nutrition is essential for children's health and development (2). Unless massive improvements in child nutrition are made, it will be difficult to achieve Millennium Development Goals (3). To reduce the burden of child under nutrition it is important to implement appropriate policies and interventions targeting correction o determinants of under nutrition (4). Considerable investments have been made by governments and aid agencies in programs designed to prevent malnutrition. Approaches have included school lunch programs, nutrition education, introducing exotic vegetables (5). A major drawback to these approaches is the dependence on imported solutions and outside personnel, and progress can quickly dissipate once the program funding dries up (6). For hundreds of years, traditional healers have prescribed different parts of M. oleifera for treatment of skin diseases (7). Respiratory illnesses, ear and dental infections, hypertension diabetes (8).Water purification (9) In addition to its antioxidant properties (10,11). It had Hepatoprotective activity (12). *Moringa olifera* is a sustainable and economically sound nutrient rich food option for populations who suffer from chronic or seasonal micro- and macronutrient deficiencies(13) It had been promoted as a nutrient dense food source (14-16).The nutritional value of one Gram of fresh leaves of *M.*

oleifera have 4 times the vitamin A of carrots, 7 times the vitamin C of oranges, 4 times the calcium of milk, 3 times the potassium of bananas, ¾ the iron of spinach, and 2 times the protein of (15).To date, absolutely no negative side effects to even daily consumption of Moringa (17). *Moringa olifera* had been tried in mild to moderate degree of malnutrition in south-western Senegal, but not in severe malnutrition when a child has reached this stage of severe malnutrition, there are very gross physiological abnormalities, including infections, impaired liver and intestinal function and problems related to imbalance of electrolytes. Because of these physiological abnormalities, the severely mal-nourished child cannot tolerate iron or the usual amounts of dietary protein, fat and sodium. Until the child leaves this emergency phase and enters the rehabilitation phase. Thus Moringa leaves, with their high iron and protein content, are not appropriate for use during initial treatment of the severely malnourished (5).Scientifically speaking however, Moringa sounds like magic, the question remains: To what degree can moringa be a solution to the problem of malnutrition? lack of clinical studies make it difficult to generalize its use(6). Food nutrition institute reported that in order for *M. oleifera* to be adopted and for its widespread use to be promoted, evidence must be provided for the following five attributes: relative advantage, compatibility, complexity, observability, and trialability.The previous studies carried in countries where *M. oleifera* is locally available affordable accepted as a familial food. But if the situation is different, when the intervention is not is locally available not affordable not accepted as a familial food what will be the result. This study carried out in trail to overshaded the benefit of *Moringa olifera* in mild and moderate malnutrition and its comparative effect to the traditional line management of malnutrition

Objectives:

The aim of the study was to investigate the effect of *Moringa olifera* powder in management of mild and moderate malnutrition and find its comparative effect of the traditional line of management

2. Subjects and Methods:

Subjects:

This is a randomizes experimental clinical trail (case control study). Sample taken from special nutritional center in Cairo governorate. 30 cases 30 control. In this study, 60 child were examined, 29 (48.3%) males and 31 (51.7%) females. Children age ranged from 4 to 12 years, with a mean of (7.81±1.98) years. inclusion criteria, include pediatric age group. both sexes are involved, Degree of malnutrition mild and moderate malnourished based on diagnostic criteria(WHO Z score. Children were categorized according to height Z score to normal (+2 to -2 SD), and stunted (< -2SD) moderate (< -2SD- > 3SD) severe (< -3SD) (and according to weight Z score to normal (+2 to -2 SD), wasted (< -2SD) moderate (< -2SD- > 3SD) severe (< -3SD). Body mass index was calculated as kilograms of body weight per height in square meters. Exclusion criteria include children with severe malnutrition, patients suffering any serious chronic, hepatic, renal or cardiac disease and patients not having diabetes mellitus or serious infections or short stature due to endocrine or other systemic disease or hereditary bone dysplasia.Written informed consent was taken from the parents after explaining the aim of the study.The study protocol was approved by the human ethics committee

Methods:

All our patients are according to the WHOZ score. our cases receiving *Moringa olifera* over their traditional diet the other group control group not receiving this intervention. Ready prepared *Moringa olifera* powder was used as directed by pharmacocutical company instruction, 10mg added to 1cup of t or fruit juice taken twice daily between meals was prescribed to our patients for 40 days, Growth was monitored and recorded before and after intake of intervention

Moringa powder ingredients

According to an analysis of 100 grams of the edible portion of *Moringa olifera* the various parts of this plant have been shown to contain as much of the following water-soluble vitamins: 2.6mg of vitamin B1 (thiamine), 20.5mg of vitamin B2 (riboflavin), 8.2mg of vitamin B3 (nicotinic acid), and 220mg of vitamin C (ascorbic acid). In addition, this same portion of edible product contains as much of the following fat-soluble vitamins: 16.3mg of vitamin A, 113mg of vitamin E (alpha-tocopherol acetate); as much as 423mg of the lipotropic element, Choline; 19.2 grams of fiber; and several key minerals: 2003mg of Calcium, 368mg of Magnesium, 204mg of Phosphorus, 1324mg of Potassium, 3.1mg of Copper, 28.2mg of Iron, and 870mg of Selenium **(15).**

All our studied children are subjected to the following

1-Anthropometric measurements:

- **Weight:**

The weight was recorded using platform scale; the scale was standardized by known weight before the study in each studied site and corrected according to the test.

The subject was weighed by standing bare footed on the center of the platform without touching or leaning on anything and with light clothing worn and reading was done to the nearest gm. Corrections were done according to (18).

Assessment of Weight for height Zscore Status:

weight for height Z- scores. The following categories of weight status were determined according (18)

Wasting <-2SD. moderate(< -2SD- > -3SD) severe (< -3SD)

Normal – 2 to + 2SD.

Overweight > + 2SD**:**

Height:

Height was measured using the Raven Minimetre, with direct reading of height, it was on the floor with the back resting against the upright surface to which the Minimetre if fixed. The subject was placed bare footed underneath the measuring arm, Feet parallel and with heels, buttocks, shoulders and back of head touching the wall. The head was held comfortably erect and the outer border of the orbit with the external auditory meatus in the same horizontal plane. The measuring arm was brought down on the subject's head with the back plate firmly against the wall. The red cursor line was giving the accurate height measurement according to (18).

Height:

The following categories of height status were determined according to (18)

Stunting < - 2SD. moderate(< -2SD- > 3SD) severe (< -3SD).

Normal – 2 to + 2 SD.

Tall: > + 2 SD.

2-Dietary Assessment:

Methods used for measuring food consumption of the studied children were classified into two major groups. The first group, known as quantitative daily consumption method, consisted or recalls or records designed to measure the quantity of foods consumed over one day period "twenty four-hour recall" method. The second methods included the dietary pattern for the children.

1-Dietary pattern (food frequency Questionaire)

This method was used to obtain qualitative descriptive information about usual food consumption pattern for the children.

2- Twenty four hoursrecall method:

In this method every child's mother or the child according to his age was asked to recall the exact foods intake during the previous 24 hours period. Quantities of foods consumed were estimated in household measures and grams.

Adequacy of the diet consumed was assessed by comparing the energy and nutrient intake of the person with the recommended dietary allowances "RDA", (19) Detailed description of all food and beverages consumed, including cooking methods and the amounts of each ingredients in the recipe was recorded the conversation of household "HH" measures to grams achieved through use of preprepared list of weights of commonly used household measures in Egypt developed by National Nutrition Institute, The compiled food composition tables FCT of the Nutrition institute(20) were used to determine energy and nutrient intake of each individual Adequacy of the diet consumed was assessed by comparing the energy and nutrient.A food Coding system was used, based on 2 digits denoting the food group,2 digits denoting the food item and 2 digits denoting the method of preparation. The conversation of grams of foods and breverages to energy and nutrients was carried out by computer program based on energy and nutrient data base developed form

Basis of theanalysis of dietary adequacy Dietary adequacy Bases of dietary analysis

Intake was categorized to < 50%, 50-74%, 75-99% and ≥ 100 RAD% iron estimation was based on its bioavailability according to the daily diet content of haem iron source in grams (Meat, Poultry and fish) or Ascorbic acid (mg): Low bioavailability:<30gm of haem iron source or<25mg of ascorbic, Intermediate bioavailability 30-90 gm of haem iron source or 25-75mg of ascorbic acid High bioavailability:>90gm of haem iron source or>75mg ascorbic acid(21). Sight and life vitamin "A" content of the diet was based on the retinol activity equivalents (RAE) which is equivalent to "1" microgram of all-trans retinol, to"12"microgram of all trans B-carotene andto"24" microgram.

Statistical Analysis

Children were categorized according to height Z score to normal (+2 to -2 SD), and stunted (< -2SD) and according to weight Z score to normal (+2 to -2 SD), wasted (< -2SD). Body mass index was calculated as kilograms of body weight per height in square meters. Estimated energy requirement (EER) was calculated for each individual using their age, sex, height, and weight according to the Institute of Medicine Dietary Reference Intake equations. EER was estimated based on a moderate activity coefficient of 1.13. Percentage of EER was calculated as %EER (kcal/EER). Analyses of continuous variables were summarized as means with standard deviations and categorical variables were summarized as numbers and percentages. All inferences are based on two tailed tests with a threshold of <0.05 for declaring significance. Intake was categorized to < 50%, 50-74%, 75-99% and ≥ 100%. Chi square, one sample *t* test and Student's *t* test were used to compare intake between study groups. All analyses were conducted using SPSS version 15(22).

Table (1): Age and Anthropometric measures of Individuals

Age and Anthropometric measures	Cases	Control	t	*P* value
Age	**7.86 ± 1.83**	**7.76 ± 2.16**	**0.19**	**0.85**
Height	**116.23 ± 10.07**	**116.48 ± 12.55**	**-0.09**	**0.93**
Initial Weight	**17.75 ± 3.61**	**18.41 ± 4.55**	**-0.62**	**0.54**
Weight after intervention	**21.52 ± 4.42**	**21.69 ± 5.06**	**-0.14**	**0.89**
Target weight	**21.30 ± 4.33**	**22.09 ± 5.46**	**-0.62**	**0.54**
Weight gain	**3.55 ± 0.72**	**3.68 ± 0.91**	**-0.62**	**0.54**
Weight gain (% of initial wt)	**101.02 ± 3.21**	**98.61 ± 6.25**	**-0.17**	**0.07**
BMI	**13.01± 1.09**	**13.36 ± 1.15**	**-1.18**	**0.24**
BMI after intervention	**15.78±1.44**	**15.81±1.75**	**-0.08**	**0.93**

Table (2): Distribution of the sample group according to weight and height Z score

Table (2): Weight changes of Individuals

Anthropometric measures	Initial weight	Weight after intervention	Target weight	P^a	P^b
Cases	**17.75 ± 3.61**	**21.52 ± 4.42**	**21.30 ± 4.33**	**0.000***	**0.067**
Controls	**18.41 ± 4.55**	**21.69 ± 5.06**	**22.09 ± 5.46**	**0.000***	**0.158**

P^a initial weight and weight after intervention
P^b weight after intervention and target weight

Table (3): BMI changes of Individuals

Anthropometric measures	Initial BMI	BMI after intervention	Target BMI	P^a	P^b
Cases	**13.01± 1.09**	**15.78±1.44**	**15.62±1.31**	**0.000***	**0.077**
Controls	**13.36 ± 1.15**	**15.81±1.75**	**16.03±1.38**	**0.000***	**0.242**

P^a initial BMI and BMI after intervention
P^b BMI after intervention and target BMI

Age difference had no statistical difference cases and controls (*P 0.85*). Also, there was no statistical difference between cases and controls regarding height, initial body weight and initial BMI (*P* 0.93, 0.54 and 0.24) respectively. After intervention, cases gained more weight than controls yet, it was not statistically significant (*P* 0.07). Also, there was no statistical difference between cases and controls regarding weight after intervention and BMI after intervention (*P* 0.89 and 0.93) respectively, **(Table 1)**. Figure 1 showed weight changes among cases and controls. 4.33) yet, it had no statistical significance *(P 0.067)*, **(Table2).** Mean initial BMI was (13.01 ± 1.09), mean BMI after intervention was (15.78 ± 1.44) which was statistically significant *(P<0.001).*Also, Mean BMI after intervention was slightly higher than mean target BMI (15.62 ± 1.31) yet, it had no statistical significance *(P 0.767)*, **(Table3).**

Among controls, mean initial weight was (18.41 ± 4.55) kg, mean weight after intervention was (21.69 ± 5.06) Kg with a mean weight increase of (3.68 ± 0.91) kg which was statistically significant *(P<0.001).* Mean weight after intervention was slightly less than mean target weight (22.09 ± 5.46) yet, it had no statistical significance *(P 0.158)*, **(Table2).** Mean initial BMI was (13.36 ± 1.15), mean BMI after intervention was (15.81 ± 1.75) which was statistically significant (*P<0.001).* Also, Mean BMI after intervention was slightly less than mean target BMI (16.03 ± 1.38) yet, it had no statistical significance *(P 0.242)*, **(Table 3)**

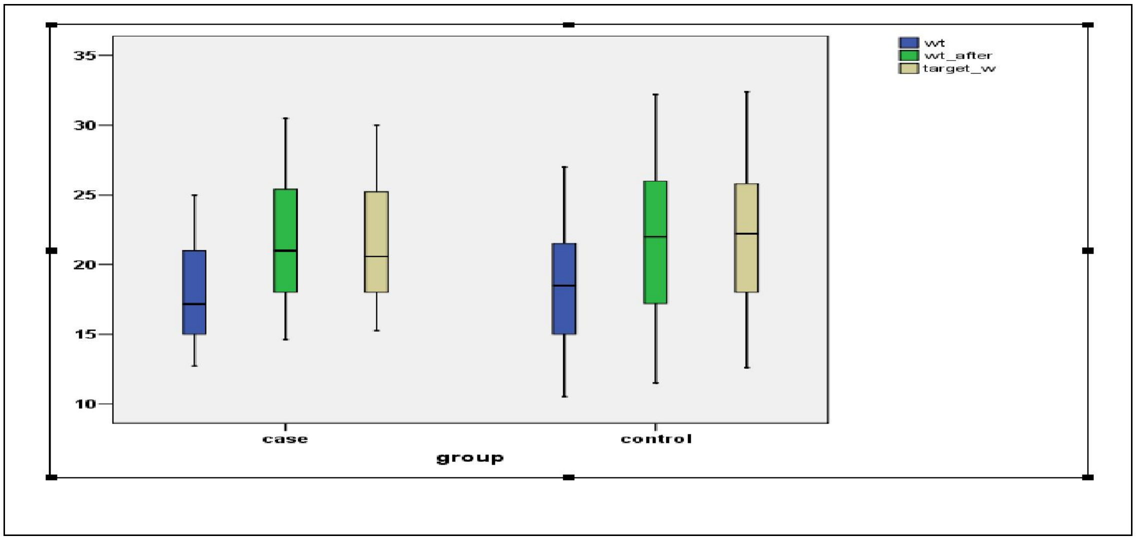

Figure (1): Box and whisker plot demonstrating weight changes among the study groups.

Table (4) Percent distribution of Individuals according to group, Height Z score and weight Z score

Energy intake and requirements	Cases		Controls		Total		χ2	P
	No	%	No	%	No	%		
Sex								
Male	12	40.0	17	56.7	29	48.3	1.66	0.30
Female	18	60.0	13	43.3	31	51.7		
Height Z score								
Normal	6	20.0	12	41.1	31	52.5	2.85	0.15
Stunted	24	80.0	18	58.6	28	47.5		
Weight Z score								
Normal	5	23.3	6	20.0	11	18.3	0.11	1.00
Wasted	25	76.7	24	80.0	49	81.7		

In this study, 60 child were examined, 29 (48.3%) males and 31 (51.7%) females.

hildren age ranged from 4 to 12 years with a mean of (7.81±1.98) years. Height Z score ranged from -3 to +2 Sd.. with mean value of (-1.56±1.25). Stunted presented (70.0%) among the sample (80.0% of the cases and 60.0% of the controls

Weight Z score ranged from -3 to +1 Sd Wasting presented (81.7%) among the sample (83.3% of the cases and 80.0% of the controls..wasting presented (70.0%) among the sample (76.7% of the cases and 70.0% of the controls). There was no statistical significant difference regarding children sex, weight and height among cases and controls **(Table4**,).

Table (5): Percent distribution of Energy intake and Dietary requirements of Individuals.

Energy intake and requirements	<50%		50-74%		75 – 99%		≥ 100%	
	No	%	No	%	No	%	No	%
EER	0	0.0	6	10.0	30	50.0	24	40.0
Protein	0	0.0	1	1.7	14	23.3	45	75.0
Carbohydrates	0	0.0	0	0.0	0	0.0	60	100.0
Vitamin A	6	10.0	32	53.3	17	28.3	5	8.3
Vitamin D	30	50.0	27	45.0	0	0.0	3	5.0
Vitamin C	4	6.7	26	43.3	10	16.7	20	33.3
Calcium	47	78.3	12	20.0	1	1.7	0	0.0
Iron	2	3.3	15	25.0	18	30.0	25	41.7
Zinc	50	83.3	7	11.7	3	5.0	0	0.0

Table (6): Difference of Daily Energy intake and requirements of macro and micro nutrients

Energy intake and requirements	Min	Mean ±SD	Max	t	*P* value
EER (% of RDA)	66.84	97.26±17.28	145.30	-1.22	0.22
Protein (% of RDA)	73.53	137.59±40.20	226.32	7.244	0.00*
Carbohydrates (% of RDA)	107.69	183.16±31.10	269.23	20.71	0.00*
Vitamin A (% of RDA)	38.83	71.27±18.86	125.00	-11.80	0.00*
Vitamin D (% of RDA)	22.00	53.20±15.45	104.00	-23.46	0.00
Vitamin C(% of RDA)	33.33	78.77±23.87	120.00	-6.89	0.00*
Calcium (% of RDA)	18.09	43.05±10.80	80.00	-40.83	0.00*
Iron (% of RDA)	40.00	104.91±49.78	225.00	0.76	0.44
Zinc (% of RDA)	25.00	38.44±13.64	78.75	-34.96	0.00*

Energy requirements

Energy intake ranged from 869 to 1811 calorie with a mean of 1314.90±186.81 calorie. Energy intake ranged from 66.84% to 145.30% of estimated caloric requirement based on age, weight, height, and an assumed moderate activity. Half the children had 75 to 99% of RDA of calories/day, (40.0%) had ≥ **100%** of RDA, while, (10.0%) had 50-74% of RDA, **(Table5)**. Mean percentage of energy intake was 97.26±17.28 which was not statistically different than the recommend (*P*< 0.22), (**Table6**).

Macronutrients

Carbohydrate intake ranged from 140 to 350 g/day which presented 107.69% to 269.23% of estimated carbohydrate RDA. Carbohydrate intake presented 64.44% to 72.23% of daily total calories. All children had ≥100% of estimated carbohydrate RDA, (**Table5).** Mean percentage of carbohydrate intake was 183.16±31.10 which was higher than the RDA (*P*< 0.001) (**Table6**).

Protein intake ranged from 20 to 43 g/day which presented 89.47% to 231.58% of RDA. Protein intake presented 6.29% to 13.81% of daily total calories. The majority of children (75.0%) had ≥100% of RDA of proteins while, (23.3%) had 75-99% of RDA of proteins, (**Table5).** Mean percentage of protein intake was 137.59±40.20 which was higher than the RDA (*P*< 0.001) (**Table6**).

Fat intake ranged from 14 to 40 g/day. Fat intake presented 12.73% to 26.47% of daily calories.

Fat Soluble Vitamins

Vitamin A intake ranged from 220 to 500 µg/ day, which presented 38.83% to 125.0% of RDA. Most of children (53.3%) had 50 to 74% of RDA of vitamin A, (28.3%) had 75-99%, while only (8.3%) had ≥100% of RDA of vitamin A (**Table5).** Mean percentage of vitamin A intake was 71.27±18.86 which was less than the RDA (*P*< 0.001) (**Table6**).

Vitamin D intake ranged from 1.10 to 5.2 µg/ day which presented 22.0% to 104.0% of RDA. Half the children had <50 % of RDA of vitamin D, (45.0%) had 50-74%, while only (5.0%) had ≥100% of RDA of vitamin D (**Table5).** Mean percentage of vitamin D intake was 53.20±15.45 which was less than the RDA (*P*< 0.001) (**Table6**).

Water Soluble Vitamins

Vitamin C intake ranged from 10 to 31 µg/ day which presented 33.33% to 120.0% of RDA. Most of children (43.3%) had 50 to 74% of RDA of vitamin C, (16.7%) had 75-99%, while (33.3%) had ≥100% of RDA of vitamin C (**Table5).** Mean percentage of vitamin C intake was 78.77±23.87 which was less than the RDA (*P*< 0.001) (**Table6**).

Minerals

Iron intake ranged from 4 to 19 mg/ day which presented 40.0% to 225.0% of RDA. Most of children (41.7%) had ≥100% of RDA of iron, (30.0%) had 75-99%, while (25.0%) had 50 to 74% of RDA of iron (**Table5).** Mean percentage of iron intake was 104.91±49.78 which was slightly higher than the RDA (*P* 044) (**Table6**).

Zinc intake ranged from 2 to 6.3 mg/ day which presented 25.0% to 78.75% of RDA. The majority of children (83.3%) had <50% of RDA of zinc, (11.7%) had 50-74%, while (5.0%) had 75 to 99% of RDA of zinc (**Table5).** Mean percentage of zinc intake was 38.44±13.64 which was less than the RDA (*P*< 0.001) (**Table6**).

Calcium intake ranged from 199 to 640 mg/ day which presented 18.09% to 80.0% of RDA. The majority of children (78.3%) had <50% of RDA of Calcium, (20.0%) had 50-74%, while (1.7%) had 75 to 99% of RDA of Calcium (**Table5).** Mean percentage of Calcium intake was 43.05±10.80 which was less than the RDA (*P*< 0.001) (**Table6**).

Energy requirements, Macronutrients and Micronutrients classified by group.Energy requirements

The majority of the cases had 75 to 99% of RDA of calories vs. (30.0%) of controls. Also, (60.0%) of the controls had ≥ 100% of RDA of calories vs. (20.0%) of cases which was statistically significant (*P*< 0.01), (**Table7**). The difference of total calories was much greater in control group compared with cases group, (*P*< 0.05). Also, percent of energy intake was calories much higher in control group compared with cases group, (*P*< 0.05) (**Table8**).

Macronutrients

The majority of children (86.7 % of controls and 63.3% of cases) had ≥100% of RDA of proteins. There was no statistical difference between cases and controls regarding protein intake adequacy, (*P* 0.097), **(Table7).** The difference of protein intake was greater in controls compared with cases, (*P*< 0.05), yet protein percent of RDA and percent of protein energy of total calories had no statistical difference (*P* 0.92 and 0.20) (**Table8**).

All the children had ≥100% of RDA of carbohydrates**.** The difference of carbohydrate intake was greater in controls compared with cases, (*P*< 0.001), also carbohydrate percent of RDA and percent of carbohydrate energy of total calories had no statistical difference (*P*< 0.001) (**Table7**).

There was no difference of fat intake was between the two groups (*P* 0.31), yet the percent of fat energy of total calories was greater in cases rather than control group (*P*< 0.001) (**Table8**).

Vitamins

Only, 16.7% controls had ≥100% of RDA of vitamin A. also, (60.0%) of cases had 50-74% of RDA vs. (46.7%) of controls. There was a statistical difference between cases and controls regarding vitamin A intake, (*P*< 0.05), **(Table7).** The difference of vitamin A intake was greater in controls compared with cases, (*P*< 0.05), also vitamin A percent of RDA was greater in controls compared with cases, (*P*< 0.05) (**Table8**).

There was no difference of vitamin D and C intake between the two groups (*P* 0.21 and 0.20), **(Table7).** There was no statistical difference between cases and controls regarding vitamin C and D percent of RDA, (*P* 0.76 and 0.99) (**Table8**).

Minerals

Only, 10.0% of cases had ≥100% of RDA of iron vs. (73.3%) of controls. Also, (50.0%) of cases had 50-74% of RDA. There was a statistical difference between cases and controls regarding iron intake adequacy, (*P*< 0.001), **(Table7).** The difference of iron intake was greater in controls compared with cases, (*P*< 0.001), also iron percent of RDA was greater in controls compared with cases, (*P*< 0.0.001) (**Table8**).

All cases had <50% of RDA of calcium vs. (56.7%) of controls. Also, (50.0%) of controls had 50-74% of RDA. There was a statistical difference between cases and controls regarding calcium intake adequacy, (*P*< 0.001), **(Table7).** The difference of calcium intake was greater in controls compared with cases, (*P*< 0.001), also calcium percent of RDA was greater in controls compared with cases, (*P*< 0.0.001) (**Table8**).

All cases had <50% of RDA of zinc vs. (66.7%) of controls. Also, (40.0%) of controls had 50-74% of RDA. There was a statistical difference between cases and controls regarding zinc intake adequacy, (*P*< 0.01), **(Table7).** The difference of calcium intake was greater in controls compared with cases, (*P*< 0.001), also zinc percent of RDA was greater in controls compared with cases, (*P*< 0.0.001) **(Table8)**

Table (8) Percent distribution of Energy intake and dietary requirements of Individuals according to group

Energy intake and requirements		cases		Controls		Total		χ2	*P* value
		No	%	No	%	No	%		
EER %	50-74 %	3	10.0	3	10.0	6	10.0	10.80	0.005*
	75 – 99%	21	70.0	9	30.0	30	50.0		
	≥ 100%	6	20.0	18	60.0	24	40.0		
PTN % of RDA	50-74 %	1	3.3	0	0.0	1	1.7	4.66	0.097
	75 – 99%	10	33.3	4	13.3	14	23.3		
	≥ 100%	19	63.3	26	86.7	45	75.0		
Vitamin A % of RDA	<50%	4	13.3	2	6.7	6	10.0	6.22	0.010
	50-74%	18	60.0	14	46.7	32	53.3		
	75 – 99%	8	26.7	9	30.0	17	28.3		
	≥ 100%	0	0.0	5	16.7	5	8.3		
Vitamin D % of RDA	<50%	16	53.3	14	46.7	30	50.0	3.17	0.21
	50-74%	14	46.7	13	43.3	27	45.0		
	≥ 100%	0	0.0	3	10.0	3	5.0		
Vitamin C % of RDA	<50%	0	0.0	4	13.3	4	6.7	4.60	0.20
	50-74%	13	43.3	13	43.3	26	43.3		
	75 – 99%	6	20.0	4	13.3	10	16.7		
	≥ 100%	11	36.7	9	30.0	20	33.3		
Iron % of RDA	<50%	2	6.7	0	0.0	2	3.3	31.66	0.000*
	50-74%	15	50.0	0	0.0	15	25.0		
	75 – 99%	10	33.3	8	26.7	18	30.0		
	≥ 100%	3	10.0	22	73.3	25	41.7		
Calcium % of RDA	<50%	30	100.0	17	56.7	47	78.3	16.59	0.000*
	50-74%	0	0.0	12	40.0	12	20.0		
	75 – 99%	0	0.0	1	3.3	1	1.7		
Zinc % of RDA	<50%	30	100.0	20	66.7	50	83.3	12.00	0.002
	50-74%	0	0.0	7	23.3	7	11.7		
	75 – 99%	0	0.0	3	10.0	3	5.0		

Table (9): Energy intake, vitamin and mineral requirements of Individuals according to group

Energy intake and requirements	Group		t	*P* value
	Cases	controls		
Total kilocalories	1254.30±106.11	1375.50±228.35	-2.64	0.01*
%EER	92.12±11.23	102.40±20.65	-2.39	0.02*
Macronutrients				
Protein (gm)	30.30±2.41	33.02±6.01	-2.30	0.03*
Protein (% of Kcal)	9.74±1.23	9.70±1.65	0.10	0.92
Protein (% of RDA)	130.84±35.00	144.35±44.36	-1.31	0.20
Carbohydrates (g)	222.90±24.46	253.33±47.43	-3.12	0.00*
Carbohydrates (% of Kcal)	70.93±2.68	73.53±3.77	-3.07	0.00*
Carbohydrates (% of RDA)	171.46±118.82	194.87±36.49	-3.12	0.00*
Fat (g)	26.83±3.03	25.57±6.11	1.02	0.31
Fat (% of Kcal)	19.33±2.14	16.77±3.26	3.59	0.00*
Vitamins				
Vitamin A (mg)	306.43±46.30	349.70±73.29	-2.73	0.01*
Vitamin A (% of RDA)	65.96±14.41	76.58±21.39	-2.26	0.03*
Vitamin D	2.52±0.36	2.92±1.07	-1.93	0.06
Vitamin D (% of RDA)	50.40±7.29	56.00±20.40	-1.42	0.16
Vitamin C (mg)	24.23±2.53	23.86±6.14	0.31	0.76
Vitamin C(% of RDA)	78.80±20.26	78.74±27.26	0.01	0.99
Minerals				
Calcium (mg)	351.23±30.43	419.58±98.82	-3.62	0.00*
Calcium (% of RDA)	38.99±6.18	47.11±12.85	-3.12	0.00*
Iron (mg)	6.52±1.10	12.45±3.79	-8.22	0.00*
Iron (% of RDA)	71.99±15.87	137.83±50.47	-6.82	0.00*
Zinc (mg)	2.30±0.29	3.85±1.04	-7.90	0.00*
Zinc (% of RDA)	28.71±38.99	48.18±13.00	-7.90	0.00*

4. Discussion

Malnutrition casts long shadows, affecting close to 800 million people, 20% of all people in the developing world (23). Data revealed that malnutrition is a major problem in Egypt, which has a hazardous impact on their intellectual and physical development (3). Two sets of requirements are suggested for malnutrition management. First are the requirements for rehabilitation with the use of a variety of appropriately processed locally available food, second are supplementary, or rehabilitation foods are being formulated to treat moderately malnourished children (24). Acceptance of *M. oleifera* as a nutritional supplement or a food additive in undernourished children is compatible in some cultures and countries but the lack of robust clinical trials data increases the uncertainty regarding *M. oleifera* nutritional benefits in undernutrition (6).The current study carried out in order to assess the advantage benefits of moringa in pediatric mild and moderate malnutrition over the traditional methods.. In this study we classify the sample study into two groups, cases 30 they receive *M. oleifera* powder on their usual diet and the control group they was treated with use of a variety of appropriately processed locally available foods within the caloric and micronutrients recommendation of the WHO in management of mild and moderate malnutrition (25). Anthropometric measurement is a practical and immediately applicable technique for assessing children's development patterns (26). In our study Stunting presented. (70.0%) among the sample (80.0% of the cases and 60.0% of the controls Weight Z score ranged from -3 to +1 Sd Wasting presented (81.7%) among the sample (83.3% of the cases and 80.0% of the controlswasting presented (70.0%) among the sample (76.7% of the cases and 70.0% of the controls).

There was no statistical significant difference regarding children sex, weight and height among cases and controls. Similar anthropometric recording of malnourished children in underdeveloped countries was recorded by **Sadaruddin and Kaushik(27)** they reported that the prevalence of stunting was (15·6%) and underweight (22·2%) was observed in school-aged children Similar result was obtained . In other studies In India out of 353 children there was, 38.2% belonged to the school-aged group, The largest percentages of children (31.8% HAZ and 29.1% WAZ) were clustered in the SD1 group, that is the severely stunted or wasted group. (4_).Our result was in correspondence of Goon and his colleagues they reported that, Underweight (WAZ < -2) and stunting (HAZ < -2) occurred in 43.4% and 52.7%, respectively. Using the 2007 World Health Organization (28). Nutritional status is a primary determinant of a child's health and well-being, inadequate dietary intake was one of the most detrimental factor of childhood malnutrition in underdeveloped countries (29). In the current study there was dietary inadequacy regarding total caloric intake with adequate intake of protein, COH and fat. Regarding micro nutrients there was inadequate intake of vitamin A, vitamin D, vitamin C, calcium and zinc with adequate intake of Iron. our result was supported with Grammatikopoulou study in 2009(30) In two districts Corfu and Samos in turkey that there was Inadequacies in the nutrient intake in the diet of Samos and concerned folate and P of the pre-schoolers and biotin of the school. In another study by **waniki EW, Makokha** (31), he reported that Consumption of food which is inadequate in required calories and from less than four varieties of food groups by the children were important predictors of malnutrition).Another supportive evidence came from **Valente,s** (32)study in 2010 he reported that The proportion of children with an intake below the Estimated Regarding the macronutrients, 65.9% and 78.8% of the individuals were above WHO recommended intake values for protein and total fats, respectively; 22% didn't ingest lower than WHO carbohydrates intake recommendation.. Regarding caloric inadequacy our result was in correspondence with that of Sandjaja results In Indonesia(33) The percentage of children with dietary intakes of energy, vitamins A and C below the Indonesian RDA. The nutritional requirements for catch-up growth depend on whether the child chronically malnourished or primarily wasted, for instance, more protein and energy are needed during the very rapid weight gain period and for those in whom lean tissue is the major component of the weight gain (34). Ingested energy required to synthesize 1 g of mixed tissue is about 5.5 kcal/g by measuring the energy cost of weight gained the rate of weight gain required to catch up over 14-40 days should be added to allow for catch-up at 5 g/kg/day (35). In the current study we put target for gaining weight according to the recommended weight gain in 40 days about (5 g/kg/day).We found that there was no statistical difference between cases and controls before the interventions regarding height and initial body weight (*P* 0.93 and 0.54) respectively. After intervention, cases gained more weight than controls yet, it was not statistically significant (*P* 0.07). Also, there was no statistical difference between cases and controls regarding weight after intervention (*P* 0.89). The mean weight increase of (3.55 ± 0.72) kg which was statistically significant (*P*<0.001). Mean weight after intervention was slightly higher than mean target weight (21.30 ± 4.33) yet, it had no statistical significance (P 0.067).Among controls, mean initial weight was (18.41 ± 4.55) kg, mean weight after intervention was (21.69 ± 5.06) Kg with a mean weight increase of (3.68 ± 0.91) kg which was statistically significant (*P*<0.001). Mean weight after intervention was slightly less than mean target weight (22.09 ± 5.46) yet, it had no statistical significance (*P* 0.158).We found no significant differences regarding adding *Moringa olifera* on the diet of the children. Ideally, good nutrition should be assured by a varied diet rich in meat, root, grain, fruit and vegetable foods (6) There was some reports of using *Moringa olifera* as therapeutic option for malnutrition in Africa. Trail to enrich infant cereals with moringa powder used was theoretically possible, as an incorporation of 5%-15% of Moringa powder for 100g of flour is accepted by mothers and children. on the other hand, the incorporation of Moringa leaf powder in manufactured infant cereal could create other problems, such as the loss of vitamins (35). Another trail of enrich bread and cookies with moringa powder with acceptance was carried in India, Cookies with 20% moringa had the nutty taste and were acceptable., (36).Certain programs fighting malnutrition in Senegal, India, Benin and Zimbabwe are now using moringa leaves, traditionally eaten in these countries or treating malnutrition (34).Food nutrition institute reported that in order to be adopt *Moringa olifera* and for its widespread use to be promoted, evidence must be provided for the following five attributes: relative advantage, compatibility, complexity, observability, and trialability (6). *Moringa olifera* interventions sound good if it locally available, inexpensive but it is not the case in our country, this approach will add economic stress in countries in which poverty and food insecurity playing an important role for prevalence of malnutrition (29). food nutrition institute report (6) that there was reduction of bioavailability of some nutritious elements of *M. oleifera* after enrichment on food, moringa leaves are high in calcium but also contain substantial quantities of oxalic acid, which interferes with the absorption of calcium., 73% of the calcium provided by M. oleifera was absorbed and 59% was retained (37). Acceptance of *M. oleifera* as a nutritional supplement or a food additive in undernourished populations is compatible in those cultures that currently use green leafy plant sources in traditional dishes (6**).**

Conclusion:

Regarding *Moringa olifera* powder we found no significant difference over the traditional dietary management of locally available diet in mild and moderate malnutrition in this limited clinical trail. Adding to its relative cost, The use of *M. oleifera* for treatment of under-nutrition lacks a scientific base in clinical studies demonstrating either efficacy. The lack of robust clinical trials data increases the uncertainty regarding *M. oleifera* nutritional benefits over the traditional rules

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