

Wasting and Its Associated Nutritional and Non-Nutritional Factors among Under-Five Children in Marrakesh Province, Morocco

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Keywords

Wasting · Under-five children · Predictive factors · Marrakesh · Morocco

Abstract

Introduction: Malnutrition is the most common nutritional disorder in developing countries and it remains one of the most common causes of morbidity and mortality among children worldwide. Therefore, the current study aimed to assess the prevalence of wasting and its associated factors among under-five children in Marrakesh province in Morocco. **Method:** A community-based cross-sectional study design was used to determine the prevalence of wasting and its associated factors among under-5 years old children. A structured questionnaire was used to collect data from 430 children paired with their mothers. Anthropometric measurements and determinant factors were collected. SPSS version 19.0 statistical software was used for analysis. Multivariate logistic regression analysis was conducted to identify factors associated to the wasting of the children. Statistical association was declared significant if *p* value was less than 0.05. **Results:** In this study, the prevalence of wasting was 9.3%. The proportions of severe and moderate

wasting children were 6.5% and 2.8%, respectively. Higher odds of wasting children among illiterate mothers were 17 times more likely compared with mothers with high levels (ORa = 17.17; 95% CI: 1.01–13.70). In line with this, the odds of wasting children among lower household incomes were 13 times more likely when compared to those with higher household incomes (ORa = 13.114; 95% CI: 1.13–7.60). Similarly, the odds of wasting children among mothers primiparous were 12 times more likely compared with multiparous (ORa = 12.88; 95% CI: 1.04–4.08). The odds of wasting children were more observed among children who did not benefit from exclusive breastfeeding (ORa = 12.297; 95% CI: 2.47–13.03, 1.03–5.34). **Conclusions:** The current study showed that the prevalence of wasting among under-five children in Marrakesh province was relatively common. Mother's education level, household income, parity, and exclusive breastfeeding were significantly associated with wasting. Therefore, nutritional educational intervention programs in Marrakesh province should focus on these factors.

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Malnutrição aguda e fatores associados, nutricionais e não nutricionais, entre crianças menores de cinco anos na província de Marrakech, Marrocos

Palavras Chave

Malnutrição severa · Menores de cinco anos · Fatores preditores · Marrakech · Marrocos

Resumo

Introdução: A malnutrição aguda é o distúrbio nutricional mais comum nos países em desenvolvimento e continua a ser uma das principais causas de morbidade e mortalidade entre crianças em todo o mundo. Assim, o objetivo deste estudo foi avaliar a prevalência de desnutrição e os fatores associados entre crianças menores de cinco anos na província de Marrakech, no Marrocos.

Método: Foi efetuado um desenho de estudo transversal comunitário para determinar a prevalência de malnutrição aguda e os fatores associados entre crianças menores de cinco anos. Utilizou-se um questionário estruturado para recolher dados de 430 crianças, juntamente com as mães. Foram obtidas medidas antropométricas e identificados os fatores determinantes. A análise estatística foi realizada utilizando o software SPSS versão 19.0. Para identificar os fatores associados à malnutrição aguda infantil, foi conduzida uma análise de regressão logística multivariada. A associação estatística foi considerada significativa quando o valor de p foi inferior a 0,05.

Resultados: Neste estudo, a prevalência de malnutrição aguda foi de 9,3%. As proporções de crianças com malnutrição severa e moderada foram de 6,5% e 2,8%, respectivamente. A ocorrência de malnutrição severa entre filhos de mães analfabetas foi 17 vezes mais propensas em comparação com mães com maior nível de escolaridade (ORa = 17,17; IC 95%: (1,01-13,70)). Em consonância com isso, as probabilidades de desnutrição infantil entre crianças com rendimentos familiares mais baixos eram 13 vezes superiores quando comparadas com aquelas com rendimentos familiares mais elevados (ORa = 13,114; IC 95%: (1,13-7,60)). Da mesma forma, a ocorrência de desnutrição dos filhos entre mães primíparas foi 12 vezes superior em comparação com as múltiparas (ORa = 12,88; IC 95%: (1,04-4,08)). A probabilidade de desnutrição infantil foi mais observada entre as crianças que não se beneficiaram do aleitamento materno exclusivo (ORa = 12,297; IC 95%: (2,47-13,03)). 1.03-5.34)). **Conclusão:** O estudo atual mostrou que a prevalência de malnutrição severa entre crianças me-

nores de cinco anos na província de Marrakech era relativamente comum. O nível educacional da mãe, a renda familiar, a paridade e a amamentação exclusiva foram significativamente associados à malnutrição. Portanto, o programa de intervenção educacional nutricional na província de Marrakech deve concentrar-se nesses fatores.

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Introduction

The World Health Organization (WHO) recommends child malnutrition as one of the health indicators for health equity [1]. Stunting, wasting, and underweight are frequent anthropometric measures used to assess malnutrition in children under the age of five. Wasting is the most dangerous type of malnutrition for children. Also known as weight for height with a z-score less than minus two standard deviations from the median weight for height in the standard reference population [2, 3]. Under the age of five is a critical developmental period because it represents the transition from childhood to adolescence, spanning the ages of 0–59 months [4].

Undernutrition among children is one of the leading major public health problems throughout the world. In 2020, one in nine people were hungry or undernourished and about 49.5 million children under five were wasted worldwide. Asia and African countries contributed 69% and 27.2% of wasting, respectively [5]. Among all under-five child deaths, childhood malnutrition was responsible for 35% of deaths. More than 2 million children die each year as a result of undernutrition before the age of 5 years [6].

The causes of malnutrition are numerous and multifaceted in which causes are intertwined with each other and are hierarchically related. Poor food and sickness are the immediate determinants, which are caused by a number of underlying factors, including household food security, maternal/childcare practices, access to health-care, and a healthy environment. The basic socioeconomic and political situations have an impact on these underlying factors [7]. Diseases with an environmental component, such as those spread by insect or protozoan vectors, or those induced by a micronutrient-deficient environment, plainly impact nutritional health [2].

In Morocco, literature on wasting children is scarce, except for data from World Bank, which has shown that wasting persists among children under five (5% wasting) [8]. Indeed, determining the magnitude and identifying the risk factors for child undernutrition in the study area is important to guide public health planners, policy-makers, and implementers to plan and design appropriate intervention strategies in order to enhance nutritional status of children. Therefore, this study was conducted to estimate the prevalence of wasting and its associated factors among children under the age of five in the Marrakesh province, Morocco.

Methods

Study Area

This study was conducted in Marrakesh, Morocco. According to data from the Moroccan General Census of Population and Housing of 2014, Marrakesh is home to a population of approximately 1,330,468 residents. It has been estimated that around 12.5% of the population consists of children under the age of five within the region [9, 10].

Research Design

A community-based cross-sectional study was conducted from January to December 2020 in Marrakesh.

Data Collection Tool and Procedures

A pretested, structured questionnaire was used to collect data. Five data collectors (clinical nurses) and two supervisors (pediatrician physicians) were recruited for the task. To maintain consistency, the questionnaire was first translated from French to Arabic, the native language of the study area. It contains socio-demographic, environmental characteristics and healthcare conditions. Women were recruited from health centers that were selected based on the following criteria: accessibility to our field team and large attendance of women enough to cover the required number for the study age range.

The anthropometric data were collected using the procedure stipulated by the WHO (2006) for taking anthropometric measurements. Before taking anthropometric data for children, their age should first be determined to ensure the study population. The child's age was interviewed by the mother and confirmed by using a birth certificate or vaccination cards.

Weight was measured by an electronic digital weight scale with minimum/lightly/clothing and no shoes. Calibration was done before weighing every child by setting it to zero [11].

The length of children aged up to 24 months was estimated without shoes, and the height was read to the nearest 0.1 cm by using a horizontal wooden length board with the infant in a recumbent position. However, for children aged 24 months and above, we measured their height using a vertical wooden board. The child was positioned upright in the center of the measuring board, ensuring that their head, shoulders, buttocks, knees, and heels made contact with the board [12]. Anthropometric-related data of a child were transferred to the ENA/SMART software

Table 1. Socio-demographic and -economic characteristics of the sample (province of Marrakesh, Morocco, 2020)

Characteristics	Total, <i>n</i> = 430	Percentage, %
Mother's age-groups, years		
19–24	98	22.8
25–29	96	22.3
30–34	116	27.0
35–39	85	19.8
40 and above	35	8.1
Mother's professional activity		
Housewife	398	92.6
Paid worker	32	7.4
Mother's educational level		
Illiterate	199	48.1
Primary school	143	34.5
Secondary school	44	10.6
Higher education	28	6.8
Husband educational level		
Illiterate	124	30.2
Primary school	155	37.8
Secondary school	55	13.5
Higher education	76	18.5
Household income		
Lower	97	22.6
Medium	262	60.9
Higher	71	16.5
Household size		
≤3	206	47.9
4–6	184	42.8
>6	40	9.3

version 2012 and the Z-score index, height-for-age Z-score, was calculated using the WHO Multicentre Growth Reference Standard.

The outcome variable was wasting (low weight-for-height). Wasting measures body mass in relation to height and describes current nutritional status. Based on the 2007 WHO growth reference, children with weight-for-height Z-scores below minus two standard deviations (-2 SD) below the mean of WHO child growth standards are considered wasted or acutely malnourished while children with Z-scores below minus three standard deviations (-3 SD) below the mean of WHO child growth standards are considered severely wasted [13, 14].

Data Processing and Analysis

Data were entered into Epi Info version 7 and exported to the Statistical Package for Social Sciences (SPSS) version 19 for analysis. Descriptive statistics, including frequencies and proportions, were computed and presented using texts and tables. The multivariate logistic regression model was carried out. The technique was a backward stepwise regression method. Finally, a *p* value of less than 0.05 in the multivariable logistic regression analysis was used to identify variables significantly associated with wasting.

Table 2. Child caring practices and maternal health service utilization (province of Marrakesh, Morocco, 2020)

Characteristics	Total, n = 430	Percentage, %
Sex of infant		
Female	194	45.1
Male	236	54.9
Birth order		
First	134	31.9
Second and above	293	68.1
Parity		
Primiparous	282	65.6
Multiparous	148	34.4
Place of birth		
Health institution	422	98.1
Home	08	1.9
Mode of delivery		
Vaginal/normal	334	77.7
Caesarian section	96	22.3

Results

Socio-Demographic and -Economic Characteristics

A total of 430 mothers were included in the study. Nearly half (45.1%) of the mothers were in the age range of 19–29 years. A total of 199 (48.1%) of the mothers and 124 (30.2%) of the fathers were illiterate. The majority (92.6%) of the mothers were housewives. One-quarter (22.6%) of the households had lower income (Table 1).

Health Service and Environment-Related Characteristics

About 236 (54.9%) of the children were male. Two-thirds (293) of the households had a second newborn or above in terms of birth order. A large proportion (65.6%) were primiparous. The vast majority (98.1%) of births occurred in health institutions. When considering the mode of delivery, 77.7% of women delivered vaginally (Table 2).

Prevalence of Wasting and Feeding Practices of Children

In this study, the prevalence of wasting was 40 (9.3%). The proportion of severe and moderate wasting children was 28 (6.5%) and 12 (2.8%), respectively.

Only about 44 (11.1%) of the children did not get the first milk (the colostrum). One-half, 229 (53.3%), of the children were on exclusive breastfeeding. About 118 (27.4%) of the mothers had supplementation during pregnancy (Table 3).

Factors Associated with Wasting among Under-Five-Aged Children

In the bivariate analysis, the mother's education level, husband's education level, household size, household income, parity, and breastfeeding were factors associated with wasting at a *p* value of less than 0.05. Consequently, these variables were subjected to multivariate logistic regression analysis, and it was noted that the mother's education level, household size, household income, parity, and breastfeeding were significantly associated with wasting at a *p* value of 0.05.

In the multivariable logistic regression analysis, we found that children of illiterate mothers had 17 times higher odds of being wasted compared to mothers with a high level of education (adjusted odds ratio [ORa] = 17.17; 95% confidence interval [CI]: 1.01–13.70). Similarly, children from households with lower income had 13 times higher odds of wasting compared to those from higher income households (ORa = 13.114; 95% CI: 1.13–7.60). Furthermore, the odds of wasting were 12 times higher among primiparous mothers compared to multiparous mothers (ORa = 12.88; 95% CI: 1.04–4.08). Additionally, children who did not benefit from exclusive breastfeeding had significantly higher odds of wasting (ORa = 12.297; 95% CI: 2.47–13.03) (see Table 4).

Discussion

In this study, the prevalence of wasting was 9.3%, which is higher when compared to the overall pooled prevalence of wasting among children under five in North Africa (6.6%) [15]. This could be related to differences in study area, socio-economic features, health service delivery, and study location. The prevalence of wasting observed in our study was comparatively lower than that reported in findings overseas, for instance, in African nations such as in the Sahel region of Burkina Faso (25%) [16], Ethiopia (11.5%) [17], and Sudan (14.1%) [18]. Out of the variables that showed significant associations with wasting, educational mothers' level, household income, parity, and exclusive breastfeeding were noted.

As supported by other studies, maternal education was found to be significantly associated with wasting [19]. Indeed, in our study, higher odds of wasting children among illiterate mothers were 17 times more likely compared with mothers with high levels (ORa = 17.17; 95% CI: 1.01–13.70). It is argued that educated mothers have higher nutritional knowledge, which in turn contributed to child feeding practices of mothers and finally

Table 3. Nutritional status and feeding-related practices (province of Marrakesh, Morocco, 2020)

Characteristics	Total, <i>n</i> = 430	Percentage, %
Feeding		
Exclusive breastfeeding	229	53.3
Formula	20	4.7
Combination of formula and breastfeeding	181	42
Colostrum's feeding		
Yes	352	88.9
No	44	11.1
Timely initiation of breastfeeding within 1 h		
Yes	340	79.1
No	90	20.9
Supplementation during pregnancy		
Yes	118	27.4
No	312	72.6
Wasting (WHZ)		
Normal, $\geq -2SD$	390	90.7
Moderate, $\geq -3 < -2SD$	28	6.5
Severe, $< -3SD$	12	2.8
Overall wasting, $< -2SD$	40	9.3
Underweight (WAZ)		
Stunting (HAZ)	46	10.7
Complementary feeding started		
<6 months	92	26.5
At 6 months	210	60.5
6–7 months	08	02.3
>7 months	37	10.7

helped them to have well-nourished children but mothers with no formal education did not [20]. It is expected that when the level of maternal education is improved, all types of childcare practices could improve including child feeding practices. Moreover, educated mothers can change traditional beliefs like disease causation, improve breastfeeding, attitudes, and practices, and more easily apply the information they get from different intervention programs [21].

In the present study, the odds of wasting children among lower household income were 13 times more likely compared to those with higher household income (ORa = 13.114; 95% CI: 1.13–7.60). In line with this, children born in the poorest and poorer households were at higher odds of being wasted as compared to wealthier households across all children under 5 years. A research in 35 LMICs found a high prevalence of wasting in children in the poorest households [22]. Research in South-East Asia suggests that children from the poorest wealth quintiles had 25% increased risk of being wasted when compared to the richest wealth quintile [23]. Households with low income tend to spend less on proper nutrition and are more susceptible to growth failure due

to poor access to sufficient food of adequate quality and poor living conditions.

In our study, the odds of wasting children among mothers primiparous were 13 times more likely compared with multiparous. This finding could be explained by the fact that primiparous mothers do not have enough experience with child nutrition.

The current study showed that one of the important predictors of wasting was exclusive breastfeeding. Children who were not breastfed for at least 6 months exclusively were more likely to get wasted. This finding is supported by those of many studies in the world [24–27]. The likely explanation for this result is that for children whose digestive and immune systems are not yet mature, inappropriate timing for providing complimentary food will affect their nutritional status. The provision of food supplements may be a significant cause of malnutrition, particularly under unhygienic conditions [27].

The study identified several variables significantly associated with wasting, including maternal education, household income, parity, and exclusive breastfeeding. Maternal education was found to be a significant factor associated with wasting. The study revealed that

Table 4. Factors associated with wasting among under-five-aged children (province of Marrakesh, Morocco, 2020)

Variables	WHZ		χ^2 test	Multivariate analysis		
	wasted, <i>n</i> (%)	not wasted, <i>n</i> (%)	<i>p</i> value	adjusted OR (95% CI)	<i>p</i> value	
Mother's age-groups, years						
19–24	08 (8.2)	90 (91.8)	0.791	–	–	
25–29	08 (8.3)	88 (91.7)				
30 and above	24 (10.2)	212 (89.8)				
Educational level						
Illiterate	28 (14.1)	171 (85.9)	0.006*	17.17 (1.01–13.70)	0.004*	
Primary school	12 (8.4)	131 (91.6)		2.11 (0.826–5.626)		0.146
Secondary school	0 (0.0)	44 (100.0)		1.932 (0.835–4.472)		0.124
Higher education	0 (0.0)	28 (100.0)		1		
Mother's professional activity						
Housewife	40 (10.1)	358 (89.9)	0.060	–	–	
Paid worker	0 (0.0)	32 (100.0)				
Husband educational level						
Illiterate	8 (6.5)	116 (93.5)	<0.001*	0.342 (0.32–4.24)	0.289	
Primary school	28 (18.1)	127 (81.9)		0.035 (0.18–3.27)	0.699	
Secondary school	0 (0.0)	55 (100.0)		1.214 (0.43–2.80)	0.636	
Higher education	0 (0.0)	76 (100.0)		1		
Household size						
≤3	8 (3.9)	198 (96.1)	0.008*	3.114 (0.13–1.30)	0.385	
4–6	32 (17.4)	152 (82.6)		4.88 (0.25–1.80)	0.435	
>6	0 (0.0)	40 (100.0)		1		
Household income						
Lower	20 (20.6)	77 (79.4)	<0.001*	13.114 (1.13–7.60)	0.001*	
Medium	16 (6.1)	246 (93.9)		0.2 (0.10–5.08)		0.236
Higher	04 (5.6)	67 (94.4)		1		
Birth order						
First	08 (5.8)	129 (94.2)	0.091	–	–	
Second and above	32 (10.9)	180 (89.1)				
Parity						
Primiparous	20 (7.1)	262 (92.9)	0.029*	12.88 (1.044.08)	<0.001	
Multiparous	20 (13.5)	128 (86.5)		1		
Place of birth						
Health institution	40 (9.5)	382 (90.5)	0.361	–	–	
Home	0 (0.0)	08 (100)				
Mode of delivery						
Vaginal/normal	32 (9.6)	302 (90.4)	0.711	–	–	
Caesarian section	08 (8.3)	88 (91.7)				
Feeding						
Exclusive breastfeeding	12 (5.2)	217 (94.8)	0.005*	0.203 (0.60–508)	0.553	
Combination of formula and breastfeeding	24 (13.3)	157 (86.7)		12.297 (2.47–13.03)	0.001*	
Formula	04 (20.0)	16 (80.0)		1		
Timely initiation of breastfeeding within 1 h						
Yes	104 (32.9)	212 (67.1)	0.373	–	–	
No	32 (38.1)	52 (61.9)				
Supplementation during pregnancy						
No	16 (13.6)	102 (86.4)	0.062	–	–	
Yes	24 (7.7)	288 (92.3)				

Table 4 (continued)

Variables	WHZ		χ^2 test	Multivariate analysis	
	wasted, <i>n</i> (%)	not wasted, <i>n</i> (%)	<i>p</i> value	adjusted OR (95% CI)	<i>p</i> value
Complementary feeding started					
<6 months	08 (8.7)	84 (91.3)	0.807	–	–
At 6 months	20 (9.5)	190 (90.5)			
6–7 months	0 (0.0)	08 (100.0)			
>7 months	04 (10.8)	33 (89.2)			

*Statistically significant at *p* value <0.05.

children of illiterate mothers had 17 times higher odds of experiencing wasting compared to children of highly educated mothers. This finding highlights the crucial role of maternal education in child nutrition. Educated mothers are more likely to possess nutritional knowledge, leading to better child feeding practices. Education can also facilitate the adoption of modern healthcare practices and influence traditional beliefs, ultimately improving child nutrition.

The study found that children from lower-income households had 13 times higher odds of experiencing wasting compared to those from higher-income households. This aligns with research in various settings, which consistently demonstrates the link between poverty and child malnutrition. Lower-income households often struggle to afford proper nutrition and may have limited access to high-quality food, leading to a higher risk of growth failure among children.

The study observed that children of primiparous mothers had 13 times higher odds of wasting compared to those of multiparous mothers. This suggests that mothers with more child-rearing experience may have better child nutrition practices. Primiparous mothers might benefit from additional support and education to improve their knowledge and skills in child nutrition.

The study emphasized the significance of exclusive breastfeeding in preventing wasting. Children who were not exclusively breastfed for at least 6 months had a higher likelihood of experiencing wasting. Inadequate timing for introducing complementary foods can negatively impact child nutrition, particularly for infants with immature digestive and immune systems. It is essential to promote proper feeding practices and the hygienic introduction of complementary foods to prevent malnutrition in this vulnerable age-group.

These findings underscore the complex interplay of socio-economic, cultural, and maternal factors in child

nutrition. They emphasize the importance of tailored interventions targeting education, income, and feeding practices to combat childhood wasting effectively. Additionally, the study's findings align with existing research, which underscores the universality of these factors in contributing to child malnutrition worldwide.

Conclusion

According to the findings of this study, it is evident that wasting is a prevailing concern within this community. Additionally, the research has established a discernible correlation between wasting and a range of both nutrition-specific and non-nutrition-specific factors. Notably, a significant association was identified between wasting and variables such as a mother's education level, household income, parity, and the practice of exclusive breastfeeding. These results underscore the pressing need for the implementation of comprehensive, long-term interventions that focus on maternal and child nutrition. Such interventions are vital in effectively reducing wasting among children under the age of five.

Statement of Ethics

For the questionnaire, informed written consent was obtained from all parents of children after explaining the purpose of the study, the importance of their contribution, and their right to refuse participation. Given that 48% of mothers and 30.2% of fathers were illiterate, the consent process was adapted accordingly.

Specifically, for illiterate parents, the information was read aloud and explained thoroughly by trained personnel, ensuring that all participants fully understood the study before providing their consent. Their consent was then either recorded verbally or through a thumbprint, depending on the parent's preference and cultural appropriateness.

This consent procedure, including the adaptation for illiterate participants, was reviewed and approved by the Institutional Ethical Committee of the Faculty of Sciences and Techniques, Sultan Moulay Slimane University, Beni Mellal. The approval number for this process is FST/LGB/2016/14OCT./006-JAN.2017-SEPT.2017, with additional authorizations from the Maternal and Child Hospital (Ref. SAA No. 252/2020).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Author Contributions

S.E.M, K.K., M.B., F.C., and M.N. contributed to the conception and design of the study. S.E.M. wrote the first draft. S.E.M, K.K., A.C., K.B., and A.E.K. contributed to the data collection. S.E.M., K.K., A.C., K.B., A.E., F.C., and MB contributed to the analysis and interpretation of the data. S.E.M., K.K., F.C., and M.B. critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. S.E.M. and F.C. are guarantors of the paper.

Data Availability Statement

The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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