Original article

Poor nutritional status and growth retardation are associated with living in the orphanage: an observational cross-sectional study

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Abstract. *Objective:* Adequate and balanced nutrition is crucial for optimal growth and development. However, children living in orphanages without a family are at risk of malnutrition. In this study, we aimed to compare the nutritional status and growth process of orphans and non-orphans. *Methods:* We recruited 111 orphans and 116 non-orphans aged 3-6 years. We excluded children with any acute or chronic disease and physical or mental problems. We assessed dietary intakes via the 3 days food record form. We took anthropometric measurements and evaluated the growth level of children using the Z-score tables of the World Health Organization. We analyzed the data using IBM SPSS. *Results:* Of the 227 children, the prevalence of undernutrition was as high as 54.8% among children in the orphans. According to Z-score of height for age values, 23.4% of orphans were only 4.3% of non-orphans were stunted. While the mean energy intake was significantly higher in orphans compared to non-orphans (1802.7±552.80 kcal vs. 1480.8±244.53 kcal, $p<0.05$), the proportion of energy from protein was lower (12.9±2.32% vs. 43.9±9.72%, $p<0.05$). The mean dietary vitamin C and calcium intakes were significantly lower in the orphans than non-orphans ($p<0.05$). *Conclusion:* The results of our study suggest that children living in the orphanages have a significant risk in terms of nutritional deficiencies and developmental delays compared to children living with their families.

Key words: orphan, nutrition, growth, deficiency, malnutrition

Introduction

The growth phases differ individually, as it is under the influence of genetic factors. Nutrition is the most crucial and commutative factor affecting a child's growth and development period (1, 2). Growth monitoring during childhood, indicating health conditions, helps in diagnosing nutrition-related diseases (3).

Inadequate and unbalanced nutrition in the pre-school period when growth and development rate is the highest may cause health problems such as growth and development retardation, malnutrition, micronutrient deficiencies, and infections (4). In developed countries, more than half of children under the age of 5 decease due to nutritional deficiency. Stunting, which is the best biomarker of chronic nutritional deficiency, can lead to cognitive retardation, decreased productivity, and an increased risk of morbidity and mortality in the preschool period (5). The World Health Organization (WHO) announced in 2011 that 18% of children in the 0-5 age group worldwide are underweight, and 28% are short (6). According to the Turkey Nutrition and Health Survey, 5.2% of children in the 0-5 age range is weak and stunted 11.5% (7).

Obesity developing in the preschool period is a crucial public health problem that causes diseases such as type 2 diabetes mellitus, coronary artery diseases, dyslipidemia, hypertension, and adult obesity (8). The prevalence of childhood obesity has increased worldwide in recent years. In the preschool period, 6.7 of 43 million children were overweight and obese in 2010. In Turkey, 14.6% of the children in 0-5 years of age group are overweight, and 5.9% of them are obese (7).

Nutrition deficiency may stem from the careless mother or poor financial status. Maternal factors or insufficient financial situations may lead to malnutrition. War environment, low birth weight, the mother with low mental level, inadequate education, and socioeconomic level can cause nutritional deficiency or obesity in children (9-12). Besides, staying in orphanages where parental care is insufficient, and the rate of depression is high poses a risk for inadequate nutrition (5). According to the studies conducted in South Africa, the frequency of nutritional deficiency and stunting is higher in children living in orphanages than children living with their families. The traumatic effect of living away from their parents, the insufficient energy and nutrients in orphanages increased this frequency (13, 14). The number of research determine the nutritional status of orphans in Turkey is limited. However, there is no research comparing the level of nutrition and development of children living in the orphanage and the family home. Therefore, we aimed to compare the nutritional status and growth level of 3-6-year-old children in the orphanage and private kindergartens.

Methods

Participants and Study Plan

We conducted an observational cross-sectional study among 227 children who stayed at the orphanage and went to private kindergartens. We excluded children with any acute or chronic disease and physical or mental problems. The sample size needed to be being 200 children to have 80% power at 5% type I error level, to detect a clinically significant difference. We also randomly selected 111 orphan and 116 non-orphan.

Non-Interventional Clinical Researches Ethics Board of Hacettepe University approved that this study complies with ethical principles. Before commencing the research, we informed the parents and caregivers about the procedure and obtained written informed consent from all participants. We conducted all processes under the ethical standards of the Declaration of Helsinki.

Anthropometric Measurements

We measured the weight (kg) and height (cm) of all children, who were wearing light clothing and no shoes, using a digital Seca scale. We calculated the weight for age, weight for height, height for age as a Z score, and evaluated based on the WHO classification (15). We considered the Z score of <-2 was as the cut-off point for screening the children who are likely to be stunted, wasted, and underweight.

Dietary Evaluation

We obtained the 3-days food consumption records form from the children via their caregivers or families. We confirmed portion sizes using Food and Nutrition Photo Catalog: dimensions and quantities (16). We analyzed the food intake with Standardized food recipes for Turkey (17) and the BEBIS dietary analysis program Version 8.0 (18) based on the national food composition database. We evaluated the mean energy and nutrients consumed by children daily by comparing them with the recommended daily allowance values (19).

Statistical analysis

We evaluated the variables using the Kolmogorov–Smirnov test to determine whether normally. We used the Student t-test to compare the normally distributed and the Mann–Whitney U test for non-normally distributed values. We used the chi-square test for categorical variables to compare the proportions in different groups, and calculated their significance using the Pearson test. We analyzed the data using IBM SPSS version 22.0 (IBM Corp., Armonk, NY, USA) and considered $p<0.05$ as statistically significant.

Results

We evaluated 227 children in this study, of which 111 were from the orphanage, and 116 were from a kindergarten. We showed the demographic characteristics and anthropometric measurements of all children in Table 1. There were no significant differences in gender among the groups (p>0.05); the mean age was 4.6±1.13 years in orphans and 5.2±0.78 years in non-orphans (p<0.05).

We categorized anthropometric measurements into five Z-score groups based on WHO criteria and summarized in Table 2. The prevalence of underweight was as high as 50.5% among orphans, compared with 9.5% in non-orphans according to the weight for age Z-scores (p<0.05). The majority of the orphans (43.2%) were severely stunted, whereas the non-orphans (46.6%) were tall (p<0.05).

We demonstrated the nutritional status of children as the mean Z-scores based on the gender and age groups in Table 3. Z-scores of height-for-age and weight-for-age were significantly lower in both female and male orphans than the non-orphans (p<0.05).

Table 1. Distribution of the demographic characteristics of children

	Orphan (n=111)		Non-orphan (n=116)		X^2	p value
Variables	**n**	**%**	**n**	**%**		
Gender						
Female	52	46.8	64	55.2	2.376	0.123
Male	59	53.2	52	44.8		
Age groups (years)						
3	24	21.6	7	6.0	79.384	0.000
4	28	25.2	5	4.3		
5	26	23.4	63	54.3		
6	33	29.7	41	35.4		
Mean age (years)	4.6±1.13		5.2±0.78			0.000

X^2: Chi-square. Pearson's chi-square test and Mann-Whitney U test was performed and p<0.05 was considered statistically significant.

Table 2. Nutritional status of children according to Z-scores

	Orphan (n=111)		Non-orphan (n=116)		X^2	p value
Variables	**n**	**%**	**n**	**%**		
Weight for age						
Severely underweight (<-2SD)	6	5.4	1	0.9	118.856	0.000
Underweight (≥ -2SD- <-1SD)	56	50.5	11	9.5		
Normal (≥-1SD-<1 SD)	48	43.2	78	67.2		
Overweight (≥1SD-<2SD)	1	0.9	16	13.8		
Obese (≥2 SD)	-	-	10	8.6		
Height for age						
Severely stunted (<-2SD)	48	43.2	-	-	255.491	0.000
Stunted (≥ -2SD- <-1SD)	26	23.4	5	4.3		
Normal (≥-1SD-<1 SD)	36	32.4	37	31.9		
Tall (≥1SD-<2 SD)	1	0.9	54	46.6		
Very tall (≥2 SD)	-	-	20	17.2		

Table 2 (*Continued*)

Variables	Orphan (n=111)		Non-orphan (n=116)		X^2	*p* value
	n	%	n	%		
Body mass index						
Severely underweight (<-2SD)	1	0.9	19	16.4	25.857	0.000
Underweight (≥ -2SD- <-1SD)	86	78.2	80	69.0		
Normal (≥-1SD-<1 SD)	-	-	-	-		
Overweight (≥1SD-<2 SD)	23	20.9	13	11.2		
Obese (≥2 SD)	-	-	4	3.4		

X^2: Chi-square. Pearson's chi-square test was performed and $p<0.05$ was considered statistically significant.

Table 3. Distribution of Z-scores related to nutritional status of children by gender and age

Age group	Orphan (n=111)			Non-orphan (n=116)		
	Female	Male	*p* value	Female	Male	*p* value
3 years						
Height for age	-2.0±0.79	-2.5±1.20	0.000[a]	0.7±0.13	1.6±0.30	0.000[b]
Weight for age	-1.2±0.77	-1.2±0.41	0.000 [a]	0.5±0.00	1.9±0.73	0.000[b]
Weight for height	-0.0±0.61	0.3±0.65	0.288 [a]	0.2±0.10	1.5±.0.80	0.001[b]
4-6 years						
Height for age	-0.9±1.03	-2.0±1.39	0.000 [a]	1.0±1.05	1.3±0.94	0.000[b]
Weight for age	-0.6±0.83	-1.2±0.83	0.000 [a]	0.2±1.00	0.6±1.07	0.000[b]
Weight for height	-0.2±1.15	0.1±1.04	0.098 [a]	-0.5±1.23	-0.5±1.80	0.002[b]

Values of Z-scores were expressed as mean ± standard deviation. Mann-Whitney *U* test was performed and p<0.05 was considered statistically significant. [a] indicates the p value in comparison of the mean Z-scores of the females, and [b] indicates the p value in comparison of the mean Z-scores of the males.

There were significantly higher Z-scores of weight for age in non-orphans (female: 0.2±0.10 vs. 0.0±0.61; male: 1.5±.0.80 vs. 0.3±0.65) compared to orphans in 3 year-old group ($p<0.05$).

We classified the nutritional deficiency status using Z-scores and considered the ≤-2 standard deviation was as the cut-off point for screening the children in Table 4. Among the children, 54.1% of females and 30.8% of males were stunting in orphans while there are no stunted children in the non-orphans. The prevalence of underweight was as high as 8.4% among orphans, compared with 0.9% in non-orphans according to the weight for age Z-scores ($p<0.05$).

We presented the mean dietary intakes of energy and nutrients of children in orphans and non-orphans in Table 5. Daily mean energy intake (1876.7±600.87 kcal vs. 1578.0±134.23 kcal, respectively), fat (74.6±32.2 g vs. 62.3±3.80 g, respectively) and carbohydrate (239.0±54.47 vs. 180.8±33.07 g, respectively) intakes were higher in orphans compared to non-orphans 3-year-old group. However, mean protein intake was significantly lower in the orphans than in the non-orphans (12.3±1.46 g vs. 18.1±1.37 g, respectively). In addition to this, children in the orphans' group had significantly lower calcium intake than those in the non-orphans of both age groups ($p<0.05$). There were no significant differences in mean iron and zinc intake among the groups ($p>.05$).

We calculated the dietary recommended allowance ratio of the children's daily intakes and showed in Figure 1 and Figure 2 by the age groups. The dietary energy intake ratio for the requirements of 3-year-old orphans was significantly higher, whereas the protein and calcium intake ratio were lower than the non-orphans ($p<0.05$). Furthermore, children in the non-orphans' group had a significantly higher dietary vitamin C and calcium intakes compared to orphans in 4-6 years old group ($p<0.05$).

Table 4. Nutritional deficiency status of children

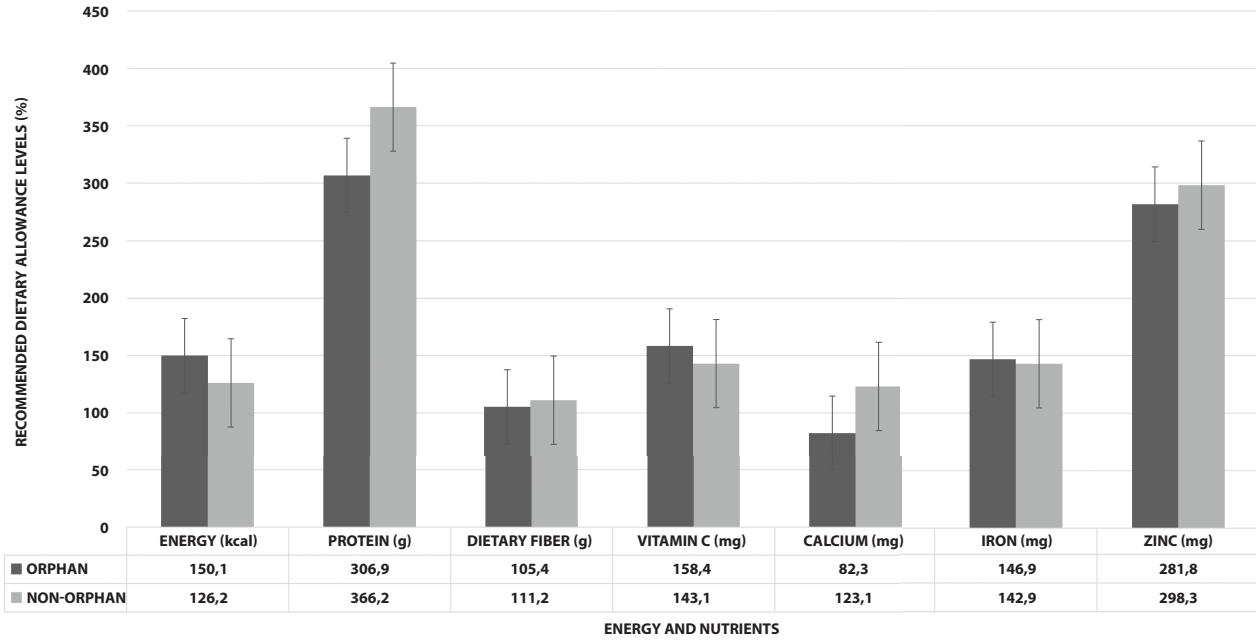
Nutritional status	Gender	Orphan (n=111)		Non-orphan (n=116)		X^2	*p* value
		n	%	n	%		
Stunting	**Female**	16	30.8	-	-	170.26	0.000
	Male	32	54.2	-	-		
Underweight	**Female**	1	1.9	-	-	118.53	0.000
	Male	5	8.4	1	0.9		
Wasting	**Female**	1	1.9	-	-	0.952	1.000
	Male	-	-	-	-		

We considered the Z score of ≤-2 standard deviation was as the cut-off point for screening the children who are likely to be stunted, wasted, and underweight. Chi-Square test and Fisher's Exact test were performed, and $p<0.05$ was considered statistically significant.

Table 5. Energy and nutrient intakes of children by age groups

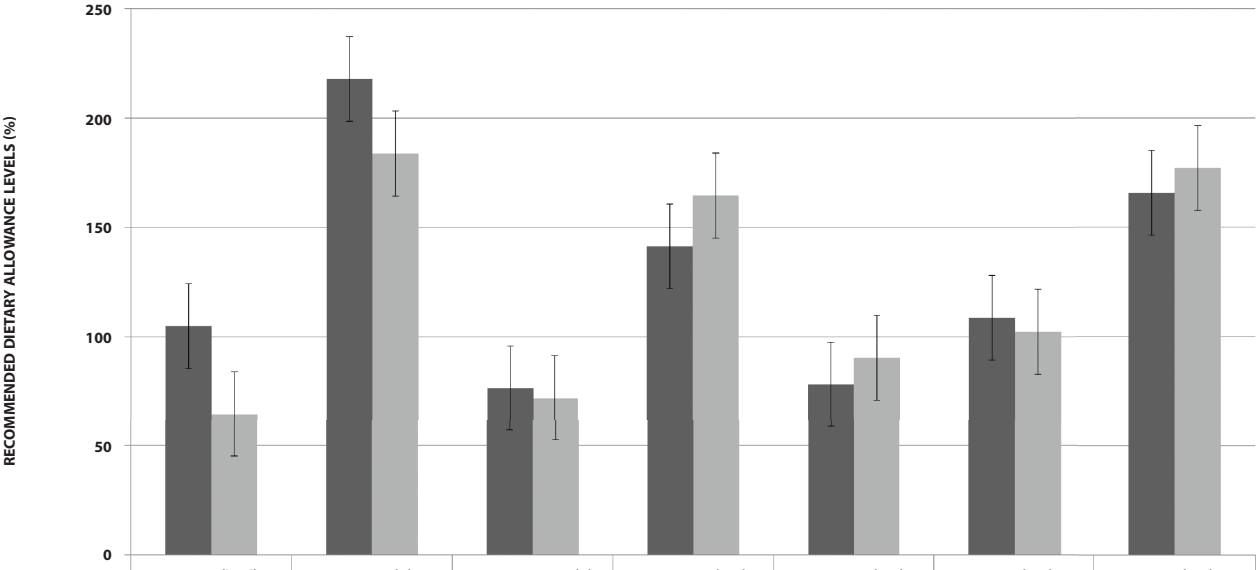
	Age (years)	Orphan (n=111)	Non-orphan (n=116)	*p* value
Energy (kcal)	**3**	1876.7±600.87	1578.0±134.23	0.035
	4-6	1728.6±504.73	1383.6±354.82	0.000
Protein (g)	**3**	57.7±23.80	68.9±2.59	0.044
	4-6	56.4±20.06	52.6±21.70	0.004
Protein (%)	**3**	12.3±1.46	18.1±1.37	0.000
	4-6	13.5±3.17	25.8±18.06	0.000
Fat (g)	**3**	74.6±32.20	62.3±3.80	0.096
	4-6	70.9±24.52	53.1±19.46	0.000
Fat (%)	**3**	34.5±3.21	35.6±4.19	0.000
	4-6	36.2±3.49	66.2±60.27	0.015
Carbohydrate (g)	**3**	239.0±54.47	180.8±33.07	0.000
	4-6	212.3±59.51	144.7±61.40	0.000
Carbohydrate (%)	**3**	53.2±4.19	46.6±4.77	0.000
	4-6	50.3±3.35	39.8±14.99	0.000
Dietary fiber (g)	**3**	20.0±5.65	21.1±2.52	0.427
	4-6	19.1±5.33	18.0±7.51	0.098
Vitamin C (mg)	**3**	95.1±49.92	85.8±25.63	0.460
	4-6	84.8±46.50	98.7±58.77	0.041
Calcium (mg)	**3**	658.6±262.86	984.8±169.50	0.000
	4-6	626.1±232.27	723.9±285.80	0.002
Iron (mg)	**3**	10.3±4.49	10.0±1.50	0.792
	4-6	10.8±3.99	10.2±4.00	0.056
Zinc (mg)	**3**	8.5±4.19	8.95±1.10	0.604
	4-6	8.3±3.34	8.85±2.94	0.083

Values of dietary intake were expressed as mean ± standard deviation. Mann-Whitney *U* test was performed and $p<0.05$ was considered statistically significant.



	ENERGY (kcal)	PROTEIN (g)	DIETARY FIBER (g)	VITAMIN C (mg)	CALCIUM (mg)	IRON (mg)	ZINC (mg)
ORPHAN	150,1	306,9	105,4	158,4	82,3	146,9	281,8
NON-ORPHAN	126,2	366,2	111,2	143,1	123,1	142,9	298,3

Figure 1. Dietary recommended allowance ratio of the 3-year-old children's daily energy and nutrients intakes



	ENERGY (kcal)	PROTEIN (g)	DIETARY FIBER (g)	VITAMIN C (mg)	CALCIUM (mg)	IRON (mg)	ZINC (mg)
ORPHAN	104,9	217,9	76,5	141,4	78,2	108,7	165,7
NON-ORPHAN	64,6	183,8	72	164,6	90,4	102,3	177,1

Figure 2. Dietary recommended allowance ratio of the 4-6-year-old children's daily energy and nutrients intakes

Discussion

There are approximately 140 million orphans, and evidence clearly shows that most of them are living with a surviving parent grandparent or other family members (20). In Western countries, the number of orphans has dramatically decreased thanks to foster families and children adoption services. On the other hand, due to financial difficulties related to orphanages in developing countries like Turkey, it is of great

importance because the institutions should be supported (21). According to the data, 12.667 children in Turkey are under the maintenance of 1233 orphanages affiliated to the T.R. Ministry of Family and Social Policies General Directory (22).

The orphans are faced with a lot of developmental and emotional health problems as a result of inadequate family care, insufficient, and unbalanced nutrition (14, 23, 24). Malnutrition, affecting growth and neurological development, is a crucial health problem among orphans (25, 26). In a study evaluating the nutritional status of 286 orphans aged 0-3 years in Kazakhstan, it was determined that 36.7% of them were stunted, 31.5% were wasted, and 22.1% were underweight (27). In another study conducted with 4-11 years old children in 3 different orphanages in Kenya, 47.2% of the children were stunted, 33.2% were wasted, and 9.2% were underweight (28). In a prospective study with 167 children aged 0-5 years in Palestine, it was reported that 17.6% of them were stunted (29). In a study conducted in Turkey, the prevalence of stunting and wasting was found to be 10.4% and 13.2%, respectively (30). In agreement with these studies, we found a statistically higher ratio of stunting in the orphans group than the non-orphans group. In similar studies conducted in undeveloped countries such as Uganda, Kenya, and Malawi, they found that there was no difference between orphans and non-orphans in terms of stunting and wasting prevalence. However, in Ethiopia, another of these countries, it was determined that the prevalence of wasting and stunting was higher in orphans than other children (13, 31-33).

Inadequate daily intake of energy and nutrients is one of the major causes of malnutrition (34). In a study evaluating the food consumption of orphans in Ghana, it was suggested that daily energy, carbohydrate, and fat intakes were lower than RDA standards, whereas their protein intake was adequate (35). In similar studies conducted in India and Kenya, it was found that dietary energy and nutrients intake of orphans was insufficient (36, 37). Gümüş et al (38) found that adolescents staying in the orphanage had a very high daily fat intake, although their energy intake was low. These results, in public institutions located in the catering menu system in Turkey, show that the amount of excess fat. In our study, we found that mean energy, fat, and carbohydrate intakes of orphans were higher, whereas protein, fiber, vitamin C, and calcium intakes were lower than non-orphans. In addition to this, children meet their daily energy and nutrient intake based on age groups. In line with the previous study, high amounts of energy and fat intake are thought to be related to the high-fat content of the menus. Insufficient and unbalanced planning of menus leads to malnutrition (39). However, Frank et al (40) determined that growth retardation observed in orphans was caused by the insufficient number of caregivers. Therefore, they cannot help children with general nutrition, as well as the quality and quantity of nutrients. In this study, children in the younger age group who need caregivers to provide nutrition were evaluated. However, we conclude that the daily nutritional needs of these children can be met since the number of caregivers in the orphanage where we conduct the study is sufficient, and the menus are planned by the dietician. The low rate of stunting and wasting due to the high daily energy and protein intake of orphans may be a result of their adequate and balanced nutrition before coming to the orphanage. However, a one-day dietary food record may not accurately reflect the nutritional status of children (41, 42).

The increasing prevalence of obesity in developing countries indicates that childhood obesity is a widespread public health problem (43). Consumption of foods with high energy density, having daily large portion sizes, and a low time of physical activity due to spending too much time on TV or computer use causes an increase in childhood obesity (44, 45). In our study, we found that the prevalence of overweight and obesity based on weight for age Z-scores was higher in non-orphans living with their families than the children staying in the orphanage.

When we evaluated according to BMI-for-age Z scores, we determined that this prevalence was lower in living with their families than staying in the orphanages. These different results were due to the shorter height of orphans compared to non-orphans. It is known that childhood obesity is associated with an obesogenic environment and family lifestyle (46,47). According to the results of our research, it is believed that the amount of food consumption was higher, but the level of physical activity was lower since children living with their families had easier access to food and technology. Therefore, it was concluded that the prevalence of obesity was higher in these children than orphans.

In conclusion, both the results of similar studies and our study suggest that there is a significant difference between the malnutrition and obesity prevalence of children staying in orphanages and living with their parents. However, we state that our study has limitations. It does not include the time of children staying in the orphanage. It is substantially important to monitor the growth and development of the orphans aged 3-6 when the developmental process is crucial. It will be beneficial to prevent obesity in childhood by providing education to the caregivers in the orphanage and families, and then orphans and children about healthy nutrition behavior by dieticians.

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Transparency declaration: We reported this study according to the STROBE guidelines.

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