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ORIGINAL RESEARCH

Growth evaluation of a group of children enrolled in public schools in Rabat, Morocco: the role of socioeconomic factors

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Objectives: The aim of this study was to assess the prevalence of underweight, stunting, and the socioeconomic risk factors among children enrolled in primary public schools in Rabat, Morocco.

Methods: Twenty-three schools were randomly selected. A cross-sectional study was conducted between April and June 2010. The survey was conducted on the basis of two questionnaires for both parents and children. The references used were from the World Health Organization, 2007.

Results: Our study focused on a sample of 1569 children whose average age was 9.7 ± 0.95 years. The prevalence of underweight among girls and boys was 43.1%, while that of stunting was 18.2%. The majority of the children in our population come from a low socioeconomic level. While 59% of fathers are laborers, 85% of mothers are unemployed.

Conclusion: In our study, we demonstrated that child malnutrition is strongly linked to a low socioeconomic level. These observations suggest that besides income, schooling and food quality may also be important factors that can affect growth. Educational programs, whether held in schools or informally, such as literacy or parenting classes, are valuable complements to other nutrition sustaining activities.

Keywords: underweight, stunting, malnutrition, children, low socioeconomic level

Introduction

Today, the world is facing a double malnutrition burden of both undernutrition and overnutrition. Malnutrition can affect the middle class as well as high income households of the population, but children are the most affected. Undernutrition happens when a person has both an insufficient weight and height for their age (stunting), and suffers from a vitamin and mineral deficiency (micronutrients deficiency). In industrialized countries, one in four children under 5 years of age (27%) suffers from being underweight, ie, 146 million children.[1] According to the estimations of the World Health Organization, undernutrition contributes to about one third of all child deaths.[2] This can lead to developmental delays among the young during childhood and adolescence, poor school performance, and school dropout.

Malnutrition is an issue in industrialized countries, but it is less likely to result from insufficient food than from unhealthy diets dominated by inappropriate food choices and practices, including foods containing excess dietary energy. Increasing levels of obesity are now a major public health problem in the poorer socioeconomic strata of industrialized countries, and increasingly in many developing countries also.[3] In Morocco, obesity has emerged at a time when undernutrition is still a heavy burden,

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especially among the disadvantaged groups of the population. The coexistence of over- and undernutrition cases is a real problem to the Moroccan health services that are not well prepared for such an occurrence.

The goal of this study was to analyze the anthropometric measurements of a group of children enrolled in primary public schools of Rabat, as well as the relationship between the socioeconomic level and the failure to thrive.

Materials and methods

Among the 81 primary schools from the six urban districts of the city of Rabat, 23 schools were randomly selected. The cross-sectional study was conducted between April and June 2010 in children in the fourth year of primary school. This age group was chosen for practical and physiological reasons. Indeed, at this age, children are more accessible to reasoning and are less dependent on their parents than younger children. The schools allow the majority of the children to be involved, even the most disadvantaged. They provide regular contact with children and access to parents. The survey was conducted on the basis of two questionnaires: one for the student and the other for the parents.

Field of survey and population

Rabat, the capital of Morocco, is located in the north of the country on the Atlantic Ocean. It encompasses a land area of 118 km² (45.17 square miles) and the population is around 627,000. The employment rate in this civil service city is estimated at 81%. However, in Rabat, this rate can be attributed to the emergence of relatively high industrial and economic activity. The unemployment rate is 22.5% and the city encompasses many social categories. Indeed, about 6000 families live in shanty towns and 100,000 inhabitants live in dilapidated neighborhoods and areas. An estimated 17% of the population of Rabat, for the most part, is affected by poverty, even if the majority have a job.

In 2007, 99.4% of children were enrolled in primary education in Rabat. The city has 81 public primary schools (31,305 pupils) and 63 private primary schools (14,269 pupils), ie, 68% of children attended a public school while only 32% attended a private one. All principals of the selected public primary schools were informed, through an authorization delivered by the Ministry of National Education that a survey was going to be conducted. Three survey teams of pediatricians trained for this particular project were distributed across the schools.

Survey method

To test the survey, a preliminary one was conducted on a class of a public school. Some modifications recommended by the teachers were made. The main change was to translate the questionnaire intended for the parents into Arabic, to avoid a situation where parents do not answer the questions, as most of them have a low education level. The survey included the following details.

Anthropometric measurements: girls and boys were weighed using a SECA scale (seca, Birmingham, UK). Height was measured using a wooden measuring board with a metal band of 2 meters that was graduated in millimeters, and equipped with a horizontal mobile headrest. Measurements were done without shoes and while wearing light clothing.[4] The same materials were used in all schools. The survey was conducted by pediatricians trained in measurements and who were previously made aware of the purpose of the study. Two anthropometric indicators were used:[5] (1) body mass index which corresponds to a person's weight to height ratio (in kg/m²) for the evaluation of thinness, overweight, and obesity; and (2) height for age, which was used as an indicator of moderate or severe chronic malnutrition to assess stunting. We used the reference curves for children aged between 5 and 19 years, defined in Table 1.[6]

The questions (student): The questions were filled in by a researcher with the teacher's help. They included the student identification, his/her anthropometric measurements taken in situ, as well as the transportation used to get to school.

The questions (parents): The questions were filled in by the parents. They included the child's and parent's identification and socioeconomic level, which was determined by a synthetic indicator calculated based on questions about (1) the occupation of parents; (2) education level – where parents who never attended school, or who attended Koranic or primary schools only, were considered to have a low level of education and where medium and high levels of education corresponded, respectively, to secondary education

Table 1 Reference curves for children aged between 5 and 19 years as defined by the World Health Organization[6]

Overweight	>+1 SD (equivalent to the BMI of 25 kg/m² at 19 years)
Obesity	>+2 SD (equivalent to the BMI of 30 kg/m² at 19 years)
Thinness	<–2 SD
Severe thinness	<–3 SD
Moderate chronic malnutrition	Z-score: –2 SD to 3 SD or <–2 SD
Severe chronic malnutrition	Z-score: <–3 SD

Abbreviations: BMI, body mass index; SD, standard deviations.

and higher education; and (3) monthly income, according to a study conducted in 2007 by the High Planning Commission of Morocco where a salary less than 3000 dirhams was considered to be low and it increases when the level is medium.

Other questions completed included the type of housing, dwelling occupancy status, the main substance of the soil, drinking water source, the type of house lighting, type of toilet, refuse disposal, the element of comfort in the dwelling, and consumer durable goods. The survey also included information on anthropometric measurements of the parents, and the health condition of the parents and children (diabetes, blood pressure, asthma, etc).

Statistical survey

The statistical survey results were entered using an input mask to avoid errors. Quantitative and qualitative variables were created from the data, which were coded for the statistical analysis. The statistical software used for this purpose was SPSS version 18.0 (IBM Corporation, Armonk, NY, USA). The descriptive analysis of the variables was based primarily on class size and proportions. The mean and standard deviation were used as measures of central tendency and dispersion.

Regarding the conditions, qualitative variables were compared using the Chi-square test or Fisher's exact test. The Pearson correlation test was performed to understand the relationships between quantitative variables. Means comparison of quantitative variables for different classes of a qualitative variable were performed using the Student's *t*-test for independent samples after verification of the different conditions for the test. For all statistical tests, the significance level was set at $P<0.05$.

Results

Anthropometric measurements

Our study examined 1569 children. The average age was 9.7 ± 0.95 years. Of the children studied, 13.6% were under 9 years of age (n = 214), 80% were aged between 9 and 11 years (n = 1256), and 6.4% were over 11 years of age (n = 99). Table 2 shows the main anthropometric characteristics of our population. The prevalence of underweight in girls and boys was 43.1%. The prevalence of stunting was 18.2%, and that of obesity and overweight was 8.7% (Table 3).

Socioeconomic level

Parental occupation

Of the children included in the study, 993 normal and underweight children told us their parent's profession. Of the fathers, 60% were workers, 23% of them were civil servants, and 7% were unemployed. Of the mothers, 85% were unemployed, 7% workers, and 4% civil servants. There was no significant relationship between parental occupation and an underweight condition in these children. The prevalence of stunting was higher among children whose fathers were laborers and the prevalence was less when the father was a merchant. A significant relationship is observed. (22.5% versus 11.9%, $P = 0.023$). For the mother's occupation, we observed that the prevalence of stunting was higher among children whose mothers were working and the prevalence decreased when the mother was a homemaker or a servant (23.3% versus 11.6%) (Table 4).

Table 2 Anthropometric characteristics of children according to three age brackets

Children aged less than 9 years (n = 214)	**Girls (n = 132)**	**Boys (n = 82)**	***P*-value**
Age	8.33 ± 0.33 (7.00–8.75)	8.28 ± 0.38 (7.00–8.75)	0.084
Weight (kg)	25.73 ± 5.66 (16–55)	26.43 ± 3.89 (19–40)	0.115
Height (m)	1.30 ± 0.06 (1.10–1.51)	1.31 ± 0.06 (1.21–1.47)	0.387
BMI (kg/m²)	14.97 ± 2.35 (11.07–24.77)	15.17 ± 1.68 (12.08–22.96)	0.698
Children aged between 9 and 11 years (n = 1256)	**Girls (n = 575)**	**Boys (n = 681)**	***P*-value**
Age	9.64 ± 0.90 (7.00–13.17)	9.81 ± 1.01 (7.08–14.08)	0.092
Weight (kg)	29.26 ± 7.78 (16–81)	29.11 ± 6.00 (18–62)	0.001
Height (m)	1.36 ± 0.07 (1.10–1.67)	1.36 ± 0.07 (1.20–1.73)	0.272
BMI (kg/m²)	15.65 ± 2.97 (9.69–42.53)	15.54 ± 2.21 (11.03–28.77)	0.108
Children aged over 11 years (n = 99)	**Girls (n = 60)**	**Boys (n = 39)**	***P*-value**
Age	11.71 ± 0.56 (11.08–13.17)	11.87 ± 0.68 (11.08–14.08)	0.673
Weight (kg)	36.53 ± 12.92 (20–80)	33.25 ± 6.07 (20–51)	0.261
Height (m)	1.44 ± 0.09 (1.26–1.67)	1.43 ± 0.08 (1.25–1.73)	0.250
BMI (kg/m²)	17.11 ± 4.21 (12.44–34.40)	16.02 ± 1.91 (11.98–21.78)	0.423

Notes: Results are expressed as mean ± standard deviation. The range of values is shown in parentheses. Statistical analysis was performed using the Student's *t*-test.
Abbreviation: BMI, body mass index.

Table 3 Children's nutritional status according to body mass index and height for age

	Boys (%) (n = 802)	Girls (%) (n = 767)	Total (%) (n = 1569)	*P*-value
Corpulence according to BMI				
Thinness (%)	335 (41.8)	341 (44.5)	677 (43.1)	0.293
Normal (%)	413 (51.5)	344 (44.7)	757 (48.2)	0.08
Overweight (%)	30 (3.7)	50 (6.5)	80 (5.1)	0.013
Obesity (%)	24 (3)	32 (4.2)	56 (3.6)	0.216
Stunting according to height for age				
Stunting (%)	143 (17.8)	143 (18.6)	286 (18.2)	0.685
No stunting (%)	659 (82.2)	624 (81.4)	1283 (81.8)	0.637

Note: Statistical analysis was performed using the Chi-square test.
Abbreviation: BMI, body mass index.

Monthly income of the parents

Of the children included in the study, 839 normal and underweight children, corresponding to 54% of the original group sample, told us the monthly income of their fathers. Also, 142 normal and underweight children, corresponding to 9% of the original group sample, told us their mother's monthly income. There was no significant relationship between the monthly income of the father and an underweight condition. For stunting, meaning a significant relationship is observed, the rate of growth retardation was higher when the monthly income was low (19.1% versus 12.3%, $P = 0.025$). No relationship was found between the monthly income of mothers and an underweight condition in children, or between the mother's monthly income and stunting in children (Table 4).

Parental education level

Of the children examined, 1058 normal and underweight children, which corresponds to 67% of the original sample, told us their father's education level. Also, 1088 normal and underweight children, which is 69% of the original sample, told us the education level of their mother. We found that there was no significant relationship between the level of parental education and underweight children, but we observed an inverse relationship between the prevalence of underweight and the level of parental education (49.7% of underweight children have a father with a low level of education against 47.1% whose fathers have a high level of education. 49.8% of underweight children have a mother with a low level of education against 45.2% whose mothers have a high level of

Table 4 Breakdown of the number and percentages of children suffering from stunting and underweight, according to parents' occupation, parents' monthly income, and parents' education level

	Underweight (%)	Normal (%)	Total	*P* value	Stunting (%)	No stunting (%)	Total	*P* value
Father's occupation								
Civil servant	116 (49.8)	117 (50.2)	233		31 (11.9)	230 (88.1)	261	
Merchant	25 (39.7)	38 (60.3)	63		12 (17.6)	56 (82.4)	68	
Private sector	8 (47.0)	9 (53.0)	17		4 (18.2)	18 (81.8)	22	
Laborer	295 (48.7)	311 (51.3)	606		140 (21.1)	522 (78.9)	662	
Unemployed	38 (51.4)	36 (48.6)	74	0.667	18 (22.5)	62 (77.5)	80	0.023
Mother's occupation								
Homemaker	435 (48.7)	458 (51.3)	893		185 (18.8)	796 (81.2)	981	
Laborer	36 (46.2)	42 (53.8)	78		20 (23.3)	66 (76.7)	86	
Merchant	22 (56.4)	17 (43.6)	39		6 (14.6)	35 (85.4)	41	
Civil servant	15 (37.5)	25 (62.5)	40	0.377	3 (6.7)	42 (93.3)	45	0.114
Father's monthly income								
Low <3000 Dhs	320 (48.6)	339 (51.4)	659		138 (19.1)	584 (80.9)	722	
Middle >3000 Dhs	88 (48.9)	92 (51.1)	180	0.937	25 (12.3)	178 (87.7)	203	0.025
Mother's monthly income								
Low <3000 Dhs	52 (42.3)	71 (57.7)	123		25 (18.4)	111 (81.6)	136	
Middle >3000 Dhs	12 (63.2)	7 (36.8)	19	0.089	5 (25.0)	15 (75.0)	20	0.483
Father's education level								
Low	324 (49.7)	328 (50.3)	652		161 (22.6)	551 (77.4)	712	
Middle	148 (46.4)	171 (53.6)	319		51 (14.4)	302 (85.6)	353	
High	41 (47.1)	46 (52.9)	87	0.606	9 (9.2)	89 (90.8)	98	<0.0001
Mother's education level								
Low	404 (49.8)	407 (50.2)	811		185 (20.8)	703 (79.2)	888	
Middle	109 (44.3)	137 (55.7)	246		37 (13.8)	231 (86.2)	268	
High	14 (45.2)	17 (54.8)	31	0.297	7 (18.0)	32 (82.0)	39	0.037

Notes: For education levels, "low" corresponds to attendance at koranic and primary school only; "middle" corresponds to secondary education; and "high" corresponds to higher education. Statistical analysis was performed using the Chi-square test.
Abbreviation: DhS, Moroccan dirham.

education). A significant relationship was observed between the level of parental education and the rate of stunting where 22.6% of children suffering from stunting have a father with a low level of education versus 9.2% whose father has a high level of education ($P < 0.0001$). The same results were obtained when the level education of the mother was high (20.8% versus 18%, $P = 0.037$) (Table 4).

Discussion and conclusion

The main purpose of this study was to evaluate the prevalence of underweight and of stunting, as well as the socioeconomic risk factors among children enrolled in primary public schools in Rabat. The survey was conducted on 1569 children aged between 7 and 14 years of age.

Prevalence of stunting and underweight

In our study, malnutrition in children was high; stunting affected 18.2% of children and 43.1% were underweight. These percentages are only valid for the children who attended the public schools in Rabat. These results suggest that there is a strong relationship between the high rate of prevalence of stunting and underweight and the socioeconomic status of children, which is very low for the majority of them. If we compare the results we obtained for stunting prevalence with the international rates, the international prevalence rates seem higher than our findings. Prevalence of stunting is 55% in Pakistan,[7] 50.7% in Bangladesh,[8] and 32% in the People's Republic of China.[9] Other surveys have shown much higher prevalence of stunting than our findings, eg, 74% in Guatemala[10] and 71% in Malawi.[11] For some African countries such as Togo, the prevalence of stunting and underweight are 47.6% and 45.5%, respectively.[12] In Algeria, the rate of underweight is 7.24%.[13]

These results are hard to compare due to the heterogeneity of the reference used to classify stunting and underweight, sociodemographic conditions of each population, and the nature of the survey (whether it is conducted on a small scale in schools in urban or rural areas, or on a large scale at the country level).

Socioeconomic factors

Socioeconomic status is a risk factor that may influence the evolution towards underweight and stunting. In Morocco, a child living in the most disadvantaged social classes faces a shortage of food due to lack of means, lack of suitable housing, and lack of hygiene, which can lead to certain infectious diseases. Numerous surveys have shown that repeated infections have a particular effect on the growth of poor children in developing countries.[14,15] This association, between stunting, underweight, and low social class and socioeconomic level has been reported by several studies worldwide.[12,16–18]

Occupation of the parents

The profession of the parents reflects the socioeconomic level of the children. According to our survey, stunting is more pronounced in a child whose father is a laborer or who is unemployed. As for the occupation of the mother, we noticed an increase in prevalence of stunting and underweight in children when their mother works as laborer or merchant. In most cases, these mothers are obliged to work to improve their economic situation, and are confronted with particular working hours. They start working early in the morning and return home at the end of the day. They do not have time to take care of their children or to make meals, especially breakfast. This has a negative effect on school performance due to lack of concentration during the classes and on the health of the child in general. Our results are consistent with a survey carried out in Nigeria on children aged between 0 to 59 months.[19]

Monthly income of parents

The data from our survey show an association between stunting and the monthly income of the father. In our survey, 85% of mothers are homemakers; thus, the father remains the only person working to support the whole family. The limited economic resources affect the availability of good nutrition as well as the health condition of the child. Several surveys have shown that poverty is a risk factor for stunting.[7,10] Other surveys have also highlighted the major role dietary and environmental factors play in growth disparities between developed and developing countries.[20–22] As for underweight, even though there is no significance, the prevalence increases when the father's income decreases. According to the United Nations Children's Fund, children living in the lowest income households are twice as likely to be underweight as children living in the richest households.[23]

Education level of parents

Higher education of parents is routinely lumped together with better growth in the infant and the child's height and weight in various socioeconomic contexts.[24–27] This is consistent with our result. Indeed, there is an inverse relationship between the level of the parents' education and stunting. The same result is detected in Indonesia and Bangladesh. The father's education level is generally linked to the household income, since higher educated fathers have occupations that allow them to make a very good living and they are married, most of the time, to educated women. This has a beneficial effect on the child's health condition and growth.

Our study has certain limitations, and the results cannot be considered to be representative of children of the city of Rabat, since our survey has been conducted

only on children in public primary schools. The sample needs to be collected from public and private primary schools in Rabat to have the different socioeconomic classes included.

However, our results provide indications and assessments concerning the prevalence of stunting and underweight of a low socioeconomic level and social class. The other difficulty we faced was linked to the low education level of the parents who, for some of them, were not able to fill in the survey we gave them.

To conclude, although the problem of child undernutrition in developing countries is multifaceted, we have demonstrated that it is strongly linked to a low socioeconomic level. These observations suggest that besides income, schooling and food quality can be significant factors that affect the size and weight growth. Education programs, whether held in schools or informally such, as literacy classes and parenting, are valuable complements to other nutrition sustaining activities. Every person should be aware of the malnutrition problem, its causes and its consequences.

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Disclosure

All authors declare no conflict of interest in this work.

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