Cukurova Medical Journal
ÇUKUROVA ÜNİVERSİTESİ TIP FAKÜLTESİ

Cukurova Med J 2025;50(3):673-682
DOI: 10.17826/cumj.1637711

RESEARCH

Prevalence and causes of malnutrition in seasonal agricultural workers' children under the age of five

Mevsimlik tarım işçilerinin beş yaş altı çocuklarında yetersiz beslenmenin yaygınlık ve nedenleri

Didem Yüzügüllü[1], Ferdi Tanır[2]

[1]Seyhan Health Directorate, Adana, Türkiye
[2]Cukurova University, Adana, Türkiye

Abstract

Purpose: Children under the age of five are vulnerable to malnutrition, and those living in tents with seasonal agricultural workers are at an even greater risk. This study aimed to determine the prevalence of chronic malnutrition and its associated factors in children of seasonal agricultural workers under the age of five.

Materials and Methods: The study was conducted on seasonal agricultural land in Adana, Turkey. Data were collected through questionnaires and anthropometric measurements. Three logistic regression models (stunting, underweight and wasting) were adopted to identify nutritional risk factors.

Results: The prevalence of stunting, underweight and wasting among the study participants was 40.4%, 51.7% and 23.2%, respectively. Female gender, a history of diarrhoea, breastfeeding for less than six months and incomplete vaccination were found to be associated with an increased risk of stunting. A history of diarrhoea, lack of antenatal care, breastfeeding for less than six months and incomplete vaccination were found to be associated with being underweight. A history of diarrhoea and lack of antenatal care were associated with wasting.

Conclusion: Based on these results, national healthcare services should promote improvements to the living and working conditions of agricultural workers with children under the age of five. Access to health services is important during the 0–5 age group, as growth and development must be closely monitored during this period. In addition to raising public awareness of this issue, health authorities must monitor the population at risk.

Keywords:. Children, healthcare services, malnutrition, seasonal agricultural workers.

Öz

Amaç: Beş yaş altı çocuklar yetersiz beslenmeye karşı savunmasız bir gruptur ve çadırlarda yaşayan mevsimlik tarım işçilerinin çocukları yetersiz beslenme açısından daha risklidir. Bu çalışmanın amacı, beş yaş altı mevsimlik tarım işçilerinin çocuklarında kronik yetersiz beslenmenin yaygınlığını ve ilişkili faktörleri belirlemektir.

Gereç ve Yöntem: Çalışma Adana-Türkiye'deki mevsimlik tarım arazilerinde gerçekleştirildi. Veriler anket ve antropometrik ölçümler yoluyla toplandı. Beslenmeyi etkileyen faktörleri belirlemek için üç farklı lojistik regresyon modeli (bodur, düşük kilolu, zayıf) benimsendi.

Bulgular: Çalışmaya katılanlarda bodurluk, düşük kilololuk ve zayıflık prevalansı sırasıyla %40,4, %51,7 ve %23,2 idi. Kız cinsiyet, ishal öyküsü, altı aydan az emzirme, eksik aşılama bodurluk riskinin artmasıyla ilişkili bulundu. İshal öyküsü, doğum öncesi bakım eksikliği, altı aydan az emzirme, eksik aşılama düşük kiloyla ilişkili bulundu. İshal öyküsü, doğum öncesi bakım eksikliği zayıflıkla ilişkili bulundu.

Sonuç: Bu sonuçlara göre, ulusal sağlık hizmetleri beş yaş altı çocuklarıyla birlikte yaşayan tarım işçilerinin yaşam ve çalışma koşullarında iyileştirmeleri teşvik etmelidir. Büyüme ve gelişimin yakından izlenmesi gereken bir dönem olan 0-5 yaşları arasında sağlık hizmetlerine erişim önemlidir. Bu konuda kamuoyunun farkındalığına ek olarak, risk popülasyonu sağlık otoriteleri tarafından izlenmelidir.

Anahtar kelimeler: Çocuklar, sağlık hizmetleri, malnutrisyon, mevsimlik tarım işçileri.

Address for Correspondence: Didem Yüzügüllü, Seyhan Health Directorate, Adana, Türkiye
E-mail: didemata8@gmail.com
Received: 11.02.2025 Accepted: 03.07.2025

INTRODUCTION

Malnutrition remains one of the most significant healthcare issues of the 21st century, particularly in developing countries. It is a global problem that particularly affects children. Those at high risk of chronic malnutrition include children under five, breastfeeding mothers and women during pregnancy and the postnatal period[1]. Children under the age of five are the most vulnerable to malnutrition. Chronic malnutrition in early life is known to slow down mental and cognitive development, increase the incidence of infections and raise the risk of various morbidities and mortality. The effects of malnutrition on children are expected to continue into the future. For instance, malnutrition can reduce academic success and labour productivity, as well as increasing the risk of chronic diseases in later life. According to data from the United Nations Children's Fund (UNICEF) in 2017, approximately one in four children under the age of five worldwide is stunted due to malnutrition during critical growth stages[2,3].

The World Health Organization recommends using the Z-score or standard deviation (SD) system to assess malnutrition. This method provides results in the form of Z-scores and standard deviations. Children with a reference score below 2SD (Z-score below -2) are considered to be poorly nourished, stunted, wasted or underweight. Children with a reference score below 3SD (Z-score below 3) are considered to be severely malnourished[4].

Although there has been an increase in interest in preventing malnutrition in recent years, no comprehensive studies have been conducted on the activities that can be implemented to prevent malnutrition in rural areas and among migrants. According to UNICEF, the main causes of childhood malnutrition are household food insecurity, poor care, an unhealthy environment, and a lack of healthcare services[5]. Factors such as income, poverty, employment, housing, assets and pension, which are socioeconomically and politically defined, affect them[6].

The International Labour Organization (ILO) reports that agriculture is the world's second-largest source of employment. In recent years in particular, demand for labour originating from agricultural production has played an important role in increasing international labour migration. Turkey's agricultural sector is one of the sectors with high potential for employing foreign labour and where irregular migrants are frequently found working. As of October 2021, 17.0% of people employed in Turkey worked in agriculture. Furthermore, agriculture had the highest rate of unregistered employment in Turkey at 84.5%, while the service sector had the second highest rate at 17.5%[7].

Agricultural workers are classified as seasonal and temporary agricultural employees. Seasonal agricultural employment consists of two types: Mobile agricultural employment and temporary agricultural employment. Farming families who fail to generate sufficient income from their own agricultural business are employed for seasonal and/or temporary agricultural jobs[8]. Therefore, they temporarily move to agricultural lands outside of their usual place of residence. The town of Seyhan in Adana is an area with vast agricultural land, an insufficient agricultural workforce, and a need for many seasonal agricultural workers[9].

This study aimed to determine the prevalence of chronic malnutrition and its associated factors among children under five years of age belonging to seasonal agricultural workers living in tent settlements in Adana, Turkey. It was hypothesised that children of seasonal agricultural workers would exhibit higher rates of chronic malnutrition than the general population, with specific sociodemographic, healthcare access and feeding practice factors serving as significant predictors of stunting, underweight and wasting conditions. This study contributes to the existing literature by providing the first comprehensive assessment of the prevalence of malnutrition and associated risk factors among children under five belonging to seasonal agricultural workers living in tent settlements in Turkey. This addresses a significant gap in our understanding of the nutritional vulnerabilities of this marginalised population.

MATERIAL AND METHODS

This was a cross-sectional study. The research was approved by an Internal Review Board (Health Department). The research was conducted in accordance with the Helsinki Declaration. Permission was obtained from the Çukurova University Faculty of Medicine Ethics Committee (meeting date: 31/08/2018; meeting number: 80), and written informed consent was obtained from all participants.

Sample

The study was conducted in five regions where seasonal agricultural workers were employed, located in one of the southern provinces of Turkey. This province is a region of intensive agricultural activity and receives migrants. According to the geographical database, 796,131 people live there. While the number of seasonal agricultural workers fluctuates significantly, it was reported that 1,416 individuals, including 818 children, were residing in 207 tents within the Seyhan district[10]. Of these children, 316 were aged 0–5 years (0–59 months), and the 207 children who met the inclusion and exclusion criteria constituted the study sample. There were four tented areas in the Seyhan district[10], and the study aimed to cover all of these.

The inclusion criteria for the study were having a 5-year-old child, living in an area allocated to seasonal agricultural workers, and agreeing to participate in the study. Children with chronic disorders affecting their nutritional state, including congenital heart defects, renal failure, sickle cell disease and liver disease, were excluded from the study. Of the 316 children under the age of five in the region, 207 were included in the study. Three children were excluded because their families did not agree to participate in the study. Five children were excluded because they had congenital heart disease and 15 because they moved tent during the study. Additionally, only one child per family was included; if a family had more than one child under five, the youngest was included. Therefore, 82 children were not included in the study. The researchers themselves collected the data.

Diagnostic methods

In particular, anthropometric measurements play a major role in community screening. These analyses are typically used to identify malnutrition[11]. The most common anthropometric indicators in childhood are weight-for-age and height-for-age. Malnutrition is indicated when either or both of these indicators are incomplete. Medical professionals describe children under the age of five (younger than 59 months) as a vulnerable group adversely affected by malnutrition[12].

The height and weight of each child were compared to the figures set out in the World Health Organization's guidelines on age and gender[13]. In addition, acute malnutrition was classified according to WHO/UNICEF guidelines[14].

Data collection

Data were collected through surveys and anthropometric measurements between 1 January and 8 September 2019. Researchers visited tented areas where seasonal agricultural workers live, reaching families and children. In these areas, the researchers asked the families survey questions and took anthropometric measurements. The data collection questionnaire included socio-demographic variables such as age, gender, the mother's educational background, vaccination status, breastfeeding patterns, etc. The age of the children was confirmed by either the parents or the vaccination card. In households with multiple children under the age of five, one child was randomly selected. The scales were calibrated regularly. Children's weight was measured using a portable digital scale with a capacity of 150 kg to 0.1 kg. Height was measured using a calibrated stadiometer. The researchers were involved in the data collection and control processes. Where necessary, the questionnaire was translated into local languages (Arabic or Kurdish) during fieldwork. Participants in the study included individuals of different ethnic origins, such as Turkish, Syrian and Kurdish. However, ethnic origin was not included in the survey questions. Regarding the language used for the survey and the need for an interpreter, only the language spoken was questioned, not ethnic origin.

Statistical analysis

The WHO Anthro version 3.2.2 software was used to convert the anthropometric measurements. Z-scores for weight, height and age indices were collected from the WHO 2006 standards. Height-for-age (HAZ), weight-for-height (WHZ) and weight-for-age (WAZ) were calculated based on gender[15].

A height below -2SD compared to the reference population indicates stunting, while a height below -3SD indicates severe stunting. Similarly, being below -2SD for weight-for-height compared to the reference population indicates wasting, while being below -3SD indicates severe wasting. Similarly, being below -2SD for weight compared to the reference population indicates underweight, while being below -3SD indicates severe underweight[15,16].

The frequencies and means were calculated. The results were presented in tables and figures alongside statistical inferences. Both univariate and multivariate analyses were performed to determine factors

associated with malnutrition. Significant variables with a p-value of less than 0.2 in the multivariate analysis were exported to the multivariable logistic regression model. Statistical significance was considered to be at the 5% level, i.e. $p < 0.05$.

Crosstabs, a t-test and a chi-squared test were used to determine the correlation between the selected factors and nutritional status. Three separate logistic regression models were then employed to estimate the impact of these factors on nutrition, categorised as (i) stunting, (ii) wasting, and (iii) underweight.

RESULTS

In this study, 151 out of 155 participants (97.4%) provided full answers. The characteristics of the children and their parents in the sample are presented in Table 1. The results showed that 12% of participants lived in Adana, 21% had migrated there from other cities in Turkey, and 67% had migrated from Syria.

The median age of the children was 29 months (range: 1–59 months). The median age of the mothers was also 29. The median age of the fathers was 32.

The prevalence of stunting (being short for one's age), wasting (having a poor body weight for one's height) and underweight (having a poor body weight for one's age) was analysed at different levels or categories of the selected factors, and the results are presented in Table 2. The prevalence of moderate stunting, underweight and wasting among the study participants was 33.1%, 33.8% and 19.2%, respectively. The prevalence of severe stunting, underweight and wasting among the children was 7.3%, 17.9% and 4.0% respectively (Table 2).

In terms of the causes of chronic malnutrition, the factors that were significantly associated with stunting were the child's gender ($p<0.001$), the father's educational background ($p=0.011$), the mother's educational background ($p=0.001$), the child's birth order ($p<0.001$), birth spacing ($p<0.001$), prenatal care ($p<0.001$), duration of breastfeeding ($p<0.001$), history of diarrhoea in the past six months ($p<0.001$), history of admission to a healthcare institution in the last month ($p<0.001$) and vaccination status ($p<0.001$).

The following factors were significantly associated with being underweight: father's educational background ($p=0.014$), child's birth order ($p<0.001$), birth spacing ($p=0.004$), prenatal care ($p<0.001$), postnatal care ($p=0.001$), history of diarrhoea in the past six months ($p<0.001$), history of admission to a healthcare institution in the last month ($p<0.001$), and vaccination ($p<0.001$).

The father's ($p=0.035$) and mother's ($p=0.043$) educational backgrounds, the child's birth order ($p<0.001$), birth spacing ($p<0.001$), prenatal ($p<0.001$) and postnatal ($p<0.001$) care, and the longevity of breastfeeding ($p<0.$., history of diarrhoea in the past six months ($p<0.001$), history of admission to a healthcare institution in the last month ($p<0.001$), and vaccination ($p<0.001$) were significantly associated with wasting (Table 3).

We used logistic regression models to analyse the impact of various factors on the nutritional status of seasonal agricultural workers' children under the age of five (see Table 4). Girls were 5.57 times more likely to be stunted than boys. Children who had experienced diarrhoea in the six months prior to data collection were 4.65 times more likely to be stunted than children who had not experienced diarrhoea. Children who were breastfed for less than six months were 5.9 times more likely to be stunted than those who were breastfed for six months or more. Children with incomplete vaccinations were 7.22 times more likely to be stunted than those with complete vaccinations.

Children who were incompletely vaccinated were 3.6 times more likely to be underweight than those who were fully vaccinated. Children who had experienced diarrhoea in the six months prior to data collection were 4.84 times more likely to be underweight than those with no history of diarrhoea. Children who were breastfed for less than six months were 7.26 times more likely to be underweight than those who were breastfed for six months or more. Children whose mothers received no prenatal care were 7.51 times more likely to be underweight.

Children who had experienced diarrhoea in the six months prior to data collection were 4.84 times more likely to be wasted than those who had not. Children whose mothers received no prenatal care were 3.62 times more likely to be wasted.

Table 1. Sociodemographic and health characteristics of seasonal agricultural workers' children under the age of five

Variables		Number (%)
Mother's educational background	Illiterate	67(44.4)
	Literate	23(15.2)
	Elementary school drop-out	61(40.4)
Father's educational background	Illiterate	10(6.6)
	Literate	53(35.1)
	Elementary school drop-out	88(58.3)
Mother's age	15-24	51(33.7)
	25-34	54(35.8)
	>35-44	46(30.5)
Father's age	15-24	21(13.9)
	25-34	74(49.0)
	>35-44	56(37.1)
Child's gender	Boy	75(49.7)
	Girl	76(50.3)
Longevity of breastfeeding (month)	<6 months	58(38.4)
	≥6 months	62(41.1)
	Still breastfeeding	31(20.5)
Vaccination	Complete	109(72.2)
	Incomplete	42(27.8)
Mother's first pregnancy	Yes	45(29.8)
	No	106(70.2)
Birth space from previous pregnancy	First birth	45(29.8)
	<2 years	71(47.0)
	≥2 years	35(23.2)
Place of Delivery	Home	10(6.6)
	Hospital	141(93.4)
Birth order	1	45(29.8)
	2.3	42(27.8)
	4.5	30(19.9)
	≥6	34(22.5)
Prenatal care	Yes	108(71.5)
	No	43(28.5)
Postnatal care	Yes	111(73.5)
	No	40(26.5)
Time of delivery	Preterm	15(9.9)
	Term	136(90.1)
History of diarrhea in the past 6 months	Yes	52(34.4)
	No	99(65.6)
Admission to a health institution in the last month	Yes	37(24.5)
	No	114(75.5)

Table 2. Prevalence and severity of malnutrition indicators (stunting, underweight, wasting) among children under five

Indicators of Malnutrition	Number (%)
Normal HAZ* (≥ −2SD)	90 (59.6)
Moderate stunting (HAZ≥−3SD & < −2SD)	50 (33.1)
Severe stunting (HAZ < −3SD)	11 (7.3)
Total	**151 (100.0)**
Normal WAZ** (≥ −2SD)	73 (48.3)
Moderately underweight (WAZ≥−3SD & < −2SD)	51 (33.8)
Severely underweight (WAZ < −3SD)	27 (17.9)
Total	**151 (100.0)**
Normal WHZ*** (≥ −2SD)	116 (76.8)
Moderate wasting (WHZ≥−3SD & < −2SD)	29 (19.2)
Severe wasting (WHZ < −3SD)	6 (4.0)
Total	**151 (100.0)**

SD: Standard deviation *HAZ: low height for age (stunting) **WAZ: low weight for age (underweight) ***WHZ: low weight for height (wasting)

Table 3. Distribution of stunting, underweight, and wasting by sociodemographic and health-related variables

Variables		Stunting		Underweight		Wasting	
		Yes	No	Yes	No	Yes	No
Child's gender	Boy	15 (20.0%)	60 (80.0%)	35 (46.7%)	40 (53.3%)	19(25.3%)	56(74.7%)
	Girl	46 (60.5%)	30 (39.5%)	43 (56.6%)	33 (43.4%)	16(21.1%)	60(78.9%)
		p<0.001		p=0.223		p=0.533	
Mother's education	Illiterate	46 (51.1%)	44 (48.9%)	52 (57.8%)	38 (42.2%)	26 (28.9%)	64 (71.1%)
	Literate	15 (24.6%)	46 (75.4%)	26 (42.6%)	35 (57.4%)	9 (14.8)	52 (85.2%)
		p=0.001		p=0.067		p=0.043	
Father's education	Illiterate	33 (52.4%)	30 (47.6%)	40 (63.5%)	23 (36.5%)	20 (31.7%)	43 (68.3%)
	Literate	28 (31.8%)	60 (68.2%)	38 (43.2%)	50 (56.8%)	15 (17.0%)	73 (83.0%)
		p=0.011		p=0.014		p=0.035	
Birth order	<4	24(27.6%)	63(72.4%)	28 (32.2%)	59 (67.8%)	10 (11.5%)	77 (88.5%)
	≥4	37(57.8%)	27(42.2%)	50 (78.1%)	14 (21.9%)	25 (39.1%)	39 (60.9%)
		p<0.001		p<0.001		p<0.001	
Birth spacing	< 2 years	42(59.2%)	29(40.8%)	49 (69.0%)	22 (31.0%)	29 (40.8%)	42 (59.2%)
	≥2 years	8(22.9%)	27(77.1)	14 (40.0%)	21 (60.0%)	1(2.9%)	34(97.1%)
		p<0.001		p=0.004		p<0.001	
Prenatal check	Yes	34(31.5%)	74(68.5%)	41 (38.0%)	67 (62.0%)	15 (13.9%)	93 (86.1%)
	No	27(62.8%)	16(37.2%)	37(86.0%)	6(14.0%)	20 (46.5%)	23 (53.5%)
		p<0.001		p<0.001		p<0.001	
Postnatal check	Yes	41(36.9%)	70(63.1%)	48 (43.2%)	63 (56.8%)	16 (14.4%)	95 (85.6%)
	No	20(50.0%)	20(50.0%)	30 (75.0%)	10 (25.0%)	19 (47.5%)	21 (52.5%)
		p=0.149		p=0.001		p<0.001	
Breast milk intake	<6 months	47(81.0%)	11(19.0%)	50(86.2%)	8(13.8%)	23 (39.7%)	35 (60.3%)
	≥breastfeeding for 6 months and counting	14(15.1%)	79(84.9%)	28 (30.1%)	65 (69.9%)	12 (12.9%)	81 (87.1%)
		p<0.001		p<0.001		p<0.001	
History of diarrhea in the past 6 months	Yes	37(71.2%)	15(28.8%)	44(84.6%)	8(15.4%)	29 (55.8%)	23 (44.2%)
	No	24(24.2%)	75(75.8%)	34 (34.3%)	65 (65.7%)	6(6.1%)	93(93.9%)
		p<0.001		p<0.001		p<0.001	
Admission to a health institution in the last month	Yes	26(70.3%)	11(29.7%)	32(86.5%)	5(13.5%)	23 (62.2%)	14 (37.8%)
	No	35(30.7%)	79(69.3%)	46 (40.4%)	68 (59.6%)	12(10.5%)	102(89.5%)
		p<0.001		p<0.001		p<0.001	
Fully vaccinated	Yes	25(22.9%)	84(77.1%)	42 (38.5%)	67 (61.5%)	17 (15.6%)	92 (84.4%)
	No	36(85.7%)	6(14.3%)	36(85.7%)	6(14.3%)	18 (42.9%)	24 (57.1%)
		p<0.001		p<0.001		p<0.001	

Table 4. Multivariate logistic regression analysis of factors associated with malnutrition types in children under five

Variables	Stunting OR (95% CI)	Underweight OR (95% CI)	Wasting OR (95% CI)
Longevity of Breast Milk Intake			
≥being breastfed for 6 months and counting	1.0	1.0	1.0
<6 months	5.90(1.64-21.20)*	7.26(1.85-28.37)*	2.25(0.63-8.02)
Child's gender			
Boy	1.0	1.0	1.0
Girl	5.57(1.70-18.16)*	0.53(0.17-1.64)	0.38(0.10-1.41)
Birth spacing			
≥2 years	1.0	1.0	1.0
<2 years	1.25(0.33-4.75)	0.70(0.19-2.58)	4.48(0.83-24.10)
Fully vaccinated			
Yes	1.0	1.0	1.0
No	7.22(1.83-28.47)*	3.60(1.00-12.90)*	1.74(0.47-6.41)
History of diarrhea in the past 6 months			
Yes	4.65(1.33-16.24)*	4.84(1.44-16.27)*	4.48(1.34-14.97)*
No	1.0	1.0	1.0
Prenatal check			
Yes	1.0	1.0	1.0
No	2.85(0.63-12.98)	7.51(1.71-12.88)*	3.62(1.04-12.55)*

OR: Odds ratio CI: Confidence interval *Significant at $p<0.05$.

DISCUSSION

Unfortunately, the prevalence of chronic malnutrition among the children included in the study was high. The study revealed that a history of diarrhoea, the child's gender, prenatal care, vaccinations and breastfeeding were all associated with malnutrition. According to a report published by UNICEF and the WHO in 2019, 21.9% of children under 5 years of age were stunted. The results of the Turkey Demographic and Health Survey (TDHS-2018) revealed that 10.6% of children under five years of age were stunted, with 1.5% being severely stunted[17]. The study's results revealed that the prevalence of malnutrition among the children of seasonal agricultural workers was higher than Turkey's aforementioned figures (21.8%).

This study showed that there is a significant correlation between the educational background of parents and the nutritional status of their children. This is because, as reported by Ugochukwu et al., well-educated parents are more informed about their children's health and tend to take better care of them[18]. Similarly, studies conducted in Bangladesh and India revealed an increased risk of wasting in children associated with low levels of parental education[19,20]. Therefore, our study's finding that the prevalence of malnutrition in children under five increases with low parental education levels is consistent with existing literature and highlights the connection between education and health.

The children of seasonal agricultural workers are more likely to suffer from diarrhoea than other children due to the poor and unhygienic living conditions on agricultural land[21]. The prevalence of intestinal parasites among migrant agricultural workers is estimated to range from 20% to 80%[21,22,23]. In the absence of regular restrooms, children of irregular migrant agricultural workers are more likely to defecate outdoors. This contaminates the land and consequently infects it with intestinal parasites. It was found that 34.4% of the children included in the study had experienced diarrhoea in the last six months. Additionally, malnutrition was found to be more prevalent in children who had experienced diarrhoea in the last month. Malnourished children have weakened immune systems, so they are at increased risk of prolonged and severe diarrhoea, which further impairs nutrient absorption and deepens existing deficiencies. This demonstrates a cyclical and mutually reinforcing relationship between diarrhoea and malnutrition[24,25]. Studies have shown that frequent diarrhoea, particularly during the first two years of life, can result in permanent growth and developmental issues. The consequences are not just physical, but can also affect cognitive function

and learning capacity[25,26]. Reducing malnutrition is also critical for lowering the mortality and morbidity rates associated with diarrhoea. Clearly, malnutrition and infection are interrelated and overlapping conditions. It is a vicious cycle in which infection accelerates malnutrition and malnutrition increases the risk of infection. The reason for this increased susceptibility is immune system dysfunction[27].

Various studies have been conducted on gender and malnutrition, with different results. Some studies have reported that it is more common in boys[28,29,30], while others have reported that it is more common in girls[31,32,33]. Our study revealed that girls were more likely to be stunted. Traditional structures delay the adoption of a gender-based perspective. In other words, we found that, in societies with poor socio-cultural aspects, the nutrition of girls was still not considered as important as that of boys.

Our study revealed that 38.4% of children were no longer being breastfed by six months of age. We believe this increased the prevalence of malnutrition. Another study reported that 25% of children stop breastfeeding by 6 months, compared to 40.7% by 9 months[28]. This means that our study reported a higher prevalence rate of mothers stopping breastfeeding by six months than other studies (38.4%). Breast milk is the best source of nutrition for infants, so the prevalence of malnutrition is expected to be higher among those who are deprived of it. Various studies report that the duration of breastfeeding is significantly associated with malnutrition[34]. Studies have shown that breastfeeding plays a key role in preventing malnutrition. In the Eastern Mediterranean Region, the rate of exclusive breastfeeding in the first six months remains low at 30.9%, which is directly associated with the frequency of malnutrition in the region. Inadequate breastfeeding practices increase the prevalence of types of malnutrition such as stunting, wasting and being underweight[35]. This study corroborates previous research and demonstrates that breastfeeding not only meets an infant's immediate nutritional requirements, but also plays a protective role in terms of their long-term growth and development.

According to our country's vaccination calendar, 27.8% of the children in this study had incomplete vaccinations. Children with incomplete vaccinations were also 7.22 times more likely to be stunted and 3.60 times more likely to be underweight than those with complete vaccinations. In Turkey, the Ministry of Health provides all childhood vaccines, including those for polio, measles, rubella and mumps, to refugee children in and outside camps[36]. However, some children may not have been fully vaccinated for various reasons, such as parents refusing to have their children vaccinated, seasonal agricultural workers constantly moving from place to place with their children, and health workers being unable to locate children in tented areas. Ryoko Sato's study[37] found that increasing vaccination rates among Nigerian children significantly reduced the risk of stunting. Vaccination improves long-term nutritional outcomes by preventing infectious diseases. The same study found that receiving the BCG and measles vaccines significantly reduced the rate of stunting, particularly among children aged 24–36 months. However, it was stated that vaccines do not directly affect malnutrition, but provide indirect protection by strengthening the immune system[37]. Gamal et al.'s research in Egypt concluded that incomplete vaccination increases the risk of mortality in malnourished children[38]. Vaccination is indispensable for the healthy growth of children. Increasing vaccination rates is crucial for improving public health and positively affecting nutritional outcomes.

Our study revealed that 28.5% of mothers did not receive any healthcare during pregnancy. A lack of access to healthcare during this critical period for growth and development can lead to malnutrition in the future. As expected, malnutrition was more prevalent in children whose mothers did not receive prenatal healthcare. Another study found that a lack of prenatal care was associated with higher mortality rates in cases of malnutrition. It was concluded that inadequate prenatal care increases the risk of postnatal malnutrition and negatively affects the general health of children[38]. The study conducted by Ermiati et al. emphasised the importance of effective collaboration between healthcare professionals in the management of malnutrition. In particular, the study states that increasing nutrition education during pregnancy and training health professionals in this process could reduce future rates of childhood malnutrition. The study also revealed that inadequate interventions and training during the critical prenatal period can lead to long-term malnutrition[39]. This finding is consistent with the results of our study, which showed that inadequate prenatal care negatively affects the nutritional status of children. It is also evident that inadequate vaccination, a lack of prenatal care, poor nutrition and a low level of

maternal education are interrelated and warrant further examination in future studies.

The study's limitations include its cross-sectional design which prevents establishing causal relationships, potential selection bias due to the convenience sampling method used in specific agricultural regions of Adana, possible recall bias in maternal reporting of feeding practices and health history, and the lack of a control group from the general population for direct comparison of malnutrition prevalence rates.

The fact that 21% of participants had migrated from other cities within the country and 67% had migrated from Syria showed that the majority of seasonal agricultural workers were migrants. Therefore, the findings of this study are important due to factors such as migrants' inadequate access to health services, the unregistered employment of seasonal agricultural workers and their poor living conditions.

According to the results of this study, the prevalence of moderate/severe stunting, underweight and wasting among the participants of the study were 40.4%, 51.7% and 23.2% respectively. Moreover, history of diarrhea, breastfeeding for less than six months, incomplete vaccination and lack of prenatal care were associated with malnutrition. Access to health services is important between the ages of 0-5, a period in which growth and development must be closely monitored. In addition to public awareness on this issue, the population at risk must be monitored by health authorities.

Future research should employ longitudinal study designs to establish causal relationships between identified risk factors and malnutrition outcomes in seasonal agricultural workers' children, while incorporating control groups from both settled rural and urban populations to provide comparative baseline data. Multi-center studies across different geographical regions and agricultural seasons would enhance the generalizability of findings and capture seasonal variations in nutritional status. Qualitative research exploring cultural beliefs, feeding practices, and barriers to healthcare access from the perspectives of seasonal agricultural worker families would provide deeper insights into contextual factors influencing child nutrition.

Author Contributions: Concept/Design : DY, FT; Data acquisition: DY; Data analysis and interpretation: DY; Drafting manuscript: DY; Critical revision of manuscript: FT; Final approval and accountability: DY, FT; Technical or material support: DY; Supervision: FT; Securing funding (if available): n/a.

Ethical Approval: Ethical approval was obtained from the Çukurova University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee with the decision number 80/20 dated 31.08.2018. Verbal informed consent was also obtained from each respondent. Participants with undernutrition were referred to health institutions and organizations working on nutrition.
Peer-review: Externally peer-reviewed.
Conflict of Interest: The authors report there are no competing interests to declare.
Financial Disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
Acknowledgement: Presented as a poster presentation at the 5th International and 23rd National Public Health Congress on 13-18 December 2021.

REFERENCES

1. Guler C, Akin L. Public Health Basics. Ankara, Hacettepe University Publications. 2015;412-418.
2. UNİCEF. Child malnutrition, 2023. https://data.unicef.org/topic/nutrition/malnutrition/ (accessed April 2025).
3. WHO. WHO Guideline for Complementary Feeding of Infants and Young Children 6-23 Months of Age. Geneva, World Health Organization, 2023.
4. WHO. WHO Guideline On the Prevention and Management of Wasting and Nutritional Edema (Acute Malnutrition) in Infants and Children Under 5 Years. Geneva, World Health Organization. 2024.
5. UNICEF. Food Security and Nutrition in The World, 2024. https://openknowledge.fao.org/server/api/core/bitstreams/d5be2ffc-f191-411c-9fee-bb737411576d/content (accessed March 2025).
6. Tette EM, Sifah EK, Nartey ET. Factors affecting malnutrition in children and the uptake of interventions to prevent the condition. BMC Pediatr. 2015;15:1-11.
7. International Labor Organisation. Employment by sector, 2024. http://www.ilo.org/ilostat (accessed March 2025).
8. Selek Oz C, Bulut E. Mevsimlik tarım işçilerinin türk hukuk sistemi içerisindeki yeri. Çalışma Dünyası Dergisi. 2013;1:94-111.
9. Karaman K, Yılmaz AS. Mevsimlik tarım işçileri ve enformel ilişkiler ağı: giresun'da çalışan mevsimlik tarım işçileri üzerine bir araştırma. Zeitschrift für die Welt der Türken. 2011;3:211-26.
10. Bayraktar S. Adana İli Mevsimlik Gezici Tarım İşçilerinin Mevcut Durumu ve İhtiyaçları Raporu. Adana, Kalkınma Ajansı, 2019.
11. Tezcan S, Ertan A, Aslan D. Evaluation of malnutrition status in children under five years of age. Turk J Med Sci. 2003;23:420-29.
12. Waly MI. Nutrition assessment of preschool children using z-score analysis. Can J Clin Nutr. 2014;2:50-59.
13. World Health Organization. Child Growth Standards, 2009. Geneva, World Health Organization. 2009.
14. UNICEF. Types of undernutrition: Growth failure – Acute malnutrition, 2023.

https://www.unicef.org/nutrition/training/2.3/13.html (accessed Dec 2024).
15. World Health Organization. WHO Child Growth Standards: Length/Height-For-Age, Weight-For-Age, Weight-For-Length, Weight-For-Height and Body Mass Index-For-Age. Geneva, World Health Organization, 2006.
16. Olack B, Burke H, Cosmas L, Bamrah S, Dooling K, Feikin DR et al. Nutritional status of under-five children living in an informal urban settlement in Nairobi, Kenya. J Health Popul Nutr. 2011;29:357-63.
17. Hacettepe University Institute of Population Studies. 2018 Turkey Demographic and Health Survey. Ankara, Hacettepe University Institute of Population Studies, 2019.
18. Ugochukwu EF, Onubogu CU, Edokwe ES, Okeke KN. Nutritional contents of lunch packs of primary school children in Nnewi, Nigeria. Ann Med Health Sci Res. 2014;4:108-14.
19. Islam MM, Kibria NMSJ, Kumar S, Roy DC, Karim MR. Prediction of undernutrition and identification of its influencing predictors among under-five children in Bangladesh using explainable machine learning algorithms. PloS one. 2024;19:22.
20. Meshram II, Arlappa N, Balakrishna N, Rao KM, Laxmaiah A, Brahmam GNV. Trends in the prevalence of undernutrition, nutrient and food intake and predictors of undernutrition among under five year tribal children in India. Asia Pac J Clin Nutr. 2012;21:568-76.
21. Koruk İ, Simsek Z, Tekin Koruk S, Doni N, Gürses G. Intestinal parasites, nutritional status and physchomotor development delay in migratory farm worker's children. Child Care Health Dev. 2010;36:888-94.
22. Simsek Z, Koruk İ, Yentur Doni N. An operational study on implementation of mobile primary healthcare services for seasonal migratory farm workers. Matern Child Health J. 2012;16:1906-12.
23. Halidi AG, Yaran K, Aydemir S, Ekici A, Dilbilir Y. Prevalence of intestinal parasites in school-age children in Turkey: A systematic review and meta-analysis. PLoS Negl Trop Dis. 2025;19:28.
24. Steinhoff MC. Interactions of diarrhea, pneumonia, and malnutrition in childhood: recent evidence from developing countries. Physiol Behav. 2018;176:139-48.
25. Manetu WM, M'masi S, Recha CW. Diarrhea disease among children under 5 years of age: a global systematic review. Open J Epidemiol. 2021;11:207-21.
26. Reiner RC, Olsen HE, Ikeda CT, Echko MM, Ballestreros KE, Manguerra H et al. Diseases, injuries, and risk factors in child and adolescent health, 1990 to 2017: findings from the global burden of diseases, injuries, and risk factors 2017 study. JAMA pediatrics. 2019;173:1-17.
27. Tripathy SK, Das S, Malik A. Vaccine and malnutrition: A narrative review. Journal of family medicine and primary care. 2023;12:1808-13.
28. Choudhary M, Sharma D, Nagar RP, Gupta BD, Nagar T, Pandita A. Clinical profile of severe acute malnutrition in Western Rajasthan: A prospective observational study from India. J Pediatr Neonatal Care. 2015;2:57.
29. Tariq AS, Naik SA, Rafiq AW, Saleem R. Demographic, clinical profile of severe acute malnutrition and our experience of nutrition rehabilitation centre at children hospital Srinagar Kashmir. Int J Contemp Pediatr. 2015;2:233-7.
30. Lal RS, Lal BS, Meena P, Kumar N. Clinico-laboratory profile and outcome of edematous severe acute malnutrition in children aged 6 months to 5 years. Int J Contemp Pediatr. 2016;3:954-59.
31. Aguayo VM, Jacob S, Badgaiyan N, Chandra P, Kumar A, Singh K et al. Providing care for children with severe acute malnutrition in India: New evidence from jharkhand. Public Health Nutr. 2014;17:206-11.
32. Kumar R, Singh J, Joshi K, Singh HP, Bijesh S. Co-morbidities in hospitalized children with severe acute malnutrition. Indian Pediatr. 2014;51:125-7.
33. Shah RH, Javdekar BB. Management of children with severe acute malnutrition: Experience of nutrition rehabilitation centre at Baroda, Gujarat. Int J Contemp Pediatr. 2014;1:3-6.
34. Rasania SK, Sachdev TR. Nutritional status and feeding practices of children attending MCH centre. Indian J Community Med. 2001;26:145.
35. Ibrahim C, Bookari K, Sacre Y, Hanna-Wakim L, Hoteit M. Breastfeeding practices, infant formula use, complementary feeding and childhood malnutrition: an updated overview of the Eastern Mediterranean Landscape. Nutrients. 2022;14:4201.
36. Yekeler B, Şahin M. Göçmenlerin ülkemizdeki sağlık yüküne etkisi ve göçmenlere bakış açısı: Sağlık personeli aday örneği. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi. 2021;10:98-104.
37. Sato R. Association between uptake of selected vaccines and undernutrition among Nigerian children. Hum Vaccin Immunother. 2021;17:2630-8.
38. Gamal Y, Mahmoud AO, Mohamed SA, Mohamed J, Raheem YFA. Prevalence and impact of malnutrition on outcomes and mortality of under-five years children with pneumonia: A study from Upper Egypt. Eur J Paediatr. 2023;182:4583-93.
39. Ermiati E, Ardianti AS, Azizatunnisa AZ, Sihemran KK. The role of nurses and midwives in handling malnutrition among pregnant women and children: a scoping review. J Nurs Care. 2024;7:151-60.