

Abstract

Malnutrition is a concerning public health problem in most Middle East countries. This study aimed to assess the nutritional status of 6 – 12-year-old Syrian children living in the Kingdom of Saudi Arabia and their dietary diversity and intake. Anthropometric indices, dietary diversity, and nutrient intake were determined through 24-h recalls. Four children were wasted; 75 malnourished; 2 boys underweight and severely underweight; 61 overweight and obese; and 2, 2, and 1 thin, moderately thin, and severely thin, respectively, whereas the other child was overweight and obese ($p > 0.05$). Mean dietary diversity score was 3.18 ± 0.85 , with 59.4, 25.2, and 14.5 as low, medium, and high, respectively. Energy and fiber intakes were low, whereas protein, sugar, and all micronutrients were high, except vitamins D, E, K, Ca, and Fe. Therefore, unbalanced diet leads to malnutrition, stunting, wasting, and thinness, and overweight and obesity are associated with low dietary diversity and improper intakes.

Objective

This study aimed to assess the nutritional status of Syrian children aged 6–12 years living in the Kingdom of Saudi Arabia and evaluate their dietary diversity and intake.



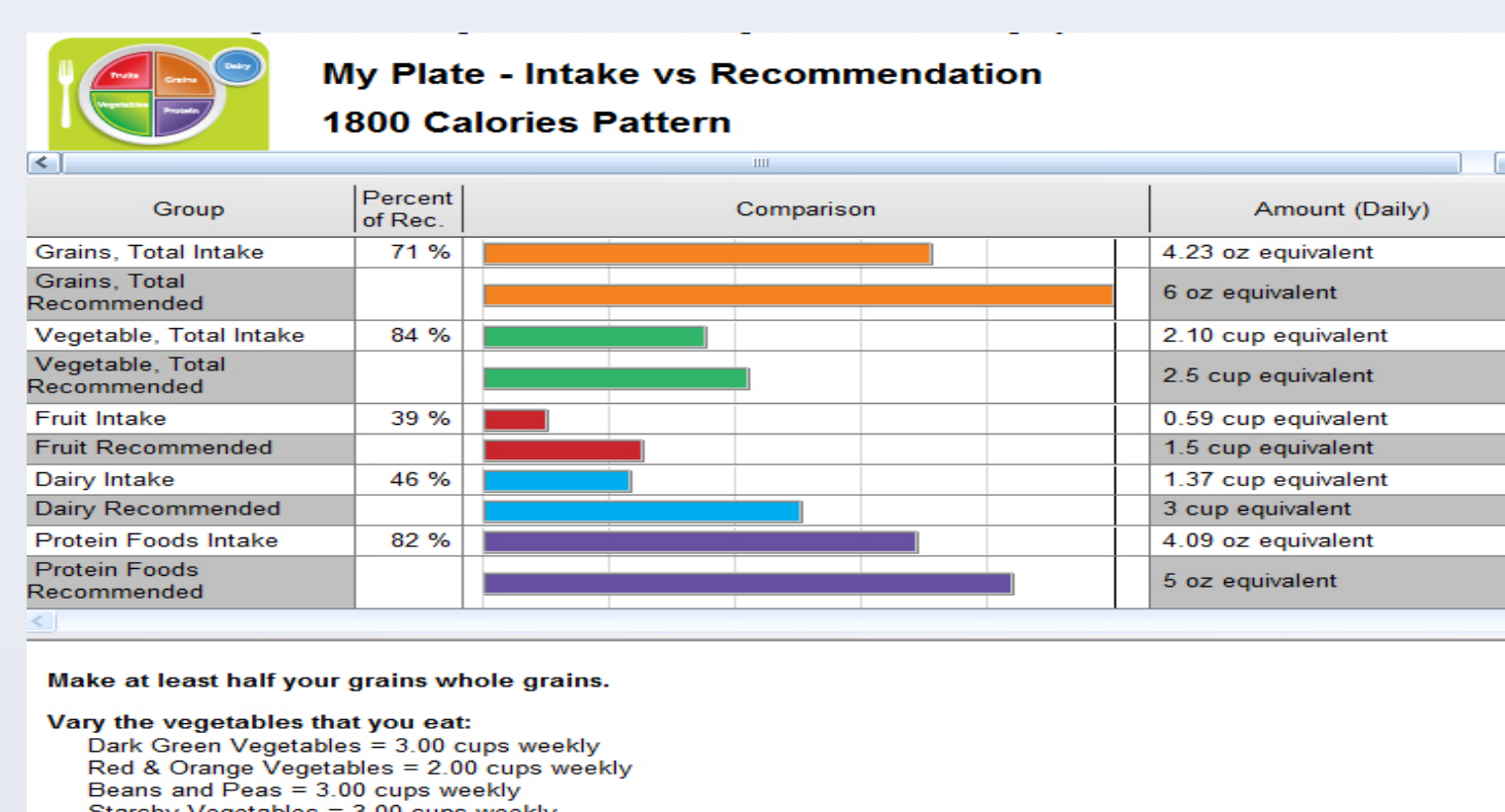
Materials and Methods

- The study was conducted in Riyadh City, Saudi Arabia, which hosts most of the Syrians in Saudi Arabia.
- A simple random sample of 105 male and female children aged between 6 and 12 years were randomly selected from the study community using random number tables.
- Dietary 24-hour recalls were conducted with parents of each child through home visitations. Personal and social data such as physical activities, disease history, and dietary intake (type, quantity, and frequency of food and a brief description of typical daily food intake) were collected.
- Anthropometric measurements including heights and weights of each child were measured using standardized techniques. Anthropometric measurements were compared based on age and used to determine the nutritional status of the children.



- Dietary diversity score (DDS) was constructed based on the parents or caregivers' recall of the child's intake within the past 24 h using the WHO's country-specific adaptation guidance.

- Foods were categorized into six food groups as recommended by the WHO: (1) staples (grains/cereals, roots, and tubers), (2) legumes and nuts, (3) dairy products (milk, yogurt, and cheese), (4) animal/flesh foods (eggs, meat, fish, poultry, and liver/organ meats), (5) vitamin A-rich fruits and vegetables, and (6) other fruits and vegetables.
- Food intake was estimated by calculating the energy consumption in kilocalories and macronutrient and micronutrient consumption using the food processor program from EISHA Company. The results of nutrients analyzed were classified according to the Dietary Requirement Intake (DRI).



- All values were shown as mean \pm standard deviation (SD). All statistical analyses were performed with the SPSS 20.0 software (SPSS Inc., Chicago, IL, USA). The level of significance was set at $P < 0.05$.

Results

Table 1 Anthropometric results of Syrian children (based on WHO standards, 2006)

Indicators	Female		Male		Total		Mean \pm SD
	N	N%	N	N%	N	N%	
Moderate underweight	1	3.0	0	0.0	1	1.0	0.01 \pm 0.78
	6	18.2	2	5.1	8	7.6	
	18	54.5	33	84.6	51	48.6	
WAZ	6	18.2	4	10.3	10	9.5	
	1	3.0	0	0.0	1	1.0	
	1	3.0	0	0.0	1	1.0	
HAZ	1	2.0	4	7.3	5	4.8	0.24 \pm 1.48
	7	14.3	3	5.5	10	9.5	
	8	16.3	7	10.9	15	14.4	
BAZ	23	46.9	31	56.4	54	51.4	
	8	16.3	9	16.4	17	16.2	
	2	4.1	2	3.6	4	3.8	
BMI	0	0	1	1.8	1	1.0	0.43 \pm 1.52
	3	6.1	2	2.2	5	4.8	
	3	6.1	4	7.1	7	6.7	
WHZ	28	57.1	29	51.8	57	54.3	
	11	22.4	15	26.8	26	24.8	
	3	6.1	5	8.9	8	7.6	
Severe malnutrition	15	30.6	20	35	35	33.3	17.6 \pm 3.19
	9	18.4	5	8.9	14	13.3	
	10	20.4	11	19.6	21	20.0	
Moderate malnutrition	14	28.6	19	33.9	33	31.4	
	1	2.0	0	0.0	1	1.0	
	0	0	1	1.8	1	1.0	
Malnutrition	3	6.1	1	2.2	4	5.33	0.72 \pm 1.66
	21	42.0	36	63.6	57	54.3	
	3	6.1	3	6.67	6	5.7	
Wasting	3	6.1	5	11.1	8	7.6	
	3	6.1	5	11.1	8	7.6	
	3	6.1	5	11.1	8	7.6	

* WAZ: Weight/ Age Z-score; HAZ: Height/ Age Z-score; BAZ: Body mass index/ Age Z-score; BMI: Body mass index; WHZ: Weight/height Z-score

Table 2 Dietary diversity

Dietary diversity score	Frequency	Percent
Lowest dietary diversity (≤ 3 food groups)	567	59.4
Medium dietary diversity (4–5 food groups)	240	25.2
High dietary diversity (≥ 6 food groups)	138	14.5
Total	954	100.0

Table 3 Average daily consumption of nutrients (24-h recall) in relation to DRI in girls and boys using T test

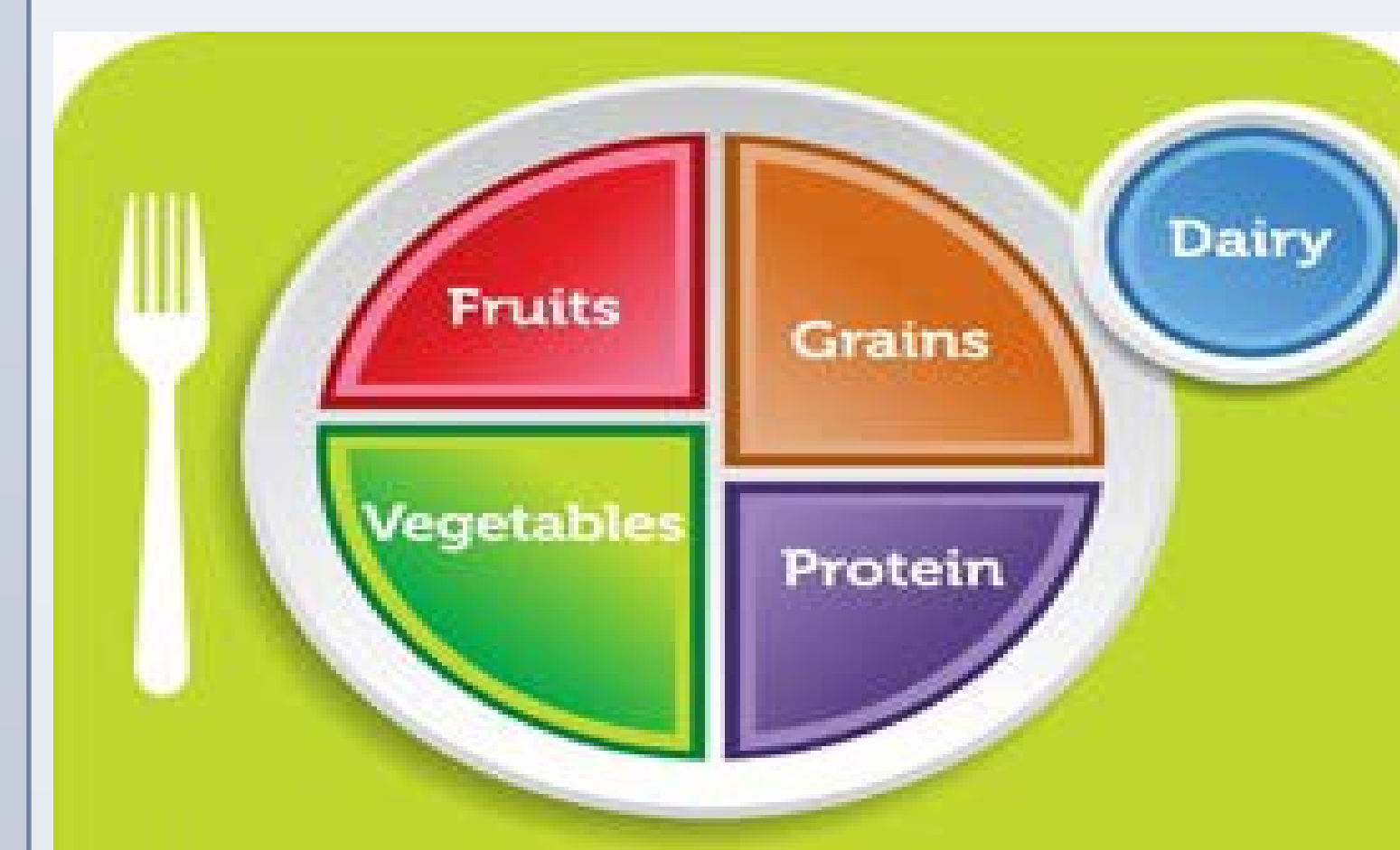
Items intake/day	Boys			Girls			DRI*		T test**	
	Mean	SE	%DR I	Mean	SE	%DRI	Girls	Boys		
Calories	1055	69.04	68.68	984.13	54.2	58.37	1686d	15.28	18.15	
Protein g	47.65	2.75	308.7	49.3	2.69	319.4	161.03	17.32	18.31	
Carbs g	133.26	9.96	102.5	114.68	7.24	88.21	47.73	13.38	15.84	
Fiber g	10.37	0.78	48.03	10.13	0.96	46.94	23.95	13.23	10.51	
Fat g	37.81	3.48	ND	37.92	2.95	ND	ND	10.86	12.86	
Chol mg	251.44	27.3	ND	268.22	23.9	ND	NDa	9.21	11.24	
Vit. A μ g	733.46	139.1	213.9	478.47	49.4	139.6	94.49	5.27	9.68	
Vit. B1 mg	0.63	0.05	115.5	0.55	0.03	99.92	49.98	13.12	16.05	
Vit. B2 mg	0.97	0.06	218.3	0.95	0.06	213.6	106.81	15.65	15.1	
Vit. B3 mg	8.65	0.76	158.6	10.12	1.14	185.5	93.30	11.39	8.86	
Vit. B6 mg	0.78	0.05	175.5	0.79	0.05	176.8	88.44	14.69	16.33	
Vit. B12 μ g	2.21	0.21	268.4	2.43	0.45	294.5	147.46	10.63	5.44	
Vit. C mg	46.2	5.64	246.4	28.89	4.61	154.1	79.34	8.2	6.27	
Vit. D μ g	1.49	0.19	29.8	1.43	0.23	28.55	14.39	7.81	6.3	
Vit. E mg	2.99	0.28	46.27	7.24	4.6	112	58.32	10.76	1.57	
Ca mg	472.69	39.29	57.4	447.69	36.6	54.36	45.46	12.03	12.25	
Iron mg	7.16	0.41	86.94	9.29	1.95	112.8	57.38	17.58	4.75	
Mg mg	140.3	10.32	141.7	132.42	8.48	133.7	71.09	13.6	15.62	
P mg	744.05	49.23	155.3	712.03	38.6	148.6	93.59	15.11	18.46	
K mg	1372.4	85.86	40.93	1196.75	77.1	35.69	56.40	15.98	15.52	
Na mg	1220.7	92.13	111.9	1127.07	87.7	103.3	95.51	13.25	12.85	
Zn mg	6.06	0.36	161.6	5.54	0.3	147.8	74.05	16.77	18.28	

*As low as possible while consuming a nutritionally adequate diet, *DRI: Dietary Reference Intake (DRIs) in bold type; AIs, adequate intakes; ND, not determined; SE, Standard Errors; **Significant at $P \leq 0.05$ and $P \leq 0.01$.

Conclusion

- Based on the results, unbalanced food consumption can be concluded to lead to malnutrition status, and the presence of stunting, wasting and thinness, is due to lack of essential nutrient intake that is associated with the low dietary diversity.

- overweight and obesity is also related with improper intakes of protein, fat, sugars, and fibers that resulted from limitation of dietary diversity.
- Both types of malnutrition (over and under) in Syrian children in the Kingdom of Saudi Arabia were caused by inadequate and inappropriate eating behaviors and absence of nutritional education in addition to other lifestyle factors, such as low physical activity.
- a nutritional strategy should be established to promote proper health in this population.



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