European Journal of Clinical and Experimental Medicine

ONLINE FIRST

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Article type: Original Article

Received: 9 January 2024

Accepted: 19 May 2024

Published online: 24 June 2024

eISSN: 2544-1361

Eur J Clin Exp Med

doi: 10.15584/ejcem.2024.3.30

Assessment of nutritional status in relation to socio-economic status during the COVID-19 pandemic in early childhood in Morocco

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ABSTRACT

Introduction and aim. The objective of this study is to evaluate the nutritional status of children aged 0-24 months, and analyze its association with socioeconomic status during the COVID-19 pandemic in Morocco.

Material and methods. This cross-sectional study was carried out in the outpatient health network between 2021 and 2022, by taking anthropometric measurements of children in accordance with World Health Organization standards and using a questionnaire sent to consenting mothers.

Results. 1012 children were included in this study. The prevalence of overweight was 13.3%, obesity 3.2%, wasting and severe wasting 2.7%. The study revealed that boys had a higher prevalence of overweight compared to girls (p=0.01), while girls were more likely to have a normal weight than boys (p=0.001).

Furthermore, a statistically significant association was observed between nutritional status and age in boys (p=0.003); however, malnutrition such as overweight and wasting increased after the age of 12 months in both genders. There was a significant correlation between child nutritional status, gender, and residence, but no significant association was found with parental education or household income.

Conclusion. This study suggests that it is important to develop strategies to improve socio-economic status in the aftermath of the COVID-19 pandemic.

Keywords. COVID-19 pandemic, early childhood, nutritional status, prevalence, socio-economic status

Introduction

Malnutrition, as defined by the World Food Program (WFP) refers to a condition where an individual's physical function is compromised to the extent that they are unable to sustain proper bodily processes like growth, pregnancy, lactation, physical labor, and the ability to fight off and recuperate from illnesses.[1] The World Health Organization (WHO) also defines malnutrition as the cellular discrepancy between the provision of nutrients and energy and the body's requirement for them to support growth, maintenance, and specific bodily functions.[2] Inadequate or excessive supply of essential nutrients can lead to the development of pathological conditions, including undernutrition (characterized by wasting, stunting, and being underweight), deficiencies in vitamins or minerals, as well as overweight and obesity.[3] The issue of malnutrition poses a substantial risk to the well-being of individuals and has emerged as a pressing public health concern, contributing to approximately 45% of fatalities during childhood.[4] Malnutrition in infants is a critical factor that can affect a variety of immediate and irreversible long-term developmental outcomes, including growth and cognitive development especially in the first thousand days of life - from conception until two years of age- when growth is rapid, nutrient requirements increase, and dietary diversification takes place.[3,5] Throughout the initial 1000 days, the nutritional status of children is influenced by a multitude of factors. These factors include genetics, the health and well-being of the mother before and after conception, societal norms within the community, national policies, and the socio-economic status of the household. The household socio-economic status encompasses various elements such as the level of education, employment status, income, geographic location, overcrowding, and gender. The severity of the outcome of early poor nutritional status on a child's current and future well-being is influenced by various factors such as their socio-economic environment, the quality of nutrition they receive later in life, how caregivers respond to their nutritional needs, and the type of childcare services available to them.[2,5-7] Considerable theoretical and empirical studies have established a strong connection between social determinants and the nutritional well-being of children. These studies suggest that socio-economic factors within communities significantly impact the rates of malnutrition and overall health outcomes, especially among children under the age of five, in numerous developing and underdeveloped nations.[8-10]

The latest worldwide data on malnutrition estimates from the collaboration between United Nations International Children's Emergency Fund (UNICEF), World Health Organization (WHO), and the World Bank Group show that for children under 5 years of age: 21% are stunted, about 7% are wasted and almost 6% are overweight.[11] Moreover, from 2000 to 2017, there was an increase in the prevalence of stunted children under the age of 5 from 50.6 million to 58.7 million, while the number of overweight children in the same age group rose from 6.6 million in 2000 to 9.7 million in 2017.[12] In addition, a study based on data collected in 10 African countries as part of the Demographic and Health Surveys (DHS) program between 2015 and 2019 on malnutrition among under-Five Children revealed that across the 10, the total average prevalence of stunting was 11.6%, the total average for wasting was 1.4% and the overweight total average was 4.9%.[13]

Undernutrition is a pathological nutritional condition that causes morbidity and mortality in children under five. Children afflicted by wasting experience compromised immunity, are vulnerable to enduring developmental impairments, and are at heightened risk of mortality, especially in cases of severe wasting. These children necessitate immediate intervention and support for survival.[14,15] Likewise, over nutrition during childhood, such as overweight and obesity, represents a crucial predictive determinant of adult obesity, resulting in significant health problems and important comorbidities. Additionally, it is estimated that overweight and obesity currently generate economic and social costs on the order of $2 trillion worldwide, with an anticipated rise in causal conditions and costs in the years following the pandemic.[14,16] However, this issue of malnutrition can be addressed by establishing robust programs supported by appropriate investments aimed at strategic interventions focused on child health, including the prevention of malnutrition, particularly during the critical 1000-day period when the risk of malnutrition is highest.[17,18]

In Morocco, as in most developing countries, malnutrition in children under five remains a public health problem, where the rates are still on the rise. This was confirmed by recent data from the 2018 National Population and Family Health Survey, which revealed that the rates of moderate and severe wasting were 2, 6% and 1.1% compared with 2.3% and 1% respectively for 2011, while overweight and obesity rates for the same age group were 10.8% and 2.9% compared with 10.7% and 2.6% respectively in 2011.[19]

In the Rabat-Salé-Kénitra region, comprising the Skhirat-Temara prefecture that has the highest projected growth rate between 2014 and 2030 (3%), the prevalence of wasting and overweight was estimated at 3.6% and 10.8% respectively among children under five.[20] However, to the best of our knowledge, no research has reported on the nutritional status or risk factors associated with children aged 0-24 months in this prefecture, despite this age group falling within the critical first 1000 days of a child's life, which is widely recognized as a crucial period for nutritional intervention. Moreover, there is extensive scientific support for the 1000-day window as a strategic timeframe for public health intervention, and giving special consideration to this pediatric population presents a unique opportunity to promote the long-term growth and well-being of children.

Aim

The aim of this study is to assess the nutritional status of infants aged 0-24 months by determining the prevalence of overweight and wasting, two dimensions of malnutrition. In addition, we seek to explore any potential association between socio-economic parameters and nutritional status in this population, particularly during the COVID-19 pandemic, which influenced the environment in which they were born and in their early days of life.

Material and methods

Study settings, design, period and population

This study is a cross-sectional descriptive study that was conducted from May 2021 to January 2022 in urban and rural health centers in the prefecture of Skhirat-Temara in Morocco, where general medicine, nursing, maternal and child health monitoring, chronic disease monitoring, youth and adolescent health monitoring including school health, health information and education services are provided. The study concerned mother and child pairs who came to the health centers to have their children immunized in accordance with the national child immunization program for children.

The research received ethical approval from the Ethics Committee for Biomedical Research of the Faculty of Medicine and Pharmacy at Mohamed V University in Rabat, Morocco (ethical approval no. C68/20 issued on 18 February 2021). Before collecting data, participants were fully informed about the study's purpose, benefits, anonymity and confidentiality guarantees during data handling and publication, as well as their right to withdraw or interrupt the interview at any time. Subsequently, oral and written consent was obtained from all participants.

Inclusion and exclusion criteria

This study included mother-child pairs residing in the Skhirat-Temara prefecture, and whose child's age was between 0 and 24 months.

It was excluded from the study the mother-infant pair whose child was born prematurely, had a history of infection or diarrhea within two weeks of the interview, had a congenital malformation or a metabolic disease influencing growth. The mother-child pair who refused to participate in the study or who had already answered the questionnaire was also excluded.

Sample size determination

To ensure that the study was representative, the population size was estimated according to the Lorenz formula developed by Cochran and Ardilly:[21,22]

$$n = \frac{z^2 \times p \times (1-p)}{m^2}$$

Where: n = sample size, z = 1.96 for a 95% confidence level, p = 13.2% estimated prevalence of childhood overweight in the region of Rabat-Salé-Kénitra, and m = the tolerated margin of sampling error (set at 5%). The necessary sample size for the results to be significantly representative was estimated at 176 participants. In the health centers, sampling was exhaustive for all mother-infant pairs who met the inclusion criteria. Our study therefore included 1012 pairs.

Data collection methods

The anthropometric data were obtained by midwives who have been trained, and informed on the objectives of the study, during face-to-face interviews with the mothers, using a structured questionnaire in Moroccan dialect, after having been tested with a dozen women to validate the comprehension of the items.

Mothers were surveyed regarding the child's age and gender, as well as socio-economic factors including the mother's age, marital status, parents' education level (categorized as illiterate, low for primary and college, medium for high school, and high for university), place of residence, parents' occupation, monthly household income defined in reference to the Moroccan guaranteed minimum Inter-professional income (SMIG) set at approximately 2800 Moroccan Dirhams (MAD) or $282, and medical coverage.

Subsequently, the child's anthropometric measurements were taken according to standard WHO procedures. The variables selected were:

Weight: the child was weighed using the digital baby scale, which has a maximum capacity of 20 kg. The scale was calibrated before each weighing.

Height: this measurement was carried out using a wooden measuring board with a 1.5 m metal strip graduated in millimeters, and a horizontal mobile headrest.

The measurements were taken with the minimum of clothes (nappy and underwear) and without shoes. The material used was the same throughout the survey.

The body mass index (BMI) was calculated according to the formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height}^2\ (\text{m}^2)}$$

The WHO BMI-for-age (BMI/A) reference curves for girls and boys (0-24 months) were used to calculate BMI/A z-scores, and to classify the child's corpulence into normal weight, overweight, obesity, wasting and severe wasting.

For this study, overweight was defined as a weight-for-height Z-score>2 standard deviation (SD), obesity as a weight-for-height Z-score>3SD, wasting as a weight-for-height Z-score<-2SD and severe wasting as a weight-for-height Z-score<-3SD according to WHO recommendations.[23]

Statistical analysis

The results were analyzed using the Jamovi statistical software, version 2.3.16. Quantitative variables with asymmetric distributions were expressed as median and quartile (age, weight, height and BMI of children), and compared by the Mann-Witney U test. Categorical variables were expressed as numbers and percentages, and then compared by the Chi-square test of independence or Fisher's exact test. Significance was set at a *p* value <0.05 for all statistical tests.

Results

Socio-economic characteristics of the mother-child population

Our study involved 1012 children. The analysis of socio-economic characteristics (Table 1) revealed a slight preponderance of boys (50.9%) with a male to female sex ratio of 1.04. The age distribution showed that 45.8% of the children were between 0 and 6 months old. More than half of the mothers were between 18 and 29 years old. The majority of the children lived in urban areas with married mothers in 98.5% of cases, housewives in 83.4% of cases and with more than half of the civil servant or employee fathers (54.6%). About two-third of the mothers and fathers were illiterate or had low education level (64.9% and 61.7% respectively). Around 42.1% of the children had parents with a monthly income below the guaranteed minimum wage (SMIG) set at $282 (Table 1).

Table 1. Socio-economic characteristics of the population (n=1012)

Variables	Population, n (%)	95% confidence interval (CI)
Age group of the child		
0–6 months	464 (45.8)	42.9–48.9
7–12 months	302 (29.8)	27–32.5
More than12 months	246 (24.4)	21.7–27
Gender of the child		
Male	515 (50.9)	47.5–54
Female	497 (49.1)	46–52.5
Age group of mothers		
18–29 year olds	542 (53.6)	50.5–56.4
30–40 year olds	419 (41.4)	38.6–44.4
More than 40 year olds	51 (5)	3.8–6.4
Residence		
Urban	894 (88.3)	86.3–90.2
Rural	118 (11.7)	9.8–13.7
Marital status		

Married	997 (98.5)	97.7–99.2
Not married	15 (1.5)	0.8–2.3
Mother's education level		
Illiterate	167 (16.5)	14.2–19
Low	490 (48.4)	45.3–51.3
Medium	174 (17.2)	15–19.6
High	181 (17.9)	15.7–20.2
Father's education level		
Illiterate	118 (11.7)	9.8–13.7
Low	506 (50)	47–53.2
Medium	222 (21.9)	19.4–24.4
High	166 (16.4)	14.1–18.7
Mother's occupation		
Housewife	844 (83.4)	81–85.6
Civil servant/Employee	134 (13.2)	11.3 - 15.5
Self-employed	34 (3.4)	2.3–4.5
Father's occupation		
Day laborer	178 (17.6)	15.4–20.1
Civil servant/Employee	553 (54.6)	51.4–57.7
Self-employed	268 (26.5)	23.8 - 29.2
Unemployed	13 (1.3)	0.7–2.1
Monthly household income		
<$282	426 (42.1)	38.9–45
$282–$504	369 (36.5)	33.4–39.5
>$504	217 (21.4)	19–24.1

Anthropometric data of the child population

Analysis of the children's anthropometric data presented in Table 2 showed a statistically significant difference in medians for weight ($p<0.001$), height ($p=0.009$) and BMI ($p<0.001$) compared to the child's gender.

Table 2. Anthropometric characteristics of the child population*****

Variable	**Global analysis**	**Population of children**		**p**‡
	Me [Q1-Q3]†	**n=1012**		
		Boys (n=515)	Girls (n=497)	

Age (months)	8 [3–12]	8 [3–12]	7 [3–12]	0.422
Weight (kg)	8.27 [6–9.9]	8.58 [6.3–10.3]	7.9 [5.5–9.6]	<0.001
Height (m)	0.68 [0.6–0.7]	0.69 [0.6–0.7]	0.66 [0.5–0.7]	0.009
BMI (kg/m^2)	16.91 [15.5–18.3]	17.31 [15.8–18.6]	16.77 [15.3–17.9]	<0.001

* † – values are presented in median and quartile, ‡ – Mann-Whitney U test is used, a p-value<0.05 was statistically significant

Concerning the children's corpulence, the prevalence of overweight was 16.5% (13.3% for overweight and 3.2% for obese). Boys were more overweight than girls with a significant association (*p*=0.01), and also more obese but without any significant difference (p=0.32). On the other hand, the proportion of normal weight was significantly higher in girls compared to boys (84.9% versus 76.7%; p=0.001). (Table 3).

Table 3. Distribution of the nutritional status among children according to BMI (n=1012)*

Variable	**Global analysis**	**Population of children, n (%)**		**p**
		Girls (n=497)	Boys (n=515)	
Normal weight (%)	817 (80.7)	422 (84.9)	395 (76.7)	0.001
Overweight (%)	135 (13.3)	53 (10.7)	82 (15.9)	0.01
Obesity (%)	32 (3.2)	13 (2.6)	19 (3.7)	0.32
Emaciation & severely emaciation (%)	28 (2.7)	9 (1.8)	19 (3.7)	0.06

* Chi^2 test was used, a p-value<0.05 was statistically significant

In addition, the distribution of nutritional status by age and sex of the child (Fig. 1) indicated that there is a statistically significant relationship between nutritional status and age in boys (p=0.003; Fig. 1a) and the prevalence of overweight increases progressively with age. From the age of 12 months, an increase in the prevalence of wasting reappears for both genders (3.9% for boys and 1.7% for girls) at the detriment of normal weight.

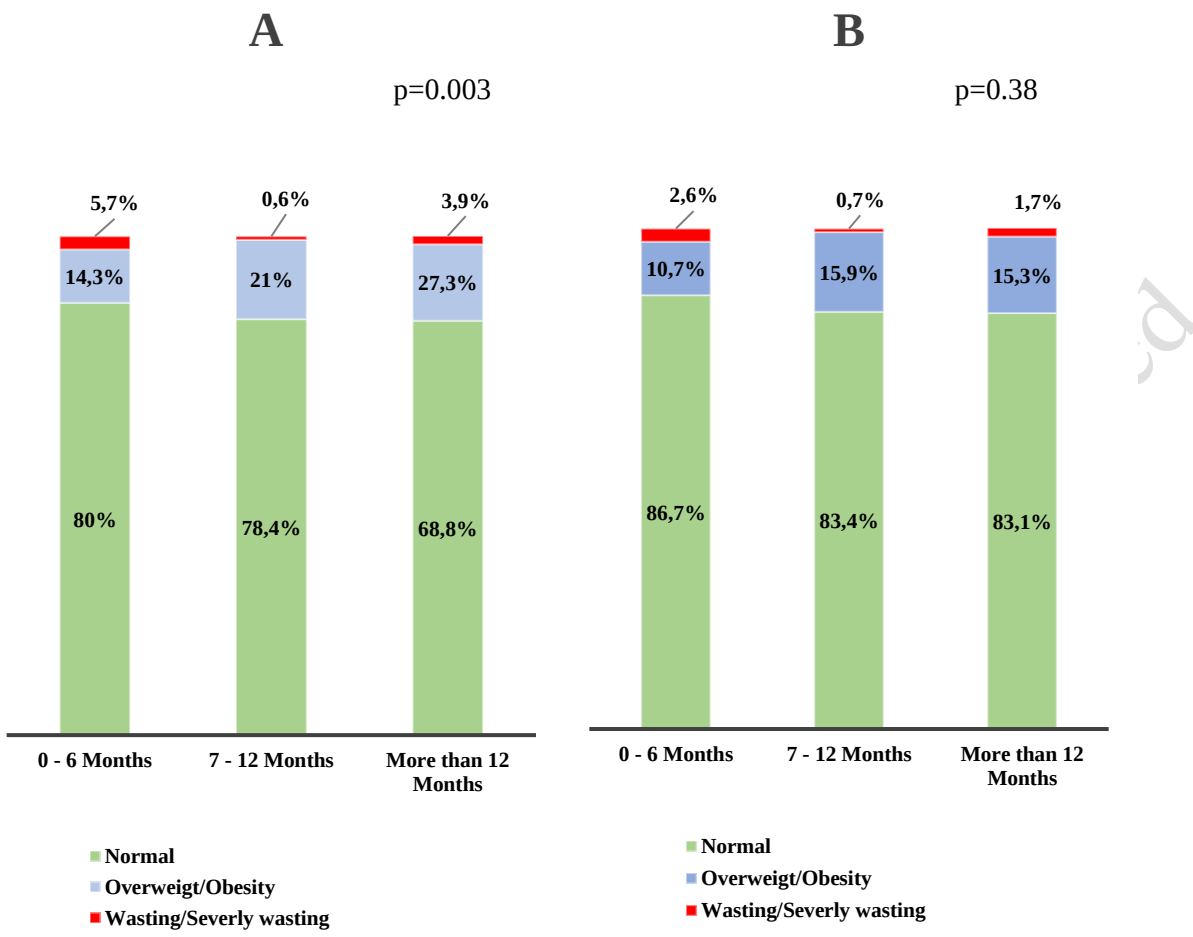

Fig. 1. Distribution of nutritional status by age and sex of the child, A: distribution for boys, B: distribution for girls

The association between the socio-economic characteristics of the population sample and the nutritional status of children

The association analysis between the socio-economic characteristics of the mother-child population and the nutritional status of the children (Table 4) revealed that more than half of overweight and obese children (65.3%) were older than six months, while 67.9% of emaciated or severely emaciated children were in their first six months of life. Indeed, a significant relationship between the child's age and nutritional status was found (p=0.001). The prevalence of overweight and obesity was significantly higher in urban children than in rural children (84.3% versus 15.7%; p=0.03). Moreover, the prevalence of overweight/obesity and wasting/severely wasting was higher in children whose monthly household income was below the SMIG, with no significant difference. However, our results did not reveal any significant association between children's nutritional status and mother's or father's level of education (p=0.26 and p=0.28 respectively).

Table 4. Distribution of the nutritional status of children according to socio-economic characteristics (n=1012)

Characteristics	Population of children			p
	Normal n=817	Overweight/Obesity n=167	Wasting/Severely wasting n=28	
Child age				
0–6 month	387 (47.3)	58 (34.7)	19 (67.9)	0.001†
7–12 month	244 (29.9)	56 (33.5)	2 (7.1)	
More than 12 month	186 (22.8)	53 (31.8)	7 (25)	
Mother's age				
18–29 old year	440 (53.9)	88 (52.7)	14 (50)	0.94‡
30–40 old year	336 (41.1)	71 (42.5)	12 (42.9)	
More than 40 old year	41 (5)	8 (4.8)	2 (7.1)	
Residence				
Urban	725 (88.7)	141 (84.3)	28 (100)	0.03‡
Rural	92 (11.3)	26 (15.7)	0 (0)	
Marital status				
Married	803 (98.3)	167 (100)	27 (96.4)	0.12‡
Not married	14 (1.7)	0 (0)	1 (3.6)	
Mother's level education				
Illiterate	136 (16.6)	25 (15)	6 (21.4)	0.26‡
Low	396 (48.5)	76 (45.5)	18 (64.3)	
Medium	142 (17.4)	31 (18.6)	1 (3.6)	
High	143 (17.5)	35 (21)	3 (10.7)	
Father's level education				
Illiterate	96 (11.7)	16 (9.6)	6 (21.4)	0.28‡
Low	405 (49.6)	84 (50.3)	17 (60.7)	
Medium	183 (22.4)	37 (22.1)	2 (7.2)	
High	133 (16.3)	30 (18)	3 (10.7)	
Mother's occupation				
Housewife	681 (83.3)	136 (81.4)	27 (96.4)	0.25‡
Employee/civil servant	111 (13.6)	22 (13.2)	1 (3.6)	
Self-employment	25 (3.1)	9 (5.4)	0 (0)	
Father's occupation				

Day laborer	144 (17.6)	24 (14.4)	10 (35.7)	0.23‡
Employee/civil servant	449 (55)	92 (55.1)	12 (42.9)	
Self-Employment	212 (25.9)	50 (29.9)	6 (21.4)	
Unemployed	12 (1.5)	1 (0.6)	0 (0)	
Monthly household income				
< $282	342 (41.9)	67 (39.8)	17 (60.7)	0.09†
$282–$504	301 (36.8)	58 (34.7)	10 (35.7)	
>$504	174 (21.3)	42 (25.1)	1 (3.6)	

***** values are presented in frequencies and percentages, † – Chi^2 test, ‡ – Fisher's exact test were used, a p-value<0.05 was statistically significant

Discussion

The present study was designed to examine the relationship between socioeconomic status and the nutritional status of children up to the age of 24 months. However, due to the lack of sufficient research on the nutritional status of children up to the age of 24 months, the comparison of the results of this study was extended to the age of 59 months. The results showed that malnutrition is a problem for the sample of children in this study. In fact, the prevalence of overweight, obesity, wasting and severe wasting were 13.3%, 3.2%, and 2.7%, respectively. These results were lower than those of the study conducted by Habibi et al among children under 24 months of age, where the prevalence of overweight, wasting and severe wasting was 22% and 4.7% respectively.[24] However, these results were similar to those reported by the Moroccan national nutrition survey of children aged 6-59 months in 2019 for wasting and severe wasting, the prevalence of which was 2.8% and remains well below the global wasting prevalence recorded in 2022 (6.8%) and the 2025 global nutrition target of reducing and maintaining wasting below 5%.[25,26] In this regard, the Ministry of Health has introduced interventions suggesting a reduction in acute malnutrition by placing nutrition at the heart of the key actions of the 2025 Health Plan, with the institutionalization of a National Nutrition Program (PNN), which sets out new ambitions in terms of prevention, care and nutritional education, to improve the nutritional status of the Moroccan population and contribute to ensuring its physical, mental and psychosocial well-being.[27] With regard to overweight and obesity, the current results are higher than those of the same study, in which the prevalence of overweight was 12.7%, indicating the persistence of nutritional problems and the emergence of weight-related disorders. Specifically, overweight and obesity are considered by the World Health Organization to be a risk factor for non-communicable diseases, meaning that greater efforts are needed to get closer to the target of 5.5% overweight prevalence set for 2025.[12,26] Also, the results of study in Turkey on children under five years indicated a lower prevalence of overweight and obesity (9%).[28] Similarly, a study conducted in Vietnam

for children under 24 months of age showed that the prevalence of overweight was 10.7%.[29] Nevertheless, the results of a study carried out in South Africa indicate a prevalence of overweight and obesity of 17.3%, higher than that reported in this study.[30] This variation may be explained by differences in environmental or individual factors of participants in different countries, such as socio-economic status, nature of the diet and perinatal background.[31] It should also be highlighted that the study was conducted during the COVID-19 pandemic where the majority of children in the study population were born, where rates of job loss and unemployment had increased and sedentary lifestyle linked to confinement was prevalent. This situation could be harmful to the development of healthy behaviors in this pediatric population and consequently contribute to the increased prevalence of childhood wasting and overweight among vulnerable families.[32]

There are conflicting reports in the literature regarding the role of gender on malnutrition. In fact, the results of the present study showed that boys are significantly more overweight than girls (p=0.01). This result is consistent with that of the previous national survey of 2019, and with other studies conducted with a majority of children ≤24 months of age.[12,33,34] However, the Nigerian study revealed no statistically significant association between nutritional status and gender.[35] This would suggest that behavioral and cultural patterns might contribute to this result.

When nutritional status was assessed by age group, it appeared that the prevalence of overweight increased continuously in boys up to the age of 24 months and in girls up to the age of 12 months, which is consistent with the results of previous surveys. Wasting was more pronounced in the first year of life in both sexes with an increase in boys than girls. This result is inversely related to age and gender in studies where the rate of wasting is higher after 12 months in girls than in boys.[36,37] In line with these results, this study found a significant relationship between nutritional status and the child's age. Therefore, prevention of malnutrition and monitoring of the nutritional status of children from 0 to 24 months of age are particularly important to ensure optimal growth and to avoid possible adverse effects in adulthood, since, this period marks the transition from milk-based to solid and diversified diets may allow malnutrition to set in.[14,36,38] This last can lead to intellectual and cognitive developmental delays and even long-term disabilities, which might affect productivity and wealth creation. Similarly, it can also lead to chronic non-communicable diseases in adulthood causing a heavy burden on health systems.[39]

Many authors have documented the impact of socio-economic status on the nutritional status of children from conception as a principal determinant of nutritional success.[36] It was generally defined as a combination of economic, social and occupational factors assessed by income or wealth, education and occupation respectively.[40] In this study, among overweight or obese children, the highest prevalence was observed among urban children, with a statistically significant difference (p=0.03; Table 4). This result is also in line with the statements of the High Commission for Planning which reported that overweight affects more urban than rural children (11.7% versus 9.7%), as well as with the results reported in other studies.[41,42] These results could be explained by the increased availability of commercialized products containing high-

energy additives in large cities, and by the replacement of breast milk by artificial milks and sweetened drinks.[43] Consequently, these highlighted the need for targeted interventions and policies to address disparities and inequalities in nutritional outcomes between different regions and populations, with the aim of promoting equitable and enhanced health for everyone.[44]

Furthermore, parental education and employment are considered to determine the wellbeing of a family and to influence health behaviors, such as specific eating habits and, knowledge and beliefs about health and nutrition.[40] According to the results of this study, the majority of children affected by wasting and severe wasting had mothers who were illiterate or had a low level of education. This is consistent with several studies that identify maternal education and maternal weaknesses such as inadequacy, inaccessibility to maternal health services, and precariousness as causal factors of nutritional disparities between regions, as well as one of the most important predictors of healthy growth and protection against child malnutrition.[34,45] In other words, considering that mothers with higher levels of education have better health-seeking behavior and are able to access and comply with written medical instructions may explain this result.[46] This implies giving particular importance to strengthening and expanding the geographical reach of healthcare policies in terms of prevention, early diagnosis of cases, and tailored treatment and follow-up for each nutritional issue. Furthermore, involving mothers through education and raising awareness about childhood malnutrition issues remains a key approach to promoting child health.

For income and wealth, studies have found that children whose families are wealthy are more affected by overweight than children whose families are poor.[29] However, the current research revealed that more than one-third of obese and overweight children, as well as 60.7% of wasted and severely wasted children, lived in households with a monthly income less than the minimum wage, while the difference was not statistically significant. This suggests that low economic status may be a risk factor for both overweight and wasting in children, and that malnutrition is prevalent throughout poor families and, low- and middle-income households in developing countries such as Morocco.[39,40,47,48]

Study limitations

The study is not free of limitations either. The first one is related to the nature of cross-sectional study, which describes relationship, and point estimates of prevalence, without any inference of causality. The second limitation could be associated with the possibility of having committed errors regarding the height measurements of the child in the lying position, which can be considered as a human error. A third limitation is that this study only explored the relationship between socio-economic status and malnutrition, although this may be influenced by other cultural and behavioral parameters of nutrition during the first 1000 days, which could be the subject of future studies.

Conclusion

The current study revealed the malnutrition problem in children up to the age of 24 months, where the prevalence of overweight, obesity, wasting and severe wasting were 13.3%, 3.2% and 2.7% respectively. In addition, the study provided significant results concerning the nutritional status of children and their socio-economic status. These results can be used not only to supplement previous studies carried out in Morocco in order to assess the epidemiological situation in relation to other countries, but also to evaluate and update the actions of the national nutrition program in relation to what remains to be improved.

Declarations

Funding

This research received no specific grant from any funding agency in the public, commercial or not- for-profit sectors.

Author contributions

Conceptualization, F.Z.B and M.O.; Methodology, M.O.; Software, A.E.H; Validation, M.O, R.R. and F.Z.L; Formal Analysis, F.Z.B, R.R; Investigation, F.Z.B; Resources, F.B; Data Curation, S.E; Writing – Original Draft Preparation, F.Z.B, F.B and F.Z.L; Writing – Review & Editing, F.Z.B; Visualization, R.R; Supervision, M.O; Project Administration, M.O.

Conflicts of interest

The others declare that they have no conflicts of interest.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval

The research received ethical approval from the Ethics Committee for Biomedical Research of the Faculty of Medicine and Pharmacy at Mohamed V University in Rabat, Morocco (ethical approval no. C68/20 issued on 18 February 2021).

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