



**EVALUATION OF NUTRITIONAL AND SOCIOECONOMIC PROFILE AMONG
CHILDREN ATTENDING A RURAL SCHOOL IN AZILAL- HIGH ATLAS OF
MOROCCO**

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ABSTRACT

Micronutrient deficiencies are a public health problem in Morocco. The purpose of this study is to evaluate the mineral and vitamin status of children enrolled in a rural area located in the Kingdom of Morocco. The study involved a sample of 152 randomized primary school children aged between 7 and 9 years old, in the Moroccan district of Azilal. The data collected were processed by the Nutrilog software integrating the Moroccan food composition and were subjected to statistical analysis by the SPSS software version 2.1. The main results of this study concern the following micronutrients: Iron, Iodine, Zinc, Magnesium, Potassium, Sodium and Calcium, Vitamins A and D. The results showed that the prevalence of insufficient in average daily intakes of iron is more than 33%, while iodine and Zinc insufficient are more than 90%. Concerning the Magnesium and Potassium the prevalence is more than 50% whereas the excess of sodium is barely perceptible at 0.7%. The daily intake average insufficient prevalence of calcium and vitamin D is more than 80% and vitamin A is over than 90%. Nearly 81.4 % of households spent less than US\$ 147 / month for their food needs. The diet behavior of the studied population is highly unbalanced and the micronutrient intake is highly insufficient. The results of this study recommend the improvement of the nutritional education programs for children, teachers and parents.

KEYWORDS: Schoolchildren-Rural-Recall 24 -vitamin-Minerals-Food composition table.

INTRODUCTION

Hidden hunger or micronutrient deficiency (vitamins and minerals) affects more than two billion people (one out of three people on the planet).^[1] Micronutrient deficiencies are a major public health problem due to its mortality, morbidity and cost implications for the majority of countries including Morocco.^[2] In Morocco Hidden hunger or micronutrient deficiency is widespread: 37.2% of pregnant women, 31.5% of children aged between 6 months and 5 years, 32.6% of women of childbearing age and 18% of men are anemic according to Ministry of Health surveys done in 2000.^[3] Half of children between 7 and 9 old are suffering from iron deficiency.^[4] 10% of women of childbearing age and 40.9% of children aged from 6 to 72 months suffer from vitamin A deficiency, for which, 3.2% have severe deficiency according to Ministry of Health surveys published in 1996.^[5] 44% of children between the ages of 7 and 9 years old are suffering from vitamin A deficiency.^[6] 63% of children between the ages of 6 and

12 have an iodine deficiency. 22% among them have goiter.^[7] Urinary iodine deficiency in children aged 7-9 years is 74.7%.^[8] 2.5% of children under 2 years have radiological rickets.^[9] 23% of children under 5 years have vitamin D deficiency.^[10] Two thirds of children aged 7-9 years have vitamin D deficiency.^[11] The Zinc daily intake average (ZDI) in preschool children is 3.56 mg / day and 73.4% of them have ZDI<RDA.^[12] 53.25% of pre-school children have a calcium intake of 100 to 300 mg / d. 22% have consumption> 300 mg / d. The calcium daily intake average (CDIA) 245.65 ± 18.01 mg / d is <WHO / FAO recommendations (500 mg / day). The percentage of these children whose CDIA is lower than the RDA (93.3%).^[12]

At the national level, halted costs and productivity losses related to micronutrient deficiencies account for 5% of national GDP. Iron deficiency alone costs two billion dirham's per year.^[9] Face to this situation and following the recommendations made at the 1990 New York Child

Summit and the Rome Nutrition Conference in 1992.^[9] Morocco focused his efforts to satisfy the population micronutrient needs by providing fortified food with vitamins and minerals as well as establishment of nutritional education actions.^[9] This study aims to evaluate vitamin and mineral status among children attending a rural school in Azilal, Morocco.

MATERIALS AND METHODS

Population

This work concerns three rural schools (Iminifri, Iwariden and Abu Antar) in Azilal located at the High Atlas region (400-700m altitudes) in Morocco.^[13] The population in this area is characterized by a high poverty rate.^[14,15] This work is a cross-sectional study involving 152 school-age children between seven and nine old undertaken during 2012.

Ethics of the study

The consent of the pupils' parents and the authorization of the Ministry of National Education and the Ministry of Health were obtained.

Student preparation

The recruiting criteria of children in the study are: students aged seven and nine old living in the studied area and attending the selected schools.

The elimination criteria are severe or chronic malnutrition. Pupils removed from the study are referred to the nearest health center for treatment.

The 24-hour recall questionnaire

Food intake data are collected following a cross-sectional survey conducted by dietitians using a 24-hour recall questionnaire. This questionnaire covers name, surname, age, gender, address, quantity and nature of food intake: bread, tomato, tea ... for breakfast, lunch, snack and dinner. This 24 h recall is repeated twice at 48 h intervals. It gives us information on the students' food intake.

Socio-economic questionnaire

Data on the socio-economic status of families were collected by interviewing parents using a questionnaire developed for this purpose at the beginning of the study. These data included information on parental education, household size, occupancy status, household spending and food expenditures.

The NURTILOG version 2.5 software

It is an analyzing system based on the nutritional references of L'Anses^[16], which provides information on the individual dietary profile. The Moroccan food composition table was integrated into software database containing food table Ciquil. France 2012; USD SR24; USA 201^[16], provided by the supplier. The added table is the first one of food composition elaborated in Morocco. This table concerns more than 400 foods consumed in Morocco. It is used to obtain the reality of the micronutrient intakes of the students in the study. The 24h questionnaire data recalls of 152 students are incorporated into this Nutrilog software to be analyzed micronutrient status for each student.

Statistical analysis

The data matrix was established by the NUTRILOG software and by Socio-economic questionnaire was subjected to a statistical analysis with the statistical software for social sciences (SPSS version 2.1).

RESULTS

Population characteristics

The socio-economic situation analysis of the population shows that the majority of mothers are illiterate at 94.6%. In contract, the fathers illiteracy rate is around 59.6%. Moreover, the size of the household, about 50.9% of families has more than 5 members. In terms of monthly spending, 54.8% of households spend less than MAD 1600 / month (eq. US\$ 195). The food amount dispense is less than MAD 1176 / month (eq. US\$ 147) for 81.4% of households surveyed (Table 1). Furthermore, the majority of families have their own homes (97%) (Table1).

Table: 1 The socio-economical pattern of children households.

Variable	Average ± SD (%)
Age (years)	8.0±0.7
Level of education	
Mother	
Illiterate	94.60
Primary	04.20
Secondary	01.20
Superior	00.00
Father	
Illiterate	59.60
Primary	31.90
Secondary	07.80
Superior	00.60
Household Size	
<6 people	49.10

6 to 10 people	50.90
housing occupancy Status	
Owner	97.00
Tenant	01.20
Don	01.80
Total of monthly expenditures	
Inf. 122 US \$	25.30
122 to 195 US \$	29.50
196 to 244 US \$	25.30
244 to 366 US \$	12.00
Sup. To 366US \$	07.80
Monthly Food Expenses	
Inf. to 110US \$	63.30
110 to 147 US \$	18.10
147 to 195 US \$	09.60
196 to 305 US \$	08.40
Sup. to 305 US \$	0.60

Daily trace element intakes

The daily intake average of iron for school children is 8.8 ± 0.2 mg / p / d (weight per person per day). The prevalence of insufficient iron daily intake by school children are 33% that is under the (recommended nutritional intakes) ANC defined as 8 mg / p / d (Table 2).

The daily intake average of iodine in school children is 51.5 ± 1.7 µg / p / d. The prevalence of insufficient iodine daily intake by students is 94% that is under ANC defined as the 20 µg / p / d (Table 2).

The daily intake average of Zinc in school children is $6.1 \text{mg} \pm 0.2$ / p / d. The prevalence of insufficient daily intake of Zinc by students is 94.1% that is under ANC defined as the 9 mg / p / d (Table 2).

The daily intake average of magnesium in school children is $203.3 \text{mg} \pm 5.4$ / p / d. The prevalence of insufficient daily intake of Magnesium in pupils is 53.3% that is under ANC defined as the 200 mg/p/d (Table 2).

Table 2 shows the distribution of potassium daily intake in school children. The daily intake average of potassium is 1495.5 ± 44.1 mg / w / d. The prevalence of insufficient daily intake of potassium by students is 51%

that is under ANC defined as 1427mg / p / d for this age group.

The daily intake of sodium in school children is presented in Table 2. The daily intake average of sodium is 697.3 ± 26.2 mg / p / d. The prevalence of excess daily intake of sodium is 0.7%. (Recommended Sodium Intake 2000mg / p / d according to WHO).

The daily intake average of calcium in school children is 470.4 ± 10.6 mg / p / d. The prevalence of insufficient intake of calcium in children attending school is 94% that is under ANC defined as 900mg/p / d for this age group (Table 2).

Daily vitamin intakes

The daily intakes of vitamin D in school children are shown in Table 2. The average daily intake of vitamin D is 2.7 ± 0.1 µg / p / d. The prevalence of insufficient intake of vitamin D in the enrolled children is 82% that is under ANC defined as 5µg / p / d.

Table 2 shows the distribution of daily intakes of vitamin A in school children. The average daily intake of vitamin A is 178.1 ± 9.8 µg / p / d. The prevalence of insufficient intake of vitamin A in enrolled children is 99% that is under ANC defined as 500 µg / p / d.

Table 2: Nutritional status of students enrolled in the study

Nutrients	Average \pm SD of daily intakes	ANC	Percentage
			Daily Input <ANC.
Iron (mg)	$8,8 \pm 0,2$	8	33%(N=51)
Iodine (µg)	$51,5 \pm 1,7$	120	94%(N=142)
Zinc (mg)	$6,1 \pm 0,2$	9	94,1%(N=143)
Magnesium (mg)	$203,3 \pm 5,4$	200	53,3%(N=81)
Potassium (mg)	$1495,5 \pm 44,1$	1427	51%(N=77)
Sodium (mg)	$697,3 \pm 26,2$	2000	Daily intake > 2g = 0.7% (N = 1)
Calcium (mg)	$470,4 \pm 10,6$	900	94%(N=142)
Vitamin D (µg)	$2,7 \pm 0,1$	5	82%(N=124)
Vitamin A (µg)	$178,1 \pm 9,8$	500	99%(N=150)

DISCUSSION

In our targeted population the majority of mothers are illiterate (94.6%). This rate is higher than the national one for this parameter even it has decreased since 2004, the illiterate of population aged 10 years and older decreased from 43.0% in 2004 to 32.0% in 2014 characterized by 22.1% and 41.9% respectively for men and women illiteracy rate.^[17] Nearly 81.4% of households spent less than US\$ 147 / month for their food needs and nearly 50.9% of families are made up of more than 5 members.

Illiteracy, the large size of the household and the low incomes of the population are factors that explain the micronutrients nutritional imbalance of children enrolled in this study.^[18,19] So these students have high food intake insufficient in iron, iodine, zinc, magnesium, potassium, calcium, vitamin D and vitamin A with the prevalence of insufficient intakes.

Respectively of 33% (8.8mg/p/d) ; 94% (51.5mg/p/d) ; 94.1% (6.1mg/p/d) ; 53,3% (203.3mg/p/d) ; 51% (1495.5mg/p/d) ; 94% (470mg/p/d) ; 82% (2.7ug/p/d) and of 99% (178ug/p/d) below the ANC [20,21]. Concerning the daily intake of sodium, the children showed a very satisfying result. The excess of food intake is minimal (0.7%). Comparing with other studies; a study carried out in Morocco, specifically in El Haouz by El Motia on children between nine and twelve years-old founds insufficient iron intakes for girls equal to 3.45mg/p/d as well as for boys 3.70 mg/p/d.^[22] The result of our iron study of 33% is lower than that found by Grillenberger *et al.* among rural school children in Kenya indicating a prevalence of insufficient iron food intake of 77%.^[23] The prevalence of insufficient iodine food intake of 94% found in this work is superior to that reported by Limbert *et al.* in Portugal on school-age children, which showed a prevalence of insufficient iodine food intake of 47%.^[24] Related to the food intake average of Zinc (6.1mg/p/d), daily input<ANC (94.1%), a previous study in Morocco by Loutfi *et al.*, in 2004 showed that for both children younger and older than thirty-six months, have a zinc intake below the recommended level respectively 89.2% and 77.8%.^[25] A similar study in Madagascar by Menjaharimisa *et al* among school children aged between six to eleven years showed that the average intake of zinc was 6.7mg/p/d.^[26] About the value of Magnesium intake recorded this studied population (203.3mg/p/d), this seems to be closed to that found by Meguid in an earlier study in Egypt among school children aged between six to nine years old with a daily intake of 214.20 ± 18.23 mg/p/d.^[27] Concerning the daily intake average of potassium (1495.5mg/p/d), a similar study carried out by El Mallah *et al.* in Lebanon among school children showed a daily intake average of potassium of 1882 ± 0.92 g/p/d.^[28] This daily intake average is higher than that found in our studied population (1495.5mgP/d). Regarding to the daily intake of sodium among school children, the observed prevalence represents the proportion of children who have a daily intake of sodium

greater than that recommended by WHO (0.7%), which is equivalent to 2000mg / p/ d (5g salt / p / d)^[29], this result is lower than the one found by Aguenau *et al* in Morocco in children aged between eight and fourteen years old. It showed that their daily intake average of salt is 8.63g/p/d (3452 mg/p/d of sodium).^[30] The prevalence of excess daily intake of sodium in this population is (72%).^[30] This finding result is also lower than that found by Feng *et al* in China among school children with a daily intake average of salt is 7.3 ± 0.3 g/p/d^[31] that is superior to recommended intake.^[29] About the value of calcium intake recorded this studied population(470 mg/p/d), Other similar study showed that daily intake of calcium in pre-school children in the Northwestern region of Morocco by El Kari showed that the average daily intake of this nutrient was 245.65 ± 18.01 mg/p/d.^[12] This study also showed that the percentage of children whose daily intake is lower than the RDA is 93.3%.^[12] In another national study carried out in El Haouz region on children between the ages of 9 and 12 by El Motia showed that the average daily intake of calcium was insufficient for both girls (338.57mg / P / d) and boys (345.42mg / p / d).^[22] But in Spain, Ortega *et al* reported in their investigation carried out by among school-aged pupils a prevalence of calcium intake insufficient equal to 76.7%.^[32] Concerning the daily intake of vitamin D, a previous investigation carried out in Morocco in El Haouz by El Motia on children between the nine and twelve years old found a daily intake of vitamin D in girls and boys respectively equal to 3.45ug/p/d and 3.70ug/p/d).^[22] Another study carried out in Algeria by Djennane on Tizi- ouzou children aged between five and fifteen recorded daily intake of vitamin D equal to $137UI \pm 3UI$ /p/d, ie 3.4 ± 0.1 ug/p/d.^[33] The result found in our study is lower than that found by Apracio vizuete *et al.* in a previous study in Spain among school children with a prevalence of insufficient daily intake of vitamin D of 85.4%.^[34] A similar study conducted by Menjaharimisa *et al.* in Madagascar among school children showed insufficient daily intake of vitamin A with an average of 318ug/p/d^[26].

CONCLUSION

The studied population is characterized by a high prevalence of insufficient daily intakes for Iron, iodine, Zinc, Magnesium, Potassium, Calcium, Vitamin D and Vitamin A. In contrast, for the sodium intake, excess intake is very low. In term of this work, it is recommended that appropriate nutrition and feeding school programs and nutrition education programs involving ministries, teachers, children, and parents should be developed to improve the nutritional status of school children and suggests appropriate nutrition policies and programs. Including improving food quality and safety, promoting healthy eating and lifestyle, food availability and how to incorporate nutritional goals into development policies and programs,. Improvement Of the quality of life of the population through the fight against poverty, the improvement of nutrition and the promotion of health.

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