

# Vitamin A intake in school-aged children in Draa-Tafilalet oasis regions, southeastern of Morocco

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**Abstract.** Vitamin A has several important functions such as preventing childhood blindness and strengthening the immune system against common diseases in children. The purpose of the present work was to assess the nutritional intake of vitamin A in oasis school-age children. A cross-sectional survey was carried out among children enrolled in public primary education establishments. 4244 school-aged children were randomly selected to take part in the study. Data on dietary vitamin A intake was assessed by the 24-hour dietary recall. Socio-economic characteristics were got using an appropriate questionnaire. Over the entire sample, the median vitamin A intake was around 409.3 µg for girls and 294.5 µg for boys. The prevalence of insufficient vitamin A intake was observed in 58.3%. The prevalence of inadequate intake according to socio-demographic and economic characteristics shows girls tend to develop vitamin A deficiency compared to boys. Children from urban areas show significant percentages of inadequacy. School-aged children with illiterate parents with low monthly income were identified as at risk of having insufficient dietary intake of vitamin A. In conclusion, we have revealed an important level of inadequacy for vitamin A in the overall processed results that must be considered.

## 1-Introduction

Vitamin A or retinol is a fat-soluble vitamin that belongs to a group of retinoid including retinol, retinal, and retinyl esters [1,2]. Vitamin A is a crucial micronutrient especially for children. It has several important functions; acutely it is involved in vision, growth, gene expression, embryonic development, and reproduction, prevention from cancer, immune function, cell division and cellular communication [1-3,4,5]. Vitamin A also has antioxidant properties and helps in fat metabolism. It is very important for vision because it is a crucial component of rhodopsin, which is a light-sensitive receptor protein, that absorbs light in the retinal receptors and it supports the good functioning of the conjunctival membranes and cornea [2]. Vitamin A also enters into the baby's embryonic growth and differentiation, playing an essential critical role in the normal development of the heart, kidneys, lungs, eyes, and bones as well as the circulatory, respiratory, and central nervous systems, and other organs [2].

Adequate vitamin A level is essential for the good health. Vitamin A deficiency (VAD) is especially a result of inadequate vitamin A dietary intake which not satisfy human needs. VAD present a serious public health issue in more than half of all countries. According to the World Health Organization, 190 million preschool-aged children and 19.1 million pregnant women around the world have a serum retinol concentration below to 0.70 micromoles/L [6]. It is infrequently found in developed countries, but it

is common in developing countries, especially in children and pregnant women with low-income and living in Africa or South-East Asia. It is thus a priority in health strategy in order to improve preformed vitamin A and/or provitamin A carotenoid status among these categories of the population. VAD lead to several problem health such as childhood blindness and it also increases the severity and the risk of common infections among children like diarrhea and measles. The most common symptom of vitamin A deficiency is xerophthalmia in children and pregnant women.

There are two main kinds of vitamin A found in alimentation, preformed vitamin A and provitamin A. For preformed vitamin A is available in animal source foods such as meat and offal (mainly in liver), poultry, fish, and dairy products. Concerning provitamin A is found in a food plant-based diet like fruits and vegetables, and most common form of provitamin A is beta-carotene, β-carotene, alpha-carotene and beta-cryptoxanthin [1-5]. we can find vitamin A also in dietary supplements (multivitamins and as a stand-alone supplement) and fortified foods.

It has been shown by many researches that the process of digestion and transformation of food containing vitamin A into substance necessary for the absorption of dietary vitamin A intake, and even the process of absorption, are associated with many factors. In fact, the digestion and absorption of vitamin A are affected by the absorption of lipids. Therefore, intensely low dietary fat intake or conditions that conflict with the

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digestion or absorption of lipids such as pancreatic and hepatic (gastroenteritis, steatorrhoea), can interfere with the absorption of vitamin A [7,8,9]. Intestinal malabsorption of vitamin A was significantly associated with respiratory and gastroenteritis infection. Indeed, in the study undertaken by Sivakumar B and all the absorption of vitamin A was significantly lower in children with respiratory infection or gastroenteritis than in children without no illnesses [9]. In view of these results, they suggested considering repeated infections that may significantly affect the rates of vitamin A deficiency in children and pregnant women, particularly in poor communities [9]. In the light of these observations, a more precise understanding of mechanisms include in digestion and intestinal absorption of vitamin A can be a key step in health policies, strategies and plans to improve vitamin A status in populations at risk [10].

In Morocco, especially in oasis regions, vitamin A intake in school-aged children was poorly investigated because of several reasons, such as the lack of data and research around the evaluation of vitamin A status in oasis population. In order to fill this gap, the current study helps to assess the vitamin A intake among school-aged children in both urban and rural areas of Draa-Tafilalet oasis regions, southeastern of Morocco.

## 2-Subject and Method

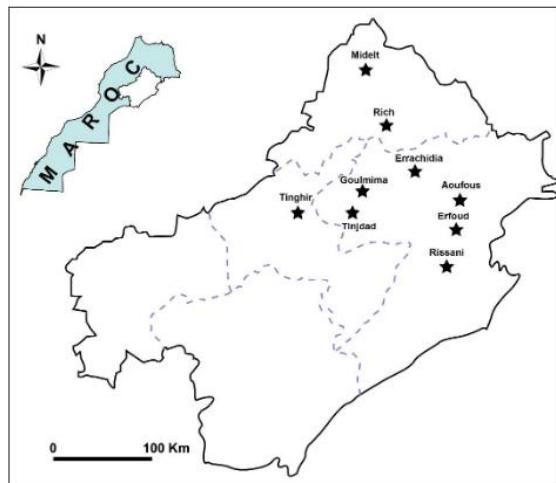
### 2-1 Study area description

The Drâa-Tafilalet region covers an area of 88,836 km<sup>2</sup>, or 12.5% of the national territory and 46% of the surface area of Moroccan oasis areas (the oasis municipalities in the region occupy 78,290 km<sup>2</sup>). It is limited to the north by the region of Fez-Meknes and the region of Beni-Mellal-Khenifra, to the east by the region of Oriental and Algeria, to the west by the region of Marrakesh-Safi and the region of Souss-Massa and in the South by Algeria. The region gathers, administratively, five provinces: Errachidia, Midelt, Tinghir, Ouarzazate and Zagora (125 municipalities including 16 in urban areas and 109 in rural areas). According to the General Population and Housing Census of 2014, the region has 1,635,008 inhabitants, of which 34.30% are urban [11].

The activity rate in the Drâa-Tafilalet region in 2014 varied between 51.1% in the province of Ouarzazate and 40.2% in the province of Errachidia. Depending on the area of residence, the urban unemployment rate reaches a maximum of 13.7% in the province of Errachidia against only 2.9% in the rural area of the same province [12].

In terms of schools, the region has 649 primary schools, 133 colleges and 75 high schools spread over the regional territory. It also had a teaching staff estimated at 12,730 teacher, 28.6% of whom are women (all cycles combined). The school enrollment rate for children aged 7 to 12 is 96.2%. This rate is higher for boys with 96.7% than girls where it is estimated at 95.6%. The number of

school-aged children in public primary education for the school year of 2013-2014 reached 224,334, 107,019 (49.5%) are girls. We should also note that 73% of the total of students in the public sector is in rural areas. The illiteracy rate for the population under 10 years old is 34% [13].



**Fig. 1.** Geographical location of the study area.

### 2-2 Data collection

An assisted questionnaire appropriate to the local conditions and studied age group was developed. A cross-sectional survey was carried out among 4244 school-aged children between May 2015 and November 2018 in Draa-Tafilalet oasis regions, southeastern of Morocco. Participants were recruited from public primary schools covering three Moroccan provinces. The sample was produced in order to represent 1% of the target population, which belongs to this age group. Before conducting this study, authorizations were given by the regional and local education authorities and express consent of tutors. All children included in the sampling were apparently healthy with no physical diseases or disabilities.

The questionnaire was partitioned into two sections: First part: set of questions for describing socioeconomic characteristics, such as age (years), household location, gender, maternal education, paternal education and household monthly income.

Second part: A 24-hour dietary recall in order to assess the vitamin A intake of school-aged children.

### 2-3 Inclusion, exclusion and criteria

During the entire study period, only children having parent's agreement were included in this work. We excluded from the study children whose parents who did not agree to answer the questionnaire.

## 2-4 Pilot sample

Before the survey, the questionnaire was pretested by the first author, a native of the studied region, and was administered on a small scale. 43 children from the same survey population with the same conditions as those for the totality of the sample, and they were not included in the study population.

## 2-5 Data analysis

Data were coding, checked, entered and statistically analyzed by appropriate software. Descriptive analyses were carried out, expressed as mean  $\pm$  standard deviation or median (interquartile range) for numerical variables and number or percentage for categorical variables. Statistical Tests used to determine associations between all factors studied ( $\chi^2$  test (Chi square)). Level of significance was fixed in 0.05, associations with p value less than 0.05 were considered statistically significant.

## 3-Results

### 3-1 Socio economic status of studied population

Socioeconomic characteristics in children were represented in table 1. The average age of the children included in the sample was  $9.81 \pm 2.13$  years with 91% belong to the age class of 5-12 years. The sample included 2049 (48.3%) boys and 2195 (51.7%) girls. Concerning the household location, 62.9% were from urban areas versus 37.1% in rural areas. For academic results, both levels of education of parents and mothers were evaluated, on one side 41.9% of mothers were illiterate against 24.8% of fathers and on the other, 20.1% of fathers had higher education but only 7.3% of mothers that continue their studies until the university. Regarding to monthly family income, 84.6% of the population had low to medium income and only 15.4% with 5000 MAD or more.

**Table 1.** Socio economic status of school-aged children.

| Characteristics    | n    | %    |
|--------------------|------|------|
| Age (years)        |      |      |
| 5-9                | 1991 | 46.9 |
| 10-12              | 1873 | 44.1 |
| $\geq 13$          | 380  | 9.0  |
| Household location |      |      |
| Urban              | 2671 | 62.9 |
| Rural              | 1573 | 37.1 |
| Gender             |      |      |
| Male               | 2049 | 48.3 |
| Female             | 2195 | 51.7 |
| Maternal education |      |      |
| University         | 287  | 6.8  |
| Secondary          | 699  | 16.5 |
| Primary            | 1477 | 34.8 |
| Illiterate         | 1781 | 41.9 |
| Paternal education |      |      |
| University         | 852  | 20.1 |
| Secondary          | 1071 | 25.2 |
| Primary            | 1269 | 29.9 |
| Illiterate         | 1052 | 24.8 |

| Household monthly income |      |      |
|--------------------------|------|------|
| Low ( $\leq 2000$ MAD*)  | 784  | 18.5 |
| Medium (2001-4999 MAD)   | 2804 | 66.1 |
| High ( $\geq 5000$ MAD)  | 656  | 15.4 |

\* 1\$US=9.36MAD

### 3-2 Median intake of vitamin A according to socioeconomic status

Median intakes of vitamin A according to socioeconomic characteristics in children were shown in table 2. In the studied population, vitamin A intake increases slightly in children with parents having a high economic level but this correlation was not significant, counter to level of education of parent were children having highly educated parents had high vitamin A intakes and p value was significant. For the place of residence of the children, median intake of vitamin A was higher in children from urban areas comparing to rural origin. The association was highly significant ( $p=0.001$ ). Vitamin A intake was high in children over 13 years old. The variations between these intakes according to the age groups studied were statistically significant ( $p= 0.009$ ). Finally, the analysis showed that girls possessed an important vitamin A intake compared to boys ( $p<0.05$ ).

**Table 2:** Median intake of vitamin A according to socioeconomic characteristics.

| Characteristics          | Median intake of vitamin A ( $\mu\text{g}$ ) M(IQR) | p     |
|--------------------------|-----------------------------------------------------|-------|
| Age (years)              |                                                     |       |
| 5-9                      | 394.3 (247.4)                                       | 0.009 |
| 10-12                    | 406.0 (270.3)                                       |       |
| $\geq 13$                | 500.4 (397.2)                                       |       |
| Household location       |                                                     |       |
| Urban                    | 417.9 (373.8)                                       | 0.001 |
| Rural                    | 370.3 (358.0)                                       |       |
| Gender                   |                                                     |       |
| Male                     | 294.5 (435.7)                                       | 0.453 |
| Female                   | 409.3 (475.0)                                       |       |
| Maternal education       |                                                     |       |
| University               | 401.8 (481.7)                                       | 0.001 |
| Secondary                | 409.3 (475.2)                                       |       |
| Primary                  | 418.0 (474.9)                                       |       |
| Illiterate               | 383.9 (340.4)                                       |       |
| Paternal education       |                                                     |       |
| University               | 424.6 (466.8)                                       | 0.000 |
| Secondary                | 413.8 (475.3)                                       |       |
| Primary                  | 417.9 (474.0)                                       |       |
| Illiterate               | 358.6 (337.7)                                       |       |
| Household monthly income |                                                     |       |
| Low ( $\leq 2000$ MAD*)  | 369.2 (320.9)                                       | 0.765 |
| Medium (2001-4999 MAD)   | 394.6 (476.0)                                       |       |
| High ( $\geq 5000$ MAD)  | 437.7 (464.8)                                       |       |

IQR: interquartile range; M: Median; p: p-value significance

### 3-3 Inadequate intake of vitamin A according to the socio-demographic and economic status

The prevalence of insufficient vitamin A intake was observed in 58.3%. The prevalence of inadequate vitamin A intake; according to the socio-demographic and economic characteristics of the study population was analyzed. The prevalence of inadequate intake according shows girls tend to develop vitamin A deficiency compared to boys. Children of urban areas show significant percentages of inadequacy. Children with illiterate parents with low to medium monthly income were identified as at risk of having insufficient dietary intake of vitamin A.

**Table 3:** Inadequate intake of vitamin A in school-aged children.

| Characteristics          | Inadequate intake of vitamin A | p     |
|--------------------------|--------------------------------|-------|
| Age (years)              |                                |       |
| 5-9                      | 1328                           | 0.004 |
| 10-12                    | 1297                           |       |
| ≥ 13                     | 285                            |       |
| Household location       |                                |       |
| Urban                    | 1742                           | 0.000 |
| Rural                    | 1168                           |       |
| Gender                   |                                |       |
| Male                     | 1414                           | 0.011 |
| Female                   | 1496                           |       |
| Maternal education       |                                |       |
| University               | 189                            | 0.002 |
| Secondary                | 473                            |       |
| Primary                  | 971                            |       |
| Illiterate               | 1277                           |       |
| Paternal education       |                                |       |
| University               | 560                            | 0.000 |
| Secondary                | 715                            |       |
| Primary                  | 833                            |       |
| Illiterate               | 802                            |       |
| Household monthly income |                                |       |
| Low (<2000 MAD*)         | 562                            | 0.005 |
| Medium (2001-4999 MAD)   | 1930                           |       |
| High (≥5000 MAD)         | 418                            |       |

### 4-Conclusion

In the present paper, a cross-sectional survey study was conducted among 4244 school-aged children in Draa-Tafilalet oasis regions, southeastern of Morocco. The purpose was to evaluate vitamin A intake. The prevalence of inadequate vitamin A intake was reported in 58.3% of studied population. Children with low to medium family monthly income, whose parent parents had low

educational levels and living in urban areas were more likely to have highest rate of inadequate vitamin A intake.

### 5-Discussion

Measuring the nutritional status presents an important key factor and an indispensable tool for health promotion. Assessment of vitamin A intake and associated factors in order to evaluate deficiencies is a major global public health concern especially in children living in developing countries. According to UNICEF, only 64 per cent of children in need are receiving the life-saving benefits of vitamin A supplementation and more than 140 million children are being left behind.

Overall, the prevalence of inadequate vitamin A intake was reported in 58.3% of studied population. Both socio-demographic and economic characteristics and levels of parent's education were important determinants of vitamin A intakes. In our finding, girls tend to develop vitamin A deficiency compared to boys. Our results are consistent with those observed in previous studies [14,15,16]. The quality of the food intake taken by boys compared to girls and the food preferences of each sex could explain those data.

Regarding economic status and parental education levels, Children with low to medium family monthly income whose parent parents had low educational levels were more likely to have highest rate of inadequate vitamin A intake. The data obtained is in agreement with several studies [17,18].

The distribution of our sample according to place of residence shows significant difference on vitamin A intake between children living in urban and rural areas. Indeed, children from urban origin tend to have intakes below recommendations. These results are in disagreement with other research [19].report no significant difference according to urban or rural environment. These results could be explained by a more pronounced food transition in urban areas compared to rural areas.

Some of the limitations of the study are methodological characteristics influenced the estimation of vitamin A intake Recall. However, this concern is common in qualitative methods researchers using food composition tables and is less likely to affect the findings of the current study.

Further studies on blood nutritional indicators such as vitamin A status in serum are needed to establish a complete nutritional profile and to extend results of this study. The research propose to focus on children who are most at risk in developing Vitamin A deficiency and planning specific interventions for specific target of studied age groups. Nutrition programs are required in the purpose of addressing the needs and challenges of micronutrient deficiencies among school-aged children in Draa-Tafilalet oasis regions, southeastern of Morocco

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